Screening new PFAS compounds 2018

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ABSTRACT

This screening project has focused on the occurrence of conventional and emerging PFASs in terrestrial and marine environments, including the Arctic. Conventional PFASs were found to be wide-spread in the environment and for the first time in Norway reported in wolf, a top predator from the terrestrial environment. Otters living in close proximity to human settlements and preying on the marine food chain, are heavily contaminated with PFASs. Areas where ski-testing activities are common are a potential "hot spot" where PFASs can enter the food chain. The difference in PFAS-profile between the samples indicates that the diversity in samples are necessary to reveal the complete picture of PFASs in the environment.

NORWEGIAN TITLE

Screening av nye PFAS-stoffer 2018

KEYWORDS

Screening	PFASs	Arctic

ABSTRACT (in Norwegian)

I dette screeningprosjektet ble det fokusert på forekomsten av vanlige og nye PFAS-er i terrestrisk og marint miljø, inkludert arktisk. De vanlige PFAS-ene ble funnet i alle typer prøver, og ble for første gang rapportert i norsk ulv, en toppredator i det terrestriske miljøet. Oter som lever tett på menneskelige aktiviteter og er en del av den marine næringskjeden, har de høyeste mengdene av vanlige PFAS-er i denne screeningen. Resultatene viser også at områder hvor det foregår skitesting er potensielle punktkilder. Forskjellen i PFAS-profil mellom prøvene viser at forskjellige typer prøver er viktig for å få et fullstendig bilde av PFAS-er i miljøet.

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Contents

Summary

The screening programme 2018 part 1, conducted by NILU-Norwegian Institute for Air Research together with the Norwegian Institute for Water Research (NIVA), Norwegian Institute for Nature Research (NINA) and Norwegian Polar Institute (NPI), has focused on the occurrence of conventional and emerging per- and polyfluoroalkyl substances (PFASs) in terrestrial and marine environments, including the Arctic.

A total of 82 conventional, new emerging and volatile PFASs were screened for in abiotic and biological samples. Both local hotspots as well as remote locations were sampled. Extractable organic fluorine (EOF) was determined as a measure for unknown PFASs and other organic fluorine compounds (e.g. pharmaceuticals) present in the samples.

A summary table of detection frequencies for all of the investigated compounds in the different matrices are presented below.

Conventional PFASs were found to be wide-spread in the environment and for the first time in Norway reported in wolf, a top predator from the terrestrial environment. However, the highest concentrations of conventional PFASs in biological samples were found in otter, followed by polar bear, arctic fox and white-tailed eagle and glaucous gull. Lowest concentrations were found in samples from terrestrial species, wolf and moose. The most prominent compound was perfluoroocatne sulfonic acid (PFOS). A high detection frequency showed that several of the long chain perfluoroalkyl carboxylic acids (PFCAs) were present in the magnitude of samples.

In the abiotic environment, snow from ski-testing tracks had the highest concentrations of conventional PFASs. Areas where ski-testing activities are common are a potential “hot spot” where PFASs can enter the food chain. In surface water samples, the PFAS profiles were dominated by PFCAs. The highest concentrations were found for short chain PFCAs, except for snow samples from cross-country ski-testing tracks which were dominated by long chain PFCAs (C12-C16). For sediment and soil, PFOS was the dominating compound.

Some conventional PFASs were detected in dust. I In air from hot spots and the Arctic, the detection frequency was low.

The screening for new ionic PFASs consisted of 29 different compounds: Sulfonate ethers and telomers, carboxylic ethers, cyclic PFCAs, and polyfluoroalkyl phosphoric acid esters (PAPs). The fluorotelomer sulfonic acids (FTSs), 6:2 and 8:2 FTS were detected in several samples. When detected, 6:2 FTS was the most prominent in abiotic samples, and 8:2 FTS dominated in biological samples. One source for these compounds is Aqueous Film-Forming Foam (AFFFs). One cyclic furan-PFAC was detected in waste water from Longyearbyen. The source for this compound is yet unknown.

Additionally, the samples were screened for 26 semi-volatile PFASs: Sulphonamides, acrylates and fluorotelomer alcohols (FTOHs). Several of these are considered as precursors for the conventional PFASs. Perfluorooctanesulfonamide (FOSA), a precursor to PFOS, was detected in biological samples from otter, white tailed eagle and one arctic fox. The concentration was from 0-35% of the reported PFOS concentration. Perfluorobutylsulphonamide (FBSA) and methyl- and ethyl-perfluorooctane sulfonamidoacetic acid (Me- and Et-FOSAA) were detected in wastewater samples from Longyearbyen. A precursor to PFCAs, 10:2 FTOH, was detected in one dust sample, and one snow sample.

Air samples from the Arctic were also investigated with respect to very volatile PFASs. None of the listed compounds were detected in the investigated samples.

Four ultra-short chain PFASs were included in the screening program. Trifluoroacetic acid (TFA) was reported in several biological matrices, snow and air. The highest concentration was reported for arctic fox liver at 222 ng/g. Perfluoropropanesulfonic acid (PFPrS) was only detected in glaucous gull, where concentrations were <0.5 ng/g. The highest concentrations for perfluoropropanoic acid (PFPrA) were measured in air and dust samples from potential hot spots, where the maximum concentration was 8.86 ng/mL, same level as some of the more common PFASs.

For the majority of the samples, the EOF-concentration exceeded the calculated amount of fluorine in the samples, based on the sum of the concentrations of common PFASs. After all detected PFASs from this screening were included in the sum, the calculated amount of fluorine became equal to the EOF. This was observed for some liver samples from otter and arctic fox.

The ubiquitous presence of conventional PFASs in the investigated samples should be of concern. Even though some have been phased-out and banned several years ago, the exposure to wildlife continues.

Table 1: Detection frequencies (%) of the investigated compounds in the investigated samples.

Nr	Matrix	Surface water, Lake Mjøsa	Surface water, River Alna	Sediment, North Sea	Sediment, Lake Mjøsa	Sediment, River Alna (suspected hotspot)	Soil, Alna (suspected hot spot)	Perch liver, Lake Mjøsa	Blue mussel	POCIS, passive water sampler	White-tailed eagle, liver	Otter, liver	Wolf, liver	Moose, liver	Glaucous gull, egg	Polar bear, blood plasma	Arctic fox, liver	Waste water LYB	Snow, test track	Air, outdoor and in door	Dust,	Arctic air, Zeppelin
1	PFBS	0	100	0	0	0	0	0	0	100	0	40	20	20	0	100	40	100	0	0	20	0
2	PFPeS	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	40	0	0	0	0	0
3	PFHxS	0	83	0	0	0	50	0	0	100	100	100	40	0	100	100	100	20	0	0	20	0
4	PFHpS	0	0	0	0	0	0	0	0	0	100	100	40	100	100	100	100	60	50	0	0	0
5	PFOS*	0	100	33	33	33	100	100	0	100	100	100	100	100	100	100	100	100	100	0	60	0
6	PFNS	0	0	0	0	0	0	0	0	0	60	80	0	20	20	0	80	40	50	0	0	0
7	PFDS	0	17	0	0	0	0	0	0	0	60	60	0	0	0	0	100	0	50	0	80	0
8	PFDoDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	PFPeA	100	100	67	0	0	25	0	0	100	80	80	0	40	0	20	80	100	100	0	40	0
10	PFHxA	67	100	0	0	0	75	0	0	100	20	0	20	0	0	0	0	100	100	0	60	0
11	PFHpA	100	100	0	0	0	0	0	0	100	60	60	60	0	100	100	80	100	100	0	40	0
12	PFOA	100	100	0	0	33	100	75	40	100	100	100	20	40	100	100	100	100	100	40	80	0
13	PFNA	100	100	0	0	0	100	75	20	100	100	100	100	100	100	100	100	100	100	0	40	0
14	PFDA	33	100	0	67	33	100	100	20	100	100	100	100	100	100	100	100	100	100	20	80	0
15	PFUnDA	0	75	67	33	67	25	100	0	100	100	100	100	100	100	100	100	100	100	20	40	0
16	PFDoDA	0	75	0	67	33	100	100	40	60	100	100	80	0	100	100	100	40	100	20	40	0
17	PFTrDA	0	0	0	67	33	100	100	80	0	100	100	60	0	100	100	100	0	100	0	20	0
18	PFTeDA	0	17	67	67	33	100	100	60	0	100	100	0	0	100	80	100	0	100	0	0	0
	PFHxDA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	100	n.a.	n.a.	n.a.
	PFOcDA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	100	n.a.	n.a.	n.a.

n.a.: not analysed

Table 1 continued. Detection frequencies (%) of the investigated compounds in the investigated samples.

Nr	Matrix	Surface water, Lake Mjøsa	Surface water, River Alna	Sediment, North Sea	Sediment, Lake Mjøsa	Sediment, River Alna (suspected hotspot)	Soil, Alna (suspected hot spot)	Perch liver, Lake Mjøsa	Blue mussel	POCIS, passive water sampler	White-tailed eagle, liver	Otter, liver	Wolf, liver	Moose, liver	Glaucous gull, egg	Polar bear, blood plasma	Arctic fox, liver	Waste water LYB	Snow, test track	Air, outdoor and in door	Dust,	Arctic air, Zeppelin	Snowbunting
19	short F53 B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	F53B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	long F53B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	6:2 FTS	0	50	0	0	0	0	0	0	100	100	100	0	0	0	0	20	40	100	0	0	0	0
23	8:2 FTS	0	33	0	0	0	0	0	0	100	80	100	0	0	0	0	20	60	75	0	0	0	0
24	10:2 FTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	377-73-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0
26	863090-89-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Gen X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	378-03-0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	801212-59-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	96513-97-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	948014-44-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	151772-58-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	ADONA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	13252-14-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	151772-59-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	65294-16-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 1 continued. Detection frequencies (%) of the investigated compounds in the investigated samples.

Nr	Matrix	Surface water, Lake Mjøsa	Surface water, River Alna	Sediment, North Sea	Sediment, Lake Mjøsa	Sediment, River Alna (suspected hotspot)	Soil, Alna (suspected hot spot)	Perch liver, Lake Mjøsa	Blue mussel	POCIS, passive water sampler	White-tailed eagle, liver	Otter, liver	Wolf, liver	Moose, liver	Glaucous gull, egg	Polar bear, blood plasma	Arctic fox, liver	Waste water LYB	Snow, test track	Air, outdoor and in door	Dust,	Arctic air, Zeppelin	Snowbunting
37	1212077-14-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	65150-95-0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	52481-85-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	65578-62-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0
41	144808-89-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	374-88-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	10:2 mono PAP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	12:2 mono PAP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	14:2 mono PAP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	16:2 mono PAP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	101896-22-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	FBSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	n.a.
49	N-Me FBSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.a.
50	N-Et- FBSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.a.
51	N-Me FHxSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.a.
52	N-Me FHxSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.a.
53	38850-58-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.a.

Table 1 continued. Detection frequencies (%) of the investigated compounds in the investigated samples.

Nr	Matrix	Surface water, Lake Mjøsa	Surface water, River Alna	Sediment, North Sea	Sediment, Lake Mjøsa	Sediment, River Alna (suspected hotspot)	Soil, Alna (suspected hot spot)	Perch liver, Lake Mjøsa	Blue mussel	POCIS, passive water sampler	White-tailed eagle, liver	Otter, liver	Wolf, liver	Moose, liver	Glaucous gull, egg	Polar bear, blood plasma	Arctic fox, liver	Waste water LYB	Snow, test track	Air, outdoor and in door	Dust,	Arctic air, Zeppelin
54	FOSA	0	0	0	0	0	0	0	0	0	100	100	0	0	0	0	80	0	0	0	0	0
55	N-Me-FOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	N-Et-FOSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	N-Me-FOSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	N-Et-FOSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	N-Me-FOSAA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	0
60	N-Et-FOSAA	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	80	0	0	0	0
61	67584-55-8	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	0	0	0	0	0	0	0	0	0	0	0
62	17329-79-2	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	0	0	0	0	0	0	0	0	0	0	0
63	67584-57-0	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	0	0	0	0	0	0	0	0	0	0	0
64	1893-52-3	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	0	0	0	0	0	0	0	0	0	0	0
65	67584-61-6	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	0	0	0	0	0	0	0	0	0	0	0
66	67906-70-1	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	0	0	0	0	0	0	0	0	0	0	0
67	67584-59-2	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	0	0	0	0	0	0	0	0	0	0	0
68	67939-33-7	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	0	0	0	0	0	0	0	0	0	0	0
68	10:2 FTOH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	20	0	0
70	12:2 FTOH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	14:2 FTOH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	16:2 FTOH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	18:2 FTOH										0	0	0	0	0	0	0	0	0	0	0	0

n.a.: not analysed

Table 1 continued. Detection frequencies (%) of the investigated compounds in the investigated samples.

Nr	Matrix	Surface water, Lake Mjøsa	Surface water, River Alna	Sediment, North Sea	Sediment, Lake Mjøsa	Sediment, River Alna (suspected hotspot)	Soil, Alna (suspected hot spot)	Perch liver, Lake Mjøsa	Blue mussel	POCIS, passive water sampler	White-tailed eagle, liver	Otter, liver	Wolf, liver	Moose, liver	Glaucous gull, egg	Polar bear, blood plasma	Arctic fox, liver	Waste water LYB	Snow, test track	Air, outdoor and in door	Dust,	Arctic air, Zeppelin
74	307-33-5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
75	335-64-8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
76	355-24-8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
77	355-41-9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
78	336-19-6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
79	TFA	0	0	0	33	100	0	0	0	0	100	100	100	100	100	0	100	0	100	100	0	0
80	PFPrA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	100	100	80	67
81	PFEtS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	PFPrS	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0

n.a.: not analysed

Sammendrag

Screening-programmet 2018, del 1 som ble gjennomført av NILU – Norsk institutt for luftforskning, i samarbeid med Norsk institutt for vannforskning (NIVA), Norsk institutt for naturforskning (NINA) og Norsk Polarinstitutt (NPI), hadde fokus på å kartlegge forekomst av kjente og ukjente per- og polyfluorerte forbindelser (PFAS-er) i terrestrisk og marint miljø, inkludert arktisk.

I tillegg til biologiske prøver, ble vann, jord, sediment, luft og støv undersøkt. Både lokale punktkilder og bakgrunnsområder ble undersøkt. Ved å bestemme ekstraherbar mengde organisk fluor, får man et mål på mengden av ukjente organiske fluorforbindelser. Disse kan både være ukjente PFAS-er og for eksempel fluorerte legemidler.

Oppsummering av hvilke PFAS-er som ble funnet i hvilke prøvetyper er gitt i tabell 1 på de foregående sidene (på engelsk).

Begrepet «vanlige PFAS-er» omfatter de forbindelsene hvor karbonkjeden (C4-C14) er fullt ut fluorert, og hvor den funksjonelle gruppen er karboksylat eller sulfonat. De vanlige PFAS-ene ble funnet i alle prøver med unntak av luftprøver fra Zeppelin, og ble for første gang rapportert i norsk ulv, en toppredator i det terrestriske miljøet. De høyeste konsentrasjonene ble derimot funnet i oter, etterfulgt av isbjørn, polarrev, havørn, polarmåke, ulv og elg. Den dominerende forbindelsen var perfluoroktansulfonsyre (PFOS). Resultatene viser de langkjedede perfluorokarboksylsyrene (PFCAer) var tilstede i mange av prøvene.

I det abiotiske miljø, som her omfatter snø, vann, jord, sediment, luft og støv, ble de høyeste mengdene av PFAS-er funner i snø. Snøprøvene var samlet inn fra et område som ble benyttet til testing av ski i forbindelse med et Norgescup-renn. Resultatene viser at områder hvor ski testes er potensielle punktkilder. Det var de langkjedede PFCA-ene (C12-C16) det ble funnet mest av i disse prøvene. I jord og sedimentprøver ble det funnet mest PFOS. Noen av de vanlige PFAS-ene ble funnet i støv. Forekomsten av dem i luft fra potensielle punktkilder og Arktis var lav.

Gruppen nye ioniske PFASer bestod av 29 forskjellige forbindelser: Sulfonateter og telomerer, karboksyleter, sykliske PFCA-er, og polyfluoralkylfosforsyre-estere (PAP-er). Fluortelomersulfonsyrene (FTS-er), 6:2 og 8:2 FTS, ble funnet i flere prøver. I prøvene hvor de ble funnet, dominerte 6:2 FTS i abiotiske prøver og 8:2 FTS i biologiske prøver. En kjent kilde for FTS-er er brannskum av typen AFFF (Aqueous Film-Forming Foam). I alle avløpsvann-prøver fra Longyearbyen ble en perfluorert syklisk furan funnet. Kilden til denne forbindelsen er ukjent.

Prøvene ble også analysert for 26 semi-flyktige PFAS-er: Sulfonamider, akrylater og fluorotelomer alkoholer (FTOH-er). Flere av disse kan brytes ned til de vanlige PFAS-ene. Perfluorooctansulfonamid (FOSA), som i organismer kan brytes ned til PFOS, ble funnet i oter, havørn og polarrev. Mengden var 0-35% av den rapporterte PFOS-konsentrasjonen. I avløpsvann fra Longyearbyen ble perfluorobutylsulfonamid (FBSA) og metyl- og etyl-perfluorooktansulfonamieddiksyre (Me-og Et-FOSAA) påvist. En forløper til PFCAer, 10:2 FTOH, ble funnet i en støv- og en snøprøve.

Luftprøver fra Arktis ble undersøkt for veldig flyktige PFAS-er. Ingen av PFAS-ene som var en del av denne screeningen, ble funnet i prøvene.

Fire ultra-korte PFAS-er var del av screeningprogrammet. Trifluoreddiksyre (TFA) ble funnet i flere av de biologiske prøvene, samt snø og luft. Den høyeste konsentrasjonen ble rapportert for en prøve fra polarrev, 222 ng/g. Perfluoropropansulfonsyre (PFPrS) ble bare funnet i polarmåke, med konsentrasjoner <0.5 ng/g. Den høyeste konsentrasjonene av perfluoropropansyre (PFPrA), opp til

8.86 ng/mL, ble funnet i luft- og støvprøver fra potensielle punktkilder. Mengden PFPrA var på samme nivå som noen av de mer vanlieg PFASene.

I de fleste prøvene var mengden EOF større enn den teoretiske mengden fluorid beregnet ut i fra summen av konsentrasjonene av vanlige PFAS-er. Etter at alle påviste PFAS-er i denne studien, ble inkludert i totalsummen, ble den teoretiske mengden fluorid lik EOF. Dette ble observert for noen prøver fra oter og fjellrev .

Resultatene fra denne studien viser at de vanlige PFAS-ene finnes i alle typer prøver. Utfasinger og forbud har pågått i flere år, men det er fortsatt en kontinuerlig eksponering av PFAS-er i naturen og dyrelivet.

Screening new PFAS compounds 2018

1 Background and introduction

1.1 General

Since the 1950's per- and polyfluoroalkyl substances (PFASs) have been used as ingredients or intermediates of surfactants and surface protectors for assorted industrial and consumer applications (OECD 2013). This group of compounds is recognised as highly persistent, potentially bioaccumulative and toxic. The stability of these compounds is caused by a very strong C-F bond, effective shielding of carbon by fluorine atoms (Kissa 2001), and lack of hydrogen in the perfluoroalkyl moiety. Numerous applications have been described, among them: aqueous film–forming foams (AFFFs), floor polish, ski waxes, and water-proof coatings of textile fibres and paper cardboard and latest also in cosmetics (Buck et al 2011, Brinch et al., 2018, Schultes et al. 2018). They are present in all environmental media, humans, assorted consumer products and industrial application and detected globally. Studies have revealed the potential for atmospheric long-range transport of PFAS (Ahrens et al, 2011; AMAP Assessment 2015).

Little is known about the worldwide production and consumption of many of these chemicals (OECD, 2015), and more than 4000 PFASs are on the global market for intentional uses, and the chemical identities of many are yet unknown (Wang et al., 2017, OECD, 2018).

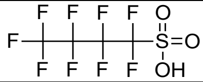
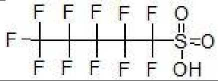
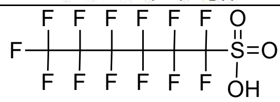
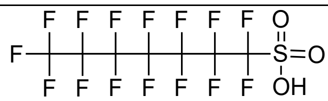
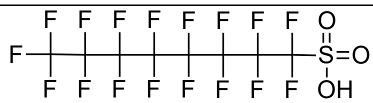
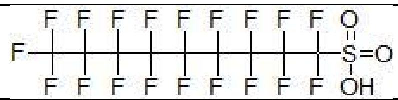
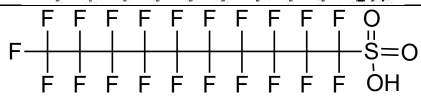
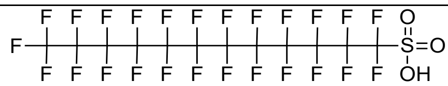
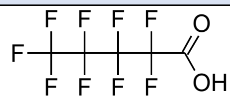
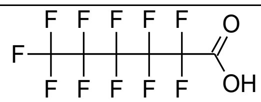
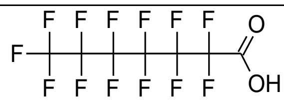
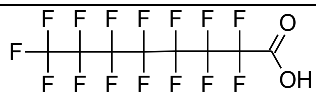
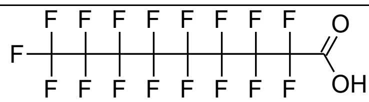
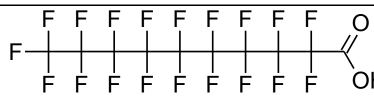
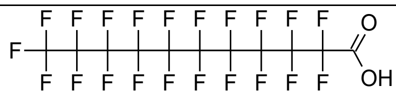
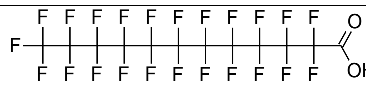
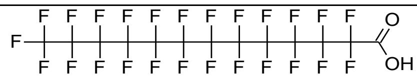
In 2017, the Norwegian Environment Agency nominated a large and diverse group of poly- and perfluorinated compounds for analysis. The criteria for selection were the potential occurrence of these compounds in the Arctic environment, with a high detection rate for conventional ionic PFAS as well as a number of volatile fluororganic compounds detected in air (Schlabach et al., 2018). To follow up on these findings, in 2018, the Norwegian Environment Agency commissioned the here presented study with a much broader scope of target compounds. The aim of the study was to investigate the presence of PFASs in air, water, sediments, biological tissue from marine and terrestrial environments. Based on samples from Svalbard, potential long range transport (LRT) of the compounds in questions can be evaluated.

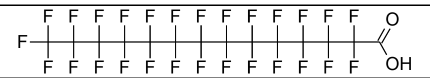
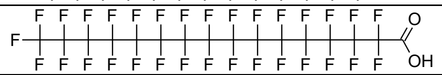
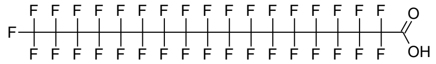
1.2 Selected compounds

In this chapter the compounds selected for this screening study are listed, together with their acronym (if any), and CAS-number. To identify the compound in question, each compound is given a number from 1-82.

1.2.1 Conventional PFASs

Table 2: Number, name, acronym (if any), structure and CAS nr of ionic PFASs: perfluoro carboxylates (PFCAs) and perfluoro sulfonates (PFSAs)

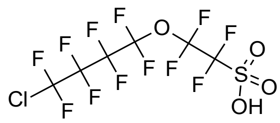
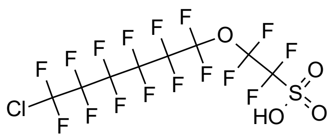
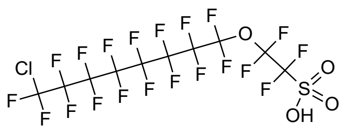
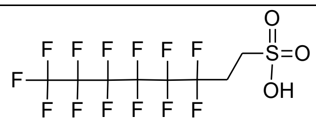
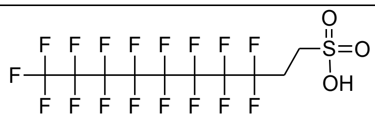
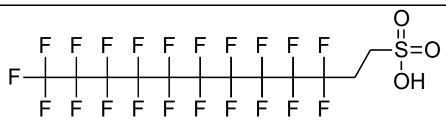
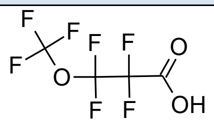
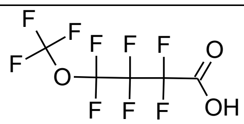
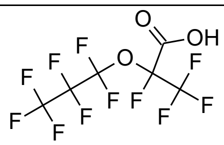
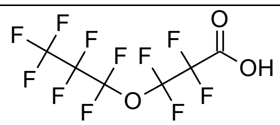
Nr	Name	Acronym	Structure	CAS
	Sulfonates			
1	Perfluorobutane sulfonic acid	PFBS		375-73-5
2	Perfluoropentane sulfonic acid	PFPeS		2706-91-4
3	Perfluorohexane sulfonic acid	PFHxS		355-46-4
4	Perfluoroheptane sulfonic acid	PFHpS		375-92-8
5	Perfluorooctane sulfonic acid	PFOS		1763-23-1
6	Perfluorononane sulfonic acid	PFNS		474511-07-4
7	Perfluorodecane sulfonic acid	PFDS		335-77-3
8	Perfluorododecane sulfonic acid	PFDoDS		79780-39-5
	Carboxylates			
9	Perfluoropentanoic acid	PFPeA		2706-90-3
10	Perfluorohexanoic acid	PFHxA		307-24-4
11	Perfluoroheptanoic acid	PFHpA		375-85-9
12	Perfluorooctanoic acid	PFOA		335-67-1
13	Perfluorononanoic acid	PFNA		375-95-1
14	Perfluorodecanoic acid	PFDA		335-76-2
15	Perfluoroundecanoic acid	PFUnDA		2058-94-8
16	Perfluorododecanoic acid	PFDoDA		307-55-1
17	Perfluorotridecanoic acid	PFTrDA		72629-94-8

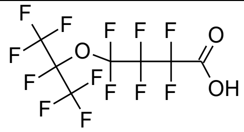
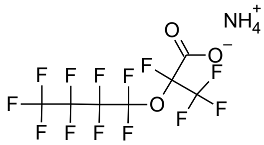
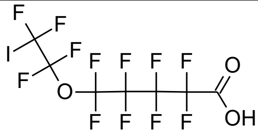
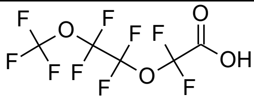
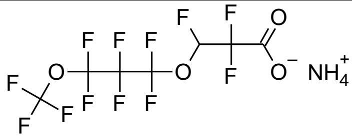
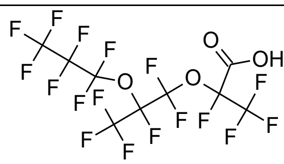
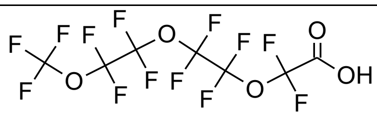
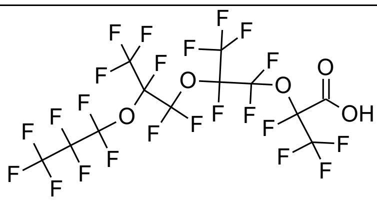
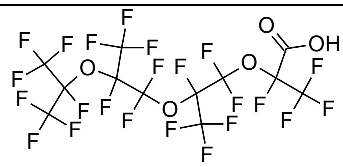
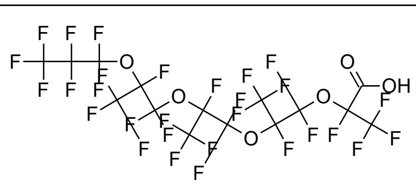
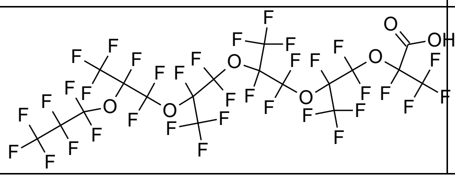
18	Perfluorotetradecanoic acid	PFTeDA		376-06-7
*	Perfluorohexadecanoic acid	PFHxDA		67905-19-5
*	Perfluorooctadecanoic acid	PFOcDA		16517-11-6

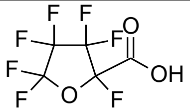
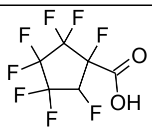
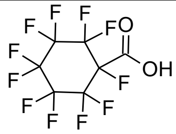
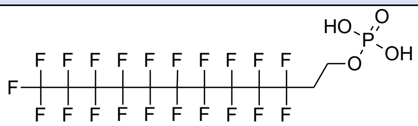
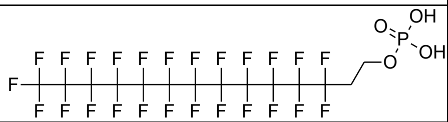
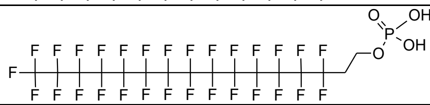
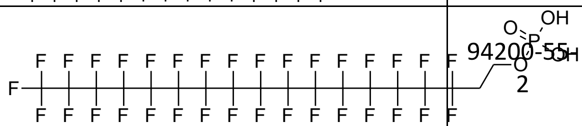
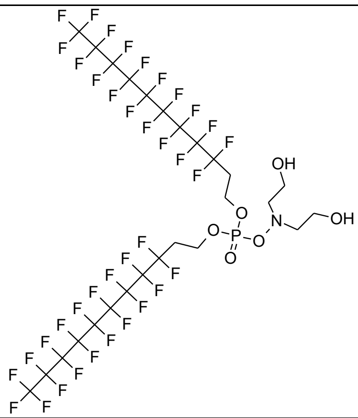
*only analysed in selected samples

1.2.2 New PFASs

Table 3: Number, name, acronym (if any), structure and CAS nr of ionic PFASs: sulfonate ethers, carboxylic ethers, cyclic PFASs and polyfluoroalkyl phosphates (PAPs).

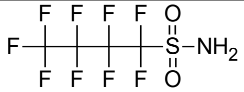
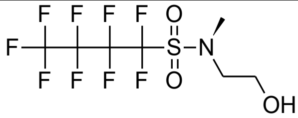
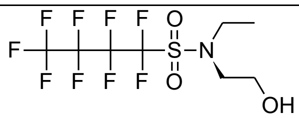
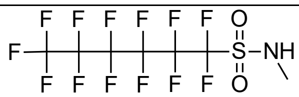
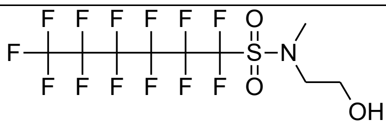
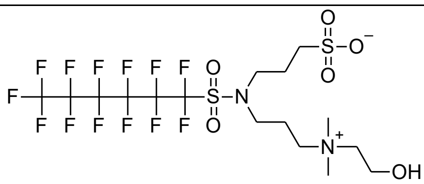
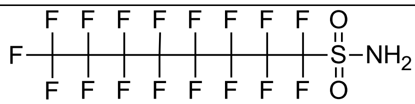
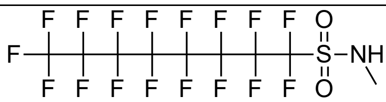
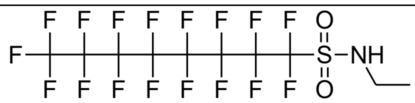
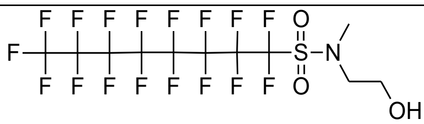
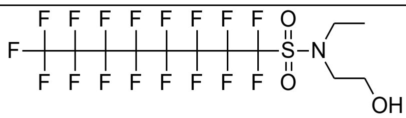
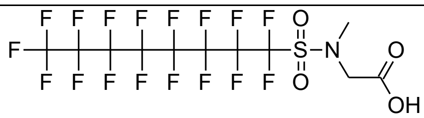
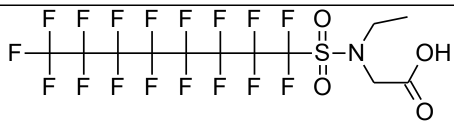
Nr	Sulfonate ethers and telomers			
19	Ethanesulfonic acid, 2-(4-chloro-1,1,2,2,3,3,4,4-octafluorobutoxy)-1,1,2,2-tetrafluoro	wCl-42-PFESA		737728-96-0
20	Ethanesulfonic acid, 2-[(6-chloro-1,1,2,2,3,3,4,4,5,5,6,6-dodecafluorohexyl)oxy]-1,1,2,2-tetrafluoro	F53B		756426-58-1
21	2-[(8-Chloro-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8-hexadecafluorooctyl)oxy]-1,1,2,2-tetrafluoroethane-1-sulfonic acid	wCl-82-PFESA		763051-92-9
22	6:2 Fluorotelomer sulfonic acid	6:2 FTS		27619-97-2
23	8:2 Fluorotelomer sulfonic acid	8:2 FTS		39108-34-4
24	10:2 Fluorotelomer sulfonic acid	10:2 FTS		120226-60-0
	Carboxylic ethers			
25	Perfluoro-3-methoxypropanoic acid	13-PFECA		377-73-1
26	Perfluoro(4-methoxybutanoic) acid	14-PFECA		863090-89-5
27	2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	GenX		13252-13-6
28	2,2,3,3-Tetrafluoro-3-(heptafluoropropoxy)propionic acid			378-03-0

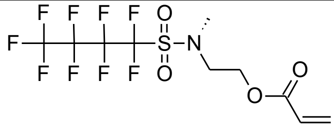
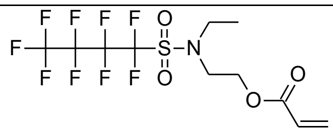
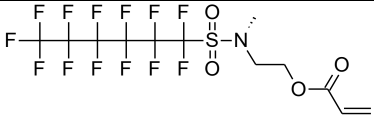
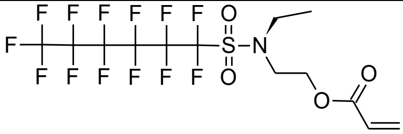
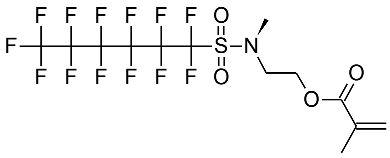
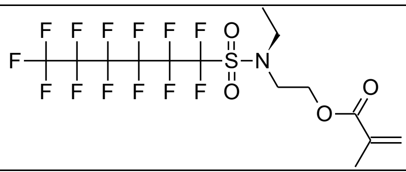
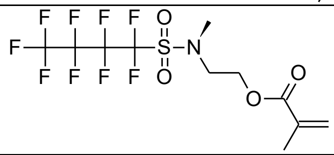
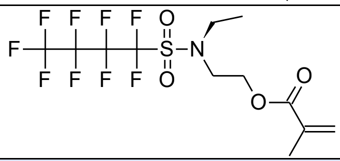
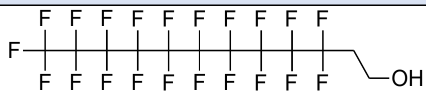
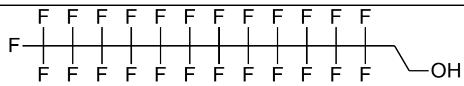
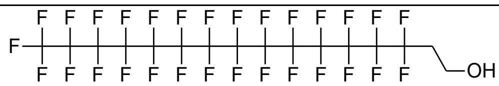
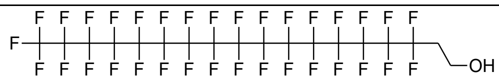
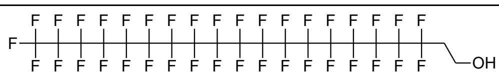
29	Perfluoro-4-isopropoxybutanoic acid	34-PFECA		801212-59-9
30	Ammonium 2,3,3,3-tetrafluoro-2-(nonafluorobutoxy) Propanoate			96513-97-2
31	2,2,3,3,4,4,5,5-Octafluoro-5-(1,1,2,2-tetrafluoro-2-iodoethoxy)pentanoic acid			948014-44-6
32	Perfluoro-3,6-dioxaheptanoic acid	36O2-PFHpA		151772-58-6
33	Ammonium 4,8-dioxa-3H-perfluorononanoate	ADONA		958445-44-8
34	Perfluoro-2,5-dimethyl-3,6-dioxanonanoic acid			13252-14-7
35	Perfluoro-3,6,9-trioxadecanoic acid	369O3-PFDA		151772-59-7
36	Perfluoro-(2,5,8-trimethyl-3,6,9-trioxadodecanoic)acid	369O3-PFDoDA		65294-16-8
37	Perfluoro(2,5,8,10-tetramethyl-3,6,9-trioxaundecanoic) acid	4x3-PFECA		1212077-14-9
38	2,4,4,5,7,7,8,10,10,11, 13,13,14,14,15,15,15-Heptadecafluoro-2,5,8,11-tetrakis(trifluoromethyl)-3,6,9,12-tetraoxapentadecan-1-oic acid	5x3-PFECA		65150-95-0
39	Perfluoro(2,5,8,11,14-pentamethyl-3,6,9,12,15-pentaoxaoctadecanoic) acid	6x3-PFECA		52481-85-3

	Cyclic			
40	2-Furancarboxylic acid, 2,3,3,4,4,5,5-heptafluorotetrahydro	Furan-PFECA		65578-62-3
41	1,2,2,3,3,4,4,5-Octafluorocyclopentane-carboxylic acid	cycC_5F_9-COOH		144808-89-9
42	1,2,2,3,3,4,4,5,5,6,6-Undecafluorocyclohexane-1-carboxylic acid	cycC_6F_{11}-COOH		374-88-9
	PAPs			
43	10:2 Fluorotelomer dihydrogen phosphate	10:2 mono PAP		57678-05-4
44	12:2 Fluorotelomer dihydrogen phosphate	12:2 mono PAP		57678-07-6
45	14:2 Fluorotelomer dihydrogen phosphate	14:2 mono PAP		94200-54-1
46	16:2 Fluorotelomer dihydrogen phosphate	16:2 mono PAP		94200-55-2
47	1,1-Bis((perfluoro-1-nonyl)ethyloxy)-N-(2-hydroxyethyl)-2-oxa-3-aza-1-phosphapentan-5-ol 1-oxide			101896-22-4

1.2.3 Semi volatile per-and polyfluorinated compounds

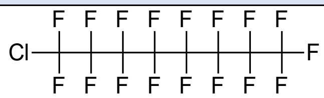
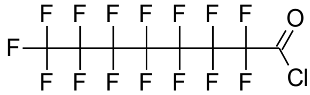
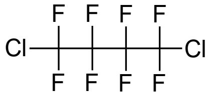
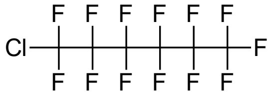
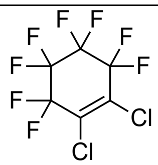
Table 4: Number, name, acronym (if any), structure and CAS nr of semi volatile per- and polyfluorinated compounds: Amides, acrylates and fluorotelomer alcohols (FTOH).

Nr	Name	Acronym	Structure	CAS
	Amides			
48	Perfluorobutylsulphonamide	FBSA		30334-69-1
49	N-Methyl perfluorobutyl-sulphonamide	N-Me FBSE		34454-97-2
50	N-Ethyl perfluorobutyl-sulphonamide	N-Et- FBSE		34449-89-3
51	N-Methyl perfluorohexane sulphonamide	N-Me FHxSA		68259-15-4
52	N-Methyl perfluorohexane sulfonamidoethanol	N-Me FHxSE		68555-75-9
53	(2-Hydroxyethyl)dimethyl (3-((3-sulfopropyl) ((tridecafluorohexyl) sulfonyl)amino)propyl) ammonium	PFHxS amid		38850-58-7
54	Perfluorooctanesulfonamide	FOSA		754-91-6
55	N-Methylperfluorooctane-sulfonamide	N-Me-FOSA		31506-32-8
56	N-Ethyl perfluorooctane sulphonamide	N-Et-FOSA		4151-50-2
57	N-Methyl perfluorooctane sulfonamidoethanol	N-Me-FOSE		24448-09-7
58	N-Ethyl perfluorooctane sulfonamidoethanol	N-Et-FOSE		1691-99-2
59	N-Methyl perfluorooctane sulfonamidoacetic acid	N-Me-FOSAA		2355-31-9
60	N-Ethyl perfluorooctane sulfonamidoacetic acid	N-Et-FOSAA		2991-50-6

	Acrylate			
61	2-(Methyl((nonafluorobutyl) sulphonyl)amino)ethyl acrylate	Me FBSAC		67584-55-8
62	2-[Ethyl(1,1,2,2,3,3,4,4,4-nonafluorobutane-1-sulfonyl)amino]ethyl prop-2-enoate	Et-FBSAC		17329-79-2
63	2-Propenoic acid, 2-[methyl[(tridecafluorohexyl) sulfonyl]amino]ethyl ester	Me FHxSAC		67584-57-0
64	2-[Ethyl(1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluorohexane-1-sulfonyl)amino]ethyl prop-2-enoate	Et-FHxSAC		1893-52-3
65	2-[Methyl(1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluorohexane-1-sulfonyl)amino]ethyl 2-methylprop-2-enoate			67584-61-6
66	2-[Ethyl(1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluorohexane-1-sulfonyl)amino]ethyl 2-methylprop-2-enoate			67906-70-1
67	2-[Methyl(1,1,2,2,3,3,4,4,4-nonafluorobutane-1-sulfonyl)amino]ethyl 2-methylprop-2-enoate			67584-59-2
68	2-[Ethyl(1,1,2,2,3,3,4,4,4-nonafluorobutane-1-sulfonyl)amino]ethyl 2-methylprop-2-enoate			67939-33-7
	Fluorotelomer alcohols			
69	10:2-Fluorotelomer alcohol	10:2 FTOH		865-86-1
70	12:2-Fluorotelomer alcohol	12:2 FTOH		39239-77-5
71	14:2-Fluorotelomer alcohol	14:2 FTOH		60699-51-6
72	16:2-Fluorotelomer alcohol	16:2 FTOH		65104-67-8
73	18:2-Fluorotelomer alcohol	18:2 FTOH		65104-65-6

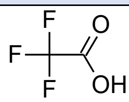
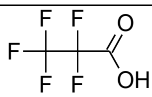
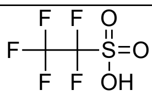
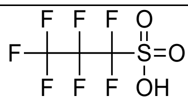
1.2.4 *Very volatile polyfluorinated substances*

Table 5: Number, name, acronym (if any), structure and CAS nr of Very volatile polyfluorinated compounds

	Name	Acronym	Structure	CAS
	Very volatile PFASs			
74	1-Chloroheptadecafluorooctane			307-33-5
75	Pentadecafluorooctyl chloride			335-64-8
76	1,4-Dichloro-1,1,2,2,3,3,4,4-octafluorobutane			355-24-8
77	1-Chloroperfluorohexane			355-41-9
78	1,2-Dichloro-perfluorocyclohexene			336-19-6

1.2.5 *Ultra short chain perfluorinated substances*

Table 6: Number, name, acronym (if any), structure and CAS nr of ultra short perpolyfluorinated acids.

Nr	Name	Acronym	Structure	CAS
	Ultra short PFASs			
79	Trifluoroacetic acid	TFA		76-05-1
80	Perfluoropropanoic acid	PFPrA		422-64-0
81	Perfluoroethanesulfonic acid	PFEtS		354-88-1
82	Perfluoropropanesulfonic acid	PFPrS		423-41-6

2 Materials and methods

2.1 Sampling stations, sample collection and sample pre-treatment

Sample collection, transport and storage before analysis was carried out at the responsibility of NILU, the Norwegian Institute for Nature Research (NINA), the Norwegian Institute for Water Research (NIVA) and the Norwegian Polar Institute (NPI). Different sample types were taken in the Norwegian Arctic area, together with hotspot areas in Tromsø, Oslo, and non urban areas. All samples were sampled and handled according the guidelines given in OSPAR/JAMP, 2009.

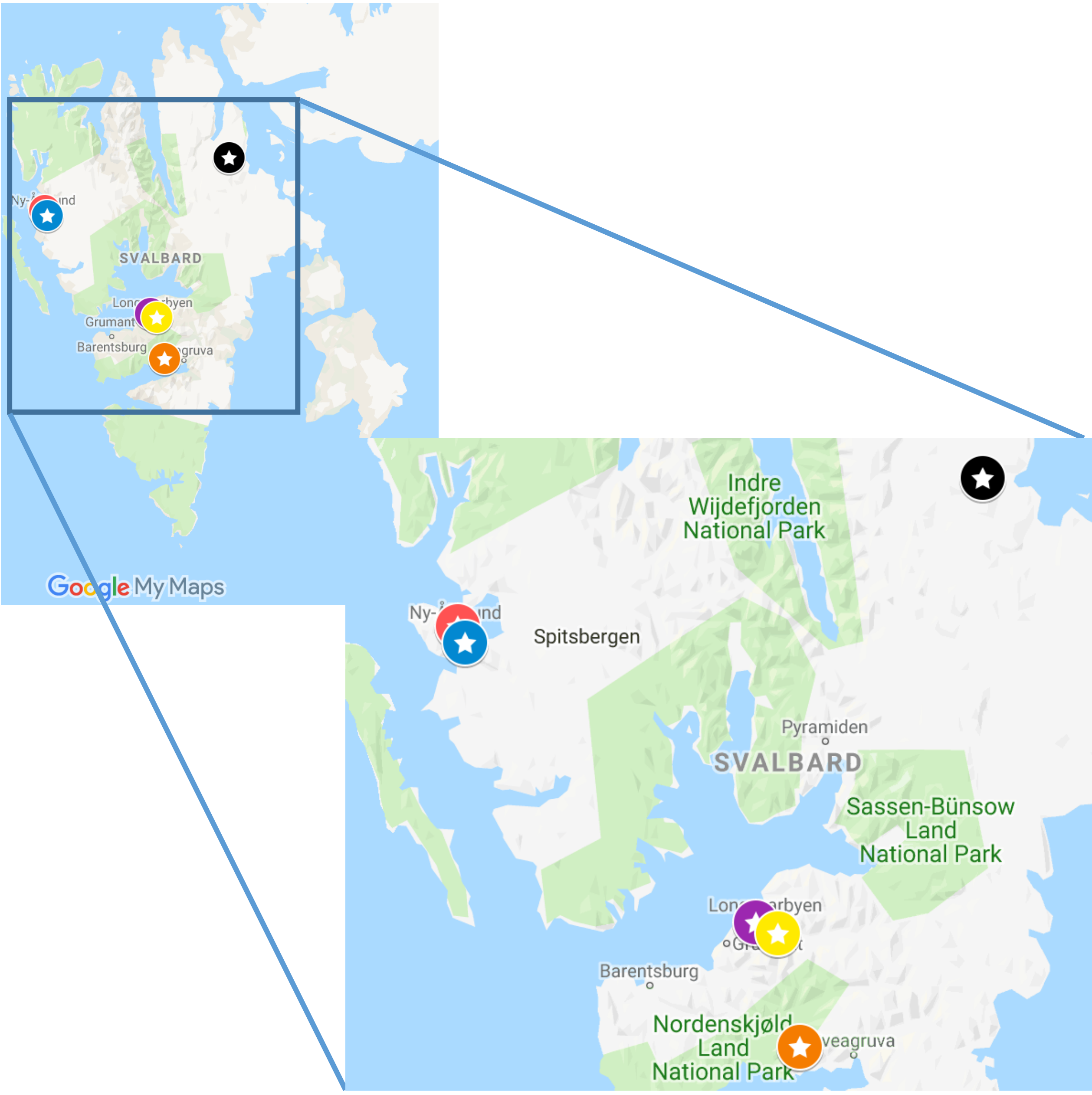


Figure 1: Sampling stations on Svalbard. Blue: air samples (Zeppelin mountain); red: glaucous gull egg (Ny Ålesund); black: polar bear blood samples (north east Svalbard); orange: arctic fox liver samples (Tempelfjord area); yellow: waste water samples (Longyearbyen); and purple: snow bunting eggs (Longyearbyen).

Figure 2: Sampling locations, main land Norway. Blue: air and dust samples (Tromsø); orange: otter liver samples (Vega); yellow: white-tailed eagle liver samples (Smøla); green: moose liver samples (Trøndelag); black: wolf liver samples (Østerdalen); purple: water and sediment samples (Lake Mjøsa); pink: snow from ski testing track (Nannestad); dark grey: air and dust samples (Helsfyr/Kjeller); light grey: soil, sediment and water samples (Alna area). Blue mussel and fish samples (North Sea), not on the map.

2.1.1 Arctic air

Air samples were collected at the Arctic observatory located at 78°54'29"N 11°52'53"E, 475 m above sea level on the Zeppelin Mountain, and south of the settlement Ny-Ålesund on Svalbard. This station is part of Norway's air monitoring network, where PCBs and many other legacy POPs have been monitored for several decades (Bohlin-Nizzetto et al. 2017). In this study we used a high volume air sampler equipped with both a filter unit and two PU-foam plugs, and a low volume samplers equipped with an ABN-adsorbent cartridge. In principle, the sampler design consist of a pump that draws air through the samplers with an average air flow rate of either 25 m^3/hour or 0.5 m^3/hour, a filter/adsorbent unit, and a flow meter (Schlabach et al. 2017). Specification on each sampler type is given in Table 7. Flow-rate and sampling conditions were digitally monitored and documented (e.g. power failures, etc.) as an integrated part of the sampling and quality control procedure

Table 7: Parameters for air sampling at Zeppelin mountain, Ny-Ålesund

Sampler ID	Type	Volume m^3	Flow m^3/h	Period	Analyte group
1	Filter	1364.36	-	30.01-01.02.19	Ionic PFASs, semi volatile PFASs, short chain PFASs, EOF
2	Filter	1361.95	-	04.02-06.02.19	Ionic PFASs, semi volatile PFASs, short chain PFASs, EOF
3	Filter	1362.36	-	06.02-08.02.19	Ionic PFASs, semi volatile PFASs, short chain PFASs, EOF
4	ABN	42.3	-	30.01-01.02.19	Volatile PFASs
5	ABN	42.4	-	04.02-06.02.19	Volatile PFASs
6	ABN	42.6	-	06.02-08.02.19	Volatile PFASs
-	ABN	40	-	Week 47, 2017	Very volatile PFASs
-	ABN	42	-	Week 48, 2017	Very volatile PFASs
-	ABN	40	-	Week 49, 2017	Very volatile PFASs

2.1.2 Biota

The sampling was performed with authorisation from the Norwegian Environment Agency and the Governor of Svalbard.

White-tailed eagle
White-tailed eagle (*Haliaeetus albicilla*) were sampled on the island Smøla. The birds had died after collision with wind turbine blades. For this project, liver samples from a total of five individuals, one male and four females, were collected. After dissection and sampling at NINA's laboratory in Trondheim, liver samples were excised and placed in aluminium foil before storage in a ziplock bag at -20 °C until analysis.

Wolf
Wolf (*Canis lupus*) were shot in licensed recreational hunting, and not for the purpose of collecting samples for this project. The Ministry of Climate and Environment grants these hunting permissions through regional hunting committees ('rovviltnemd' in Norwegian) for regulating the wolf population. Rovdata receives the dead animals for subsequent dissection, analyses and storage (-20 °C). Applying to two male and three female wolfs shot in licensed recreational hunting in Østerdalen in January 2018, Norwegian Environment Agency granted Rovdata and Norwegian Institute for Nature Research (NINA) permission to take out < 20 g liver samples for the purpose of this project. The samples were placed in plastic sample tubes before storage at -20 °C until analysis.

Otter
The otter samples came from 5 different otters (*Lutra lutra*) who were shot at the Vega archipelago , with the permission obtained from the province or county Nordland, during spring 2018. For this project, liver samples from two females and three males were collected. After dissection and sampling at NINA's laboratory in Trondheim, liver samples were excised and placed in aluminium foil before storage in a ziplock bag at -20 °C until analysis.

Moose
Moose (*Alces alces*) were shot as part of the yearly recreational hunting, in Trøndelag 2018. For this project, liver samples from a total of five individuals, one male and four females, were collected. After dissection in the field, a part of the liver were transferred to a 50 mL polypropylene tube. As soon as possible, the sample was put in a freezer and stored at -20 °C until analysis.

Polar bear
Blood from five female polar bears (*Ursus maritimus*) was collected in April of 2018 at the north-eastern part of Svalbard. Blood samples were centrifuged in the field, and the plasma transferred to cryogenic vials and immediately frozen (-20 °C). Samples (n=5) were stored frozen at -20 °C until analysis.

Snow bunting
Eggs from snow bunting (*Plectrophenax nivalis*) were sampled in Longyearbyen, Svalbard. A total of 10 eggs were collected from nests close to the airport in May 2015.

Glaucous gull
Eggs from Glaucous gull (*Larus hyperboreus*) were sampled in Ny Ålesund, Svalbard. A total of five eggs (n=5) were collected in April 2017 (n=3) and April 2018 (n=2).

Arctic fox
Arctic fox (*Vulpes lagopus*) carcasses were collected from trappers on Svalbard, mainly around Tempelfjord area. All foxes were weighed, sex-determined, and skinned before the final dissection. Body condition was evaluated according to a subjective fat index ranging from 0 to 4 (none to extensive) based on visual inspection of the skinned carcasses. For this project, liver samples from a total of five individuals, all males, were collected. After dissection and sampling at the Norwegian Veterinary Institute, in Tromsø, liver samples were excised and placed in aluminium foil before storage in a ziplock bag at -20 °C until analysis. The five animals analysed in this study had body condition 4 and age 1-4 years.

Fish
Perch (*Perca fluviatilis*) were caught using bottom nets at 25 m depth east of Helgøya in Lake Mjøsa (60°44'10"N 11°2'13"E). The fish was gently untangled from the net using laboratory disposable gloves and immediately wrapped in burnt aluminum foil. All fish were kept frozen upon shipment to the laboratory. Liver samples was excised before analysis.
Tusk (*Brosme brosme*) and cod (*Gadus morhua*) were collected from areas around offshore installations in connection with environmental surveys. Muscle tissue from these fishes were thawed and analysed.

Blue mussels
Blue mussels (*Mytilus edulis*) were collected from areas around offshore installations in connection with environmental surveys. Some soft tissue from these mussels were available for Screening 2018. A sufficient mass of soft tissue were thawed, pooled and analysed.

2.1.3 Air/dust

Hot spots
Pre-cleaned ABN cartridges were connected to a low volume samplers equipped with an ABN-adsorbent cartridge. In principle, the sampler designs consist of a pump that draws air through the samplers with an average air flow rate of 1 m^3/hour.

Dust
House dust was collected with a vacuum cleaner equipped with a filter in front of the nozzle (Bohlin-Nizzetto et al. 2015).

Office dust was collected with a glass fibre filter (GFF) soaked in isopropanol before surface areas were wiped.

2.1.4 Water/Snow

Waste water, Arctic
Wastewater samples (1 L) from Longyearbyen were sampled at the waste water treatment (WWT) station in June 2017 at different time intervals during one week. The samples were filtered in a clean cabinet and stored cold and dark before analysis.

Household waste water, hot spot Norwegian mainland
All waste water samples were collected as time-integrated composite samples (50 mL sample every 10 min) using ISCO 6700 automatic samplers fitted with LDPE tubing, and ISCO 2150 flow meters were used to measure the flow during sampling. Household wastewater samples were collected from a manhole downstream the residential area at Hellerud (sampling location 1 in Table 8) during dry weather conditions only with the flowmeter mounted in the 300 mm pipeline entering the same manhole. Industry-influenced waste water samples were collected from a manhole situated downstream the industrial areas in Groruddalen during both dry weather conditions and at the beginning of heavy rain events with the flowmeter mounted in the 1400 mm pipeline entering the same manhole (sampling location 2 in Table 8).

River water sampling (Alna)
River water samples were collected as time-integrated composite samples (50 mL sample every 5 min or 10 min) using Avalanche automatic samplers (with integrated cooling and fitted with LDPE tubing) at two different sites along the River Alna; at Brubak 30 meters downstream from where Fossumbekken meets the River Alna with the sampler located within the premises of Veflen Entreprenær AS (sampling location 3 in Table 8) and at Kværnerbyen with the sampler located inside the monitoring station of the Water and Sanitation Agency (VAV) in Oslo Municipality (sampling location 4 in Table 8). The river flow at Brubak was roughly estimated from the measured level in the river using an ISCO 2150 flow meter and the estimated expanding width of the river with rising river level. River flow data at Kværbyen was supplied by VAV. Samples were collected during heavy rain (both locations) and during dry weather conditions (only Kværnerbyen).

Freshwater; Lake Mjøsa
Water samples (2 L per site) were collected in (HP grade) 1 L bottles from surface water (0-20 cm) outside Hamar urban area (60°47'21"N 11°4'40"E), outside Hamar wastewater treatment plant (HIAS, 60°45'42"N 11°4'31"E) and at the lake outlet Minnesund (60°23'57"N 11°13'14"E). Bottles were rinsed twice with local water upon sampling.

Snow

During a cross-country competition in Nannestad 2017, snow samples were sampled from the ski testing track using 10 L buckets. The snow was transported to the lab and thawed before transferred to a clean glass bottle. Reference sample was collected a couple of kilometres away from the track.

Passive water sampling

The Polar Organic Chemical Integrative Sampler (POCIS) consisted of a 10 µm nylon membrane, 200 mg OASIS HLB and 200 mg OASIS WAX. The membrane was primed with methanol and ultrapure water prior to deployment. The POCIS were exposed for 10 days in field. In total five POCIS were sampled: Lake Mjøsa (Hamar and HIAS), River Alna (Kværner, Brubak and Breivoll).

Table 8: Overview of periods, types and weather conditions during sampling of household waste water (1 and 2), and river water (3 and 4).

Sampling location		**Sampling period**	**Type of sample**	**Weather condition (-24h to end of sampling)**	**Measured/ estimated flow**
1	Manhole No. 198323 downstream Hellerud residential area 59°54'46"N 10°50'36"E	28.6 15:57 - 29.6 11:15	Time-integrated composite of household wastewater	Dry (0 mm)	15-20 L/s
		2.7 10:00 - 3.7 11:00		Dry (0 mm)	15-20 L/s
		3.7 11:10 - 4.7 9:20		Dry (0 mm)	15-20 L/s
2	Manhole No. 182238 downstream industrial areas in Groruddalen 59°55'21"N 10°50'27"E	28.6 14:50 - 29.6 12:36	Time-integrated composite of industry-influenced wastewater	Dry (0 mm)	150-400 L/s
		2.7 10:00 - 3.7 10:00		Dry (0 mm)	150-400 L/s
		29.7 01:30 - 29.7 11:10		Wet (11.2 mm; 9.2 mm in 11 h)	300-700 L/s
		30.8 00:13 - 30.8 10:00		Wet (6.0 mm in 5 h)	300-700 L/s
3	In River Alna at Brubak N 6646841.48 59°56'44"N 10°52'44"E	28.7 13:00 - 29.7 05:10	Time-integrated composite of river water	Wet (11.2 mm; 9.2 mm in 11 h)	100-1000 L/s
		29.8 23.57 30.8 10:00		Wet (6.0 mm in 5 h)	
		8.9 08:00	Grab sample	Wet (12.6 mm in 4 h)	
4	In River Alna in Kværnerbyen 59°54'17"N 10°47'30"E	9.6 10:20 - 30.6 10:20	Time-integrated composite of river water	Dry (0 mm)	333 L/s

2.1.5 Sediment/soil

Marine

Sediment samples were collected with a modified van Veen grab (Iversen et al., 2015) as part of environmental offshore survey (135 m from pipeline). Upper 0-3 cm of the sample was collected with clean metal spoons into pre-burned glass jars and kept frozen (-20 °C) until further analysis.

Lake and river sediment (mainland Hot spot)

Sediment samples were collected at the same sites as the water samples. For Lake Mjøsa the sites were as followed; Hamar urban area, Hamar wastewater treatment plant (HIAS) and at the lake outlet Minnesund. For River Alna the sites were; Brubak and Breivoll. Approximately 100 g of top layer sediments (0-10 cm) were collected using a small van Veen grab in the littoral zone (0-50 cm depth). Samples were collected in glass jars with burnt aluminium foil underneath the lid, and kept frozen upon shipment to the laboratory.

Soil

Composite soil samples were collected in close proximity of the river sampling sites at Brubak and Kværnerbyen using a thoroughly cleaned and rinsed spoon according to protocols for the Miljøprøvebanken. Each composite sample consisted of five separate grab samples of the upper two cm of the soil eliminating larger stones.

2.2 Chemical analysis

2.2.1 Quality control

The QA/QC of the sample preparation and analysis was assured through the use of mass labelled internal standards for (^{13}C PFAS), where they were available. Quality of sample preparation and analysis for conventional PFASs was further assured through the use of reference materials and laboratory blanks. A volatile mass labelled internal standard (4:2 FTOH) was used as quality assurance with respect to possible loss of volatile PFASs during up-concentration/evaporation of solvents. For air samples, also field blanks were collected and analysed. All described methods are based on NILU's, NIVA's ans University of Örebro's (UÖ) in-house methods, which were adapted and optimized for the selected compounds. None of the used methods are accredited, but all analytical work was done according to accreditation requirements given in EN17025.

Each of the many steps involved in the process of performing environmental screening studies for contaminants of emerging concern will have an impact on the overall uncertainty of the final results. This uncertainty starts with the design of the sampling regime and is compounded through the entire process to storage of samples, chemical analysis and data treatment. Although it is difficult to estimate the absolute uncertainty for all steps in the process, we are confident that uncertainty in the results from screening studies are higher than that of routine monitoring of conventional PFASs. While the total measurement uncertainty for conventional PFASs are approximately 25 to 30 %. We would estimate that for screening studies this value would be in the order of 40 to 50 % for new emerging compounds where a standard is available.

2.2.2 Extraction and analysis of ionic PFASs, semi volatile PFASs, ultra short chain PFASs and EOF

Biota (NILU)

The sample was homogenized before an aliquot (0.2 mL/2 g) was taken out for further processing. Internal standards were added to the sample before it was extracted with methanol or acetonitrile using vortex and ultrasonication. After extraction the sample was up-concentrated followed by clean up with emulsified carbon.
A similar extract was made for extractable organofluorine (EOF) analysis without internal standard.

Waste water Longyearbyen/snow

Prior to extraction the sample was filtered, hence only water soluble PFASs are present in these samples. Internal standards were added to the sample (0.5 L) before a solid phase extraction (SPE) on a weak anion exchange (WAX) cartridges.
A similar extract was made for EOF analysis without internal standard.

Air

Particle bound PFAS: Internal standard was added to the filter samples, which were further extracted with methanol by ultrasonication, up-concentrated before clean up with activated carbon. After extraction the sample was divided in two, where internal standards was added to one aliquot and the other analysed for EOF.

Volatile PFAS: The PFASs sampled with the ABN column was extracted with 2% NH_4OH in methanol. Extraction was performed before internal standards were added since an aliquot was prepared for EOF analysis.

Sediment and soil

Prior to sample extraction, individual sediment or soil samples were well-mixed in their container. An aliquot of each sample was freeze-dried and the samples were homogenized using mortar and pestle. From each homogenized sample, two subsamples (1.0 g) were weighed into 15 mL PP tubes, which were pre-cleaned with methanol. The first subsample (denoted as Replicate 1) was spiked with internal standards before extraction and was used for target analysis. The second subsample (Replicate 2) was extracted without spiking any internal standards, which was analysed for EOF by combustion ion chromatography (CIC). After alkaline digestion and extraction the samples were cleaned up (Yeung et al., 2017) followed by a split for different analyses. Details are found in Kärrman et al. (2019).

Water

Two subsamples were taken from all water samples: Replicate 1 for target analysis and Replicate 2 for EOF analysis. The subsamples (0.2 L water for both samples) were weighed into containers for subsequent SPE. The extraction method, adapted from ISO 25101 (ISO), used WAX cartridges. Details are found in Kärrman et al. (2019).

Fish liver/blue mussel/fish mussel

Fish liver samples were homogenized before an aliquot was taken out for further processing. Whole mussel homogenate and fish fillet samples required no additional homogenization. Two subsamples (approximately 0.25 g) were weighed into MeOH rinsed 15 mL PP tubes, and thereafter followed the same steps as for the sediment and soil samples. Details are found in Kärrman et al. (2019).

Instrumental analysis (NILU)

The anionic PFASs were analysed according to Hanssen et al. (2013). Shortly, the samples were analysed by ultrahigh pressure liquid chromatography triplequadruple mass-spectrometry (UHPLC–MS/MS). Analyses were performed on a Thermo Scientific quaternary Accela 1250 pump, with a

Waters Acquity UPLC HSS 3 T column (2.1×100 mm, 1,8 µm) coupled to a Thermo Scientific Vantage MS/MS (Vantage TSQ). Ionization was conducted in the negative electrospray ionization mode (ESI-).

Instrumental analysis (NIVA/U Örebro)
Chemical analysis of most target analytes was performed using UPLC-ESI-MS/MS (ultra performance liquid chromatography electrospray ionization tandem mass spectrometry) in negative mode. The chromatographic system consisted of a Waters Acquity UPLC with a C18 BEH column (2.1 × 100 mm, 1.7 µm) coupled to a Waters XEVO TQ-S tandem mass spectrometer.

Instrumental analysis EOF
The EOF content was analyzed using combustion ion chromatography (CIC). The CIC system consists of a combustion module (Analytik Jena, Germany), a 920 Absorber Module and a 930 Compact IC Flex ion chromatograph (Metrohm, Switzerland). Separation of anions was performed on an ion exchange column (Metrosep A Supp5 – 150/4) using carbonate buffer (64 mmol/L sodium carbonate and 20 mmol/L sodium bicarbonate) as eluent in isocratic elution. In brief, the sample extract (0.1 mL) was set on a quartz boat and placed into the furnace at 1000-1050 °C for combustion, during which all organofluorine was converted into hydrogen fluoride (HF); the HF was then absorbed into Milli-Q water. The concentration of F^- ions in the solution was measured using ion chromatography.

2.2.3 Extraction and analysis of volatile PFASs

Biota
The sample was homogenized before an aliquot taken out for further processing. Internal standards were added to the sample before it was extracted with ethyl acetate using an ultrasonic bath. After extraction the sample was up-concentrated followed by clean up with activated carbon.

Water/snow
Prior to extraction the sample was filtered. Internal standards were added to the sample (100 mL) before extraction with methyl *tert*-butyl ether (MTBE). The MTBE was dried over night with Na_2SO_4 before up-concentration and analysis.

Air
Filter samples were added internal standard, extracted with methanol on ultrasonic bath, up-concentrated before clean up with activated carbon.
Internal standards were added to the ABN column before extraction with ethyl acetate, followed by an up-concentration and analysis.

Instrumental analysis
Shortly, the samples were analysed using gas chromatography mass-spectrometry (GC-MS) with positive chemical ionization (PCI) in selected ion monitoring (SIM) mode. Analyses were performed on an Supelcowax 10 column (0.25 mm x 60 m, 0.25 µm) and a Agilent 7890A GC with split/splitless injector coupled to a 5975C MSD. Methane was used as reagent gas in PCI mode (Blom and Hanssen, 2015).

2.2.4 Extraction and analysis of very volatile PFASs

Air

The very volatile PFASs were extracted from the ABN column with 1 mL hexane. No further clean-up or up-concentration before analysis (Schlabach et al., 2018).

Instrumental analysis

Analysis was performed on a QExactive GC-HRMS instrument in scan mode with mass resolution of 60000. Both a DB-5 column (0.25 mm x 30 m, 0.25 µm) and a fluorinated Restex column (RtX-200, 0.25 mm x 30 m, 1 µm) was used for analysis.

2.3 Synthesis of compounds

As part of the quality assurance one of the options to the project was synthesis of commercially unavailable substances for use as internal standards to assure reliable identification and accurate account for losses of analytes during extraction and work-up.

The most important not commercially available group of substances, was identified – alkylated amides of shorter chain perfluorosulfonic acids, PFBS and PFHxS. Multiple deuterium labelling was selected as most practical synthetic pathway. A series of d_3-methyl- and d_4-hydroxyethyl sulfonamides ($C_4F_9SO_2NXY$, $C_6F_{11}SO_2NXY$, where X, Y = -H, $-CD_3$, $-CD_2CD_2OH$) was prepared by alkylation of perfluorobutanesulfonamide (FBSA) or perfluorohexane sulfonamide (FHxSA) with deuterated methyliodide or bromoethanol. Individual substances were purified by preparative liquid chromatography. Strict quality control for non-deuterated impurities of other PFAS (< 0.1%) was applied. Three substances was been finally selected for use as ISTDs - d_3-Me-FBSA, d_4-FBSE and d_4-FHxSE.

3 Results and discussion

In total, 82 single compounds were analysed. The very volatile PFASs (compound nr. 74-78) were only measured in air samples. In addition, two conventional PFASs, PFHxDA and PFOcDA, were measured in snow samples.

The percentage detection of the various compounds in the different environmental matrices are presented in the chapters below. To simplify the discussion of the results, we choose to group the single compounds into five groups (see chapter 1.2) according to their main common molecular trait: conventional PFASs, semi volatile PFASs, very volatile PFASs, ultra short PFASs and EOF. In the chapters below, we mainly discuss the sum for each group of contaminants investigated. Single compounds/congeners are only discussed in special cases. Detected concentrations are summarized in the tables below (minimum and maximum, mean and detection frequency). Individual data can be found in the Appendix.

The detection frequency presented is the percentage of samples in which a substance was detected relative to the total number of analysed samples. It should be noted that, as always, the results are dependent on detection limits for each compound. A non-detect or zero in this table is not a guarantee that the compound was not present, but instead that the compound was not detectable.

3.1 Conventional PFASs (PFCAs and PFSAs)

The conventional PFASs, perfluorinated sulfonates (PFSAs) and perfluorinated carboxylates (PFCAs), were detected in the majority of the samples, see Table 9, Table 10 and Table 11.

Table 9: Detection frequency (%) of conventional PFASs (nr 1-18) in: surface water from Lake Mjøsa (Hamar/HIAS/Minnesund), surface water from River Alna (incluing househould waste water), sediment from the North Sea, Lake Mjøsa and River Alna, soil from Alna area, perch liver from Lake Mjøsa, blue mussel from the North Sea, and passive water samples (POCIS) from Lake Mjøsa and River Alna. Results from cod and tusk not shown.

Nr	Matrix	Surface water, Lake Mjøsa	Surface water, River Alna	Sediment, North Sea	Sediment, Lake Mjøsa	Sediment, River Alna (suspected hotspot)	Soil, Alna (suspected hot spot)	Perch liver, Lake Mjøsa	Blue mussel	POCIS, passive water sampler
1	PFBS	0	100	0	0	0	0	0	0	100
2	PFPeS	0	0	0	0	0	0	0	0	100
3	PFHxS	0	83	0	0	0	50	0	0	100
4	PFHpS	0	0	0	0	0	0	0	0	0
5	PFOS*	0	100	33	33	33	100	100	0	100
6	PFNS	0	0	0	0	0	0	0	0	0
7	PFDS	0	17	0	0	0	0	0	0	0
8	PFDoDS	0	0	0	0	0	0	0	0	0
9	PFPeA	100	100	67	0	0	25	0	0	100
10	PFHxA	67	100	0	0	0	75	0	0	100
11	PFHpA	100	100	0	0	0	0	0	0	100
12	PFOA	100	100	0	0	33	100	75	40	100
13	PFNA	100	100	0	0	0	100	75	20	100
14	PFDA	33	100	0	67	33	100	100	20	100
15	PFUnDA	0	75	67	33	67	25	100	0	100
16	PFDoDA	0	75	0	67	33	100	100	40	60
17	PFTrDA	0	0	0	67	33	100	100	80	0
18	PFTeDA	0	17	67	67	33	100	100	60	0

The results for tusk (n=1) and cod (n=1) are not included in Table 9. The concentrations of conventional PFAS, except PFNA in cod, were below LOD for both samples, and hence the detection frequencies were zero.

For the POCIS samples from Lake Mjøsa and River Alna, several of the conventional PFASs were detected in every sample, in contrast to the surface water samples from Lake Mjøsa where none of the sulfonates were reported above the detection limit.

Table 10: Detection frequency (%) of conventional PFASs (nr 1-18) in liver from white-tailed eagle, otter, wolf, moose, glaucous gull egg, polar bear blood plasma and liver from arctic fox.

Nr	Matrix	White-tailed eagle, liver	Otter, liver	Wolf, liver	Moose, liver	Glaucous gull, egg	Polar bear, blood plasma	Arctic fox, liver
1	PFBS	0	40	20	20	0	100	40
2	PFPeS	0	0	0	0	0	0	40
3	PFHxS	100	100	40	0	100	100	100
4	PFHpS	100	100	40	100	100	100	100
5	PFOS	100	100	100	100	100	100	100
6	PFNS	60	80	0	20	20	0	80
7	PFDS	60	60	0	0	0	0	100
8	PFDoDS	0	0	0	0	0	0	0
9	PFPeA	80	80	0	40	0	20	80
10	PFHxA	20	0	20	0	0	0	0
11	PFHpA	60	60	60	0	100	100	80
12	PFOA	100	100	20	40	100	100	100
13	PFNA	100	100	100	100	100	100	100
14	PFDA	100	100	100	100	100	100	100
15	PFUnDA	100	100	100	100	100	100	100
16	PFDoDA	100	100	80	0	100	100	100
17	PFTrDA	100	100	60	0	100	100	100
18	PFTeDA	100	100	0	0	100	80	100

PFOS and long chain carboxylates (C9-C11) were detected in every sample matrix presented in Table 10. For the top predators, also C12-C14, were detected in the majority of the samples. Minimum and maximum values together with mean concentrations for some of the conventional PFASs are presented in Table 15 and Table 16.

Table 11: Detection frequency (%) of conventional PFASs (nr 1-18) in waste water from Longyearbyen, snow from ski testing track, hot spots such as outdoor, indoor air and dust, and arctic air (Zeppelin station). PFHxDA and PFOcDA are only reported for snow samples.

Nr	Matrix	Waste water LYB	Snow, test track	Air, outdoor and in door	Dust	Arctic air, Zeppelin
1	PFBS	100	0	0	20	0
2	PFPeS	0	0	0	0	0
3	PFHxS	20	0	0	20	0
4	PFHpS	60	50	0	0	0
5	PFOS	100	100	0	60	0
6	PFNS	40	50	0	0	0
7	PFDS	0	50	0	80	0
8	PFDoDS	0	0	0	0	0
9	PFPeA	100	100	0	40	0
10	PFHxA	100	100	0	60	0
11	PFHpA	100	100	0	40	0
12	PFOA	100	100	40	80	0
13	PFNA	100	100	0	40	0
14	PFDA	100	100	20	80	0
15	PFUnDA	100	100	20	40	0
16	PFDoDA	40	100	20	40	0
17	PFTrDA	0	100	0	20	0
18	PFTeDA	0	100	0	0	0
	PFHxDA	n.a.	100	n.a.	n.a.	n.a.
	PFOcDA	n.a.	100	n.a.	n.a.	n.a.

n.a.: not analysed

Local sources as the waste water samples from Longyearbyen and snow from ski testing track were dominated by PFCAs, however PFOS was also detected in these samples, see Table 11. Even if the compounds PFHxDA and PFOcDA originally were not part of this study they were included since they were detected in snow samples from the ski testing track.

Minimum and maximum values together with mean concentrations for some of the conventional PFASs are presented in Table 18 and Table 19.

Table 12: PFAS concentrations (ng/L) in water samples from Lake Mjøsa (Hamar, HIAS and Minnesund) and River Alna.

Sample type/area	PFHxS	PFOS*	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTDA
	(Min – max) **Mean**** Detection frequency (%)							ng/L	
Lake Mjøsa	(<0.30) **0.13** 0	(0.23) **0.11** 0	(0.36-2.11) **0.97** 100	(0.18-0.30) **0.24** 100	(<0.21-0.35) **0.19** 33	(<0.16) **0.07** 0	(<0.08) **0.03** 0	(<0.08) **0.03** 0	(<0.11) **0.05** 0
River Alna (and household waste water)	(<0.26-1.04) **0.64** 83	(0.48-4.34) **2.35** 100	(1.72-10.1) **4.64** 100	(0.47-3.15) **1.35** 100	(0.36-3.20) **1.15** 100	(<0.13-0.45) **0.22** 83	(<0.06-0.17) **0.10** 75	(<0.10) **0.03** 0	(<0.10) **0.06** 0

*: only linear PFOS
**: For the non-detects, LOD/2 was used for calculating mean.

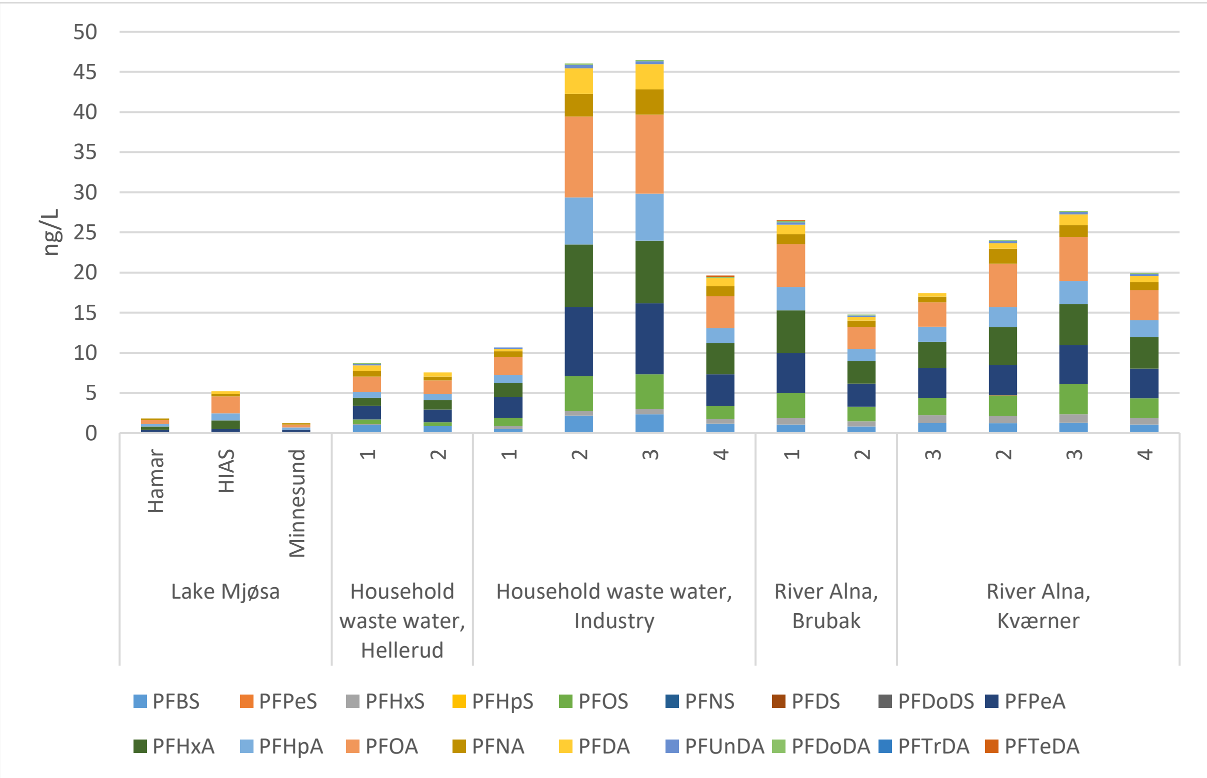


Figure 3: PFAS concentrations (ng/L) in water samples from Lake Mjøsa, househould waste water (Hellerund and industry) and River Alna (Brubak and Kværner).

The sum PFAS concentrations in household waste water samples from industry (located in the Alna area) and samples from River Alna were up to an order of magnitude higher than Lake Mjøsa, see Figure 3. The PFAS profile was similar, dominated by PFCAs. River Alna runs through an industrialised area, and previous reports have shown elevated concentrations in several environmental media from the area (Heimstad et al., 2017).

Table 13: PFAS concentrations (ng/g d.w.) in sediment and soil samples from the North Sea, Lillehammer, Hamar and Alna.

Sample type/area	PFHxS	PFOS*	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	(Min – max) **Mean**** Detection frequency (%)						ng/g d.w.		
North Sea, sediment	(<0.50) **0.03** 0	(<0.06-0.08) **0.05** 33	(<0.05) **0.03** 0	(<0.02) **0.01** 0	(<0.02) **0.01** 0	(<0.01-0.03) **0.02** 67	(<0.004) **0.002** 0	(<0.01) **0.01** 0	(<0.01) **0.01** 0
Lake Mjøsa, sediment	(<0.05) **0.03** 0	(<0.06-0.07) **0.04** 33	(<0.05) **0.03** 0	(<0.02) **0.01** 0	(<0.02-0.05) **0.03** 67	(<0.01-0.02) **0.01** 33	(<0.004) **0.002** 0	(<0.01) **0.01** 0	(<0.01) **0.01** 0
River Alna, sediment	(<0.05) **0.03** 0	(0.03-0.29) **0.16** 100	(<0.03-0.07) **0.05** 75	(<0.02) **0.01** 75	(<0.02-0.10) **0.06** 100	(<0.02-0.10) **0.06** 100	(<0.004) **0.002** 0	(<0.01) **0.004** 0	(<0.10) **0.004** 0
Alna, soil	(<0.05-0.056) **0.03** 25	(0.32-1.37) **0.86** 100	(<0.06-0.51) **0.28** 100	(<0.02-0.21) **0.16** 100	(0.05-0.21) **0.16** 100	(<0.02-0.06) **0.016** 25	(<0.004) **0.002** 0	(<0.01) **0.005** 0	(<0.10) **0.005** 0

*: only linear PFOS
**: For the non-detects, LOD/2 was used for calculating mean.

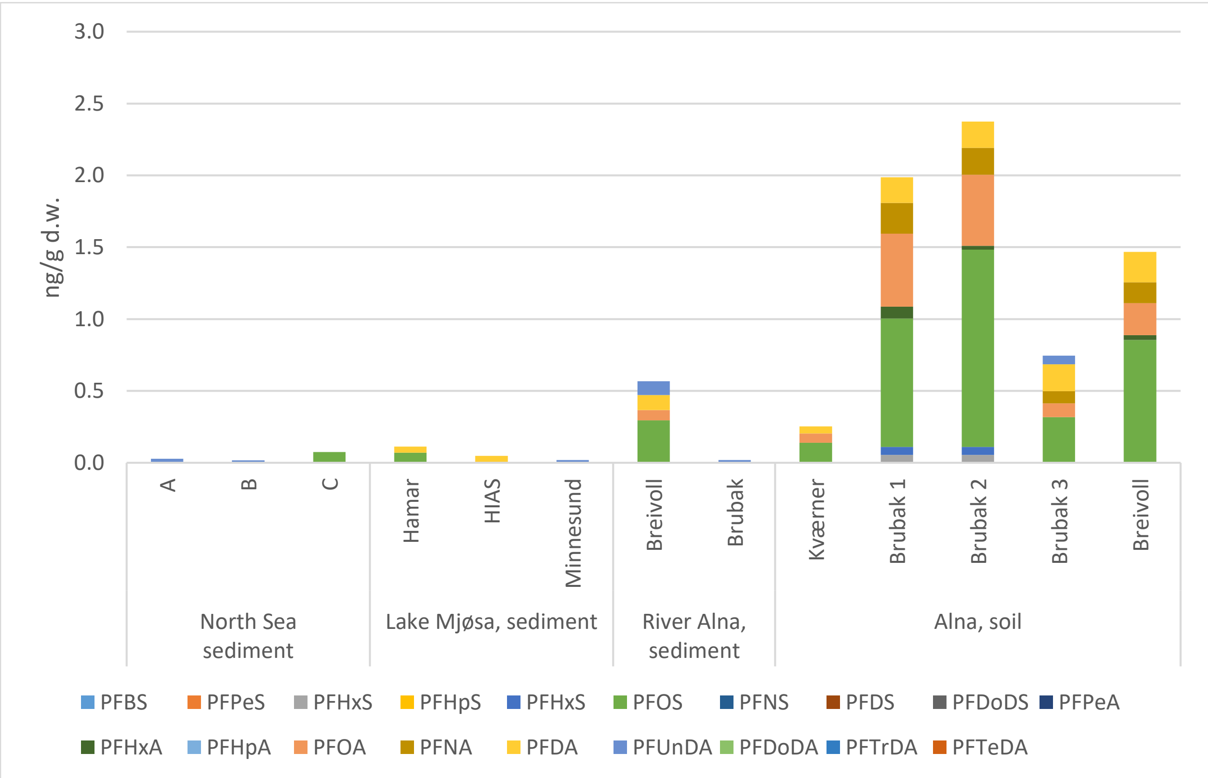


Figure 4: PFAS concentrations (ng/g d.w.) in sediment samples from the North Sea, Lake Mjøsa, River Alna and soil samples from the Alna area.

Only PFOS and PFDA were reported above limit of detection (LOD) in sediment samples from the North Sea and Lake Mjøsa (Table 13). PFOS has previously been detected in sediment collected close to offshore installations in the North Sea (unpublished results). PFOS was the dominating compound in soil collected from the Alna area. This is in accordance with previous studies (Heimstad et al., 2017).

Table 14: PFAS concentrations (ng/g) in perch liver from Lake Mjøsa and blue mussel from the North Sea.

Sample type/area	PFHxS	PFOS*	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	(Min – max) **Mean**** Detection frequency (%)							ng/g	
Lake Mjøsa, perch liver	(<0.79) **0.20** 0	(17.7-34.7) **26.8** 100	(<0.72) **0.49** 75	(<0.39-0.41) **0.28** 75	(2.39-3.45) **2.90** 100	(1.72-5.77) **3.45** 100	(1.14-8.70) **4.17** 75	(0.58-8.26) **3.83** 75	(0.42-8.81) **3.38** 75
North Sea, blue mussel	(<0.05) **0.03** 0	(<0.05) **0.03** 0	(<0.05-0.8) **0.05** 40	(<0.02-0.06) **0.02** 20	(<0.02) **0.02** 20	(<0.01) **0.01** 0	(<0.004) **0.002** 0	(<0.01-0.07) **0.04** 40	(<0.01-0.03) **0.01** 20

*: only linear PFOS

**: For the non-detects, LOD/2 was used for calculating mean.

The PFAS concentrations in fish liver from Lake Mjøsa were higher than what was found in blue mussel the North Sea (Table 14 and Figure 5). PFOS is the dominating compound, and several of the long chain PFCAs are present. Both PFAS profile and concentrations in perch were similar to previous reports from Norwegian lakes (Fjeld et. al., 2017). In only one of two fish samples from the North Sea, one PFAS compound was detected above detection limit (PFNA; 0.6 ng/g ww). Two of three blue mussel samples had detectable concentrations of PFCAs, as shown in Table 14.

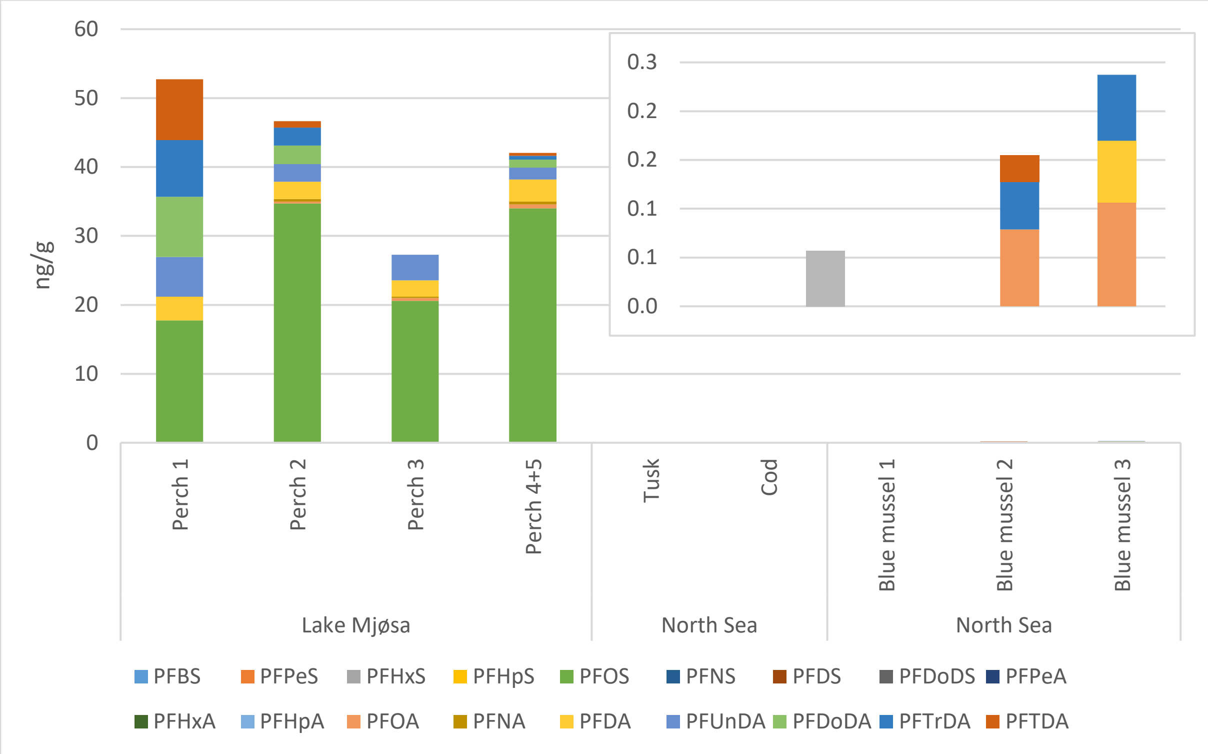


Figure 5: PFAS concentrations (ng/g) in fish and blue mussel. Perch samples (liver) are from Lake Mjøsa, tusk (muscle), cod (muscle) and blue mussel are from the North Sea. Small graph illustrated samples from the North Sea on a smaller scale.

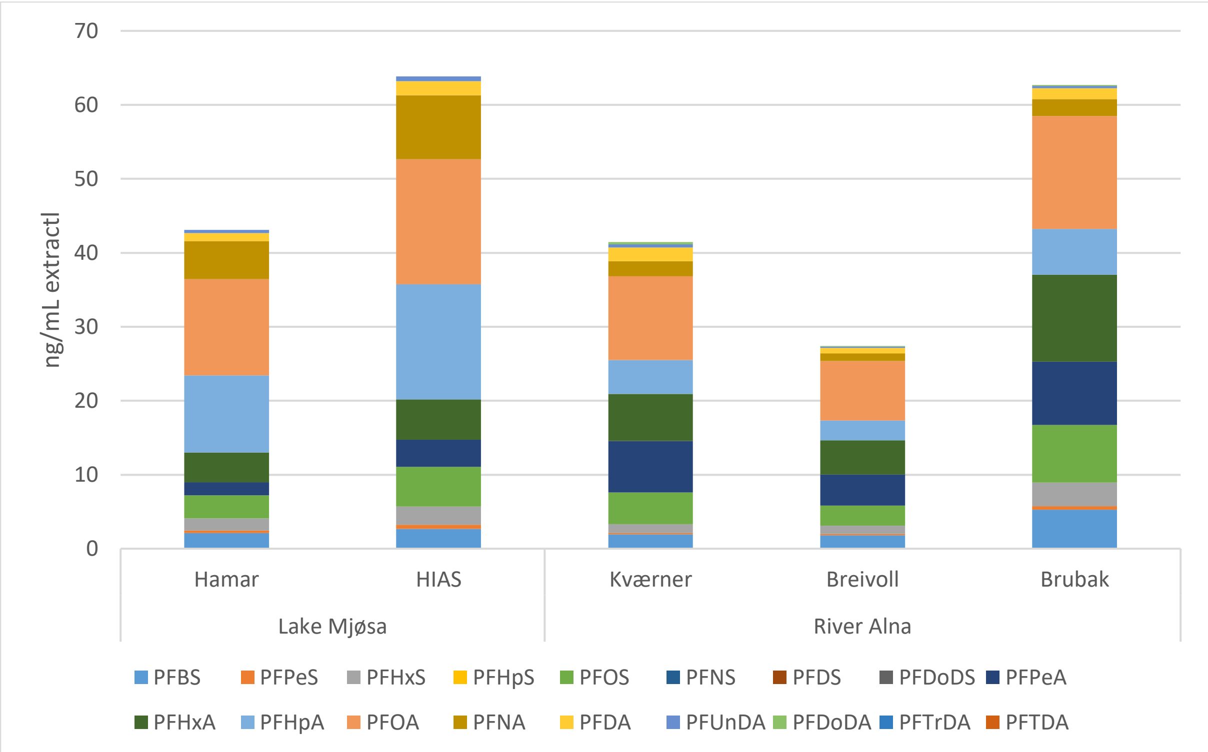


Figure 6: PFAS concentrations (ng/mL extract) in passive water samplers from Lake Mjøsa and River Alna.

The sum PFAS concentration in extracts from passive water samples ranged from 28 ng/sampler to 64 ng/sampler. In locations where the PFAS concentrations in water are suspected to be low, a surface sample does not necessarily give the correct picture. When comparing the PFAS profiles for surface wate samples in Lake Mjøsa (Figure 3) with the POCIS samples from Lake Mjøsa (Figure 6), we see that there are more PFAS compounds detectec in the POCISs compared to the surface sample. Also, in surface water samples from Lake Mjøsa, the sum concentration of conventional PFASs were an order of magnitude lower than surface water from River Alna. This is not observed for the POCIS samples. The exposure periode for the POCIS samplers, 10 days, could be one explanation.

Table 15: PFAS concentrations (ng/g) in liver samples from white-tailed eagle, otter, wolf and moose.

Sample type	PFHxS	PFOS	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	(Min – max) **Mean*** Detection frequency (%)							ng/g w.w.	
White-tailed eagle liver	(0.51-1.00) **0.67** 100	(6.71-30.2) **18.3** 100	(0.17-0.44) **0.30** 100	(0.68-2.06) **1.56** 100	(0.89-2.10) **1.66** 100	(1.37-6.51) **4.27** 100	(0.44-2.08) **1.38** 100	(1.01-8.85) **5.13** 100	(0.22-1.09) **0.63** 100
Otter liver	(1.80-4.35) **3.09** 100	(72.2-218) **130** 100	(6.30-17.5) **10.4** 100	(53.7-151) **84.0** 100	(14.7-38.1) **23.2** 100	(12.0-16.2) **14.1** 100	(1.29-1.74) **1.57** 100	(2.25-3.89) **3.14** 100	(0.26-0.37) **0.30** 100
Wolf liver	(<0.05-0.65) **0.20** 40	(0.68-2.20) **1.61** 100	(<0.05-0.09) **0.04** 25	(0.55-1.91) **1.18** 100	(0.25-1.49) **0.75** 100	(0.22-1.33) **0.69** 100	(<0.05-0.25) **0.13** 80	(<0.10-0.32) **0.13** 60	(<0.10) **0.05** 0
Moose liver	(<0.05) **0.03** 0	(0.18-0.39) **0.27** 100	(<0.05-0.08) **0.04** 40	(0.09-0.25) **0.19** 100	(0.06-0.18) **0.11** 100	(0.10-0.19) **0.13** 100	(<0.05) **0.03** 0	(<0.10) **0.05** 0	(<0.10) **0.05** 0

*: For the non-detects, LOD/2 was used for calculating mean.

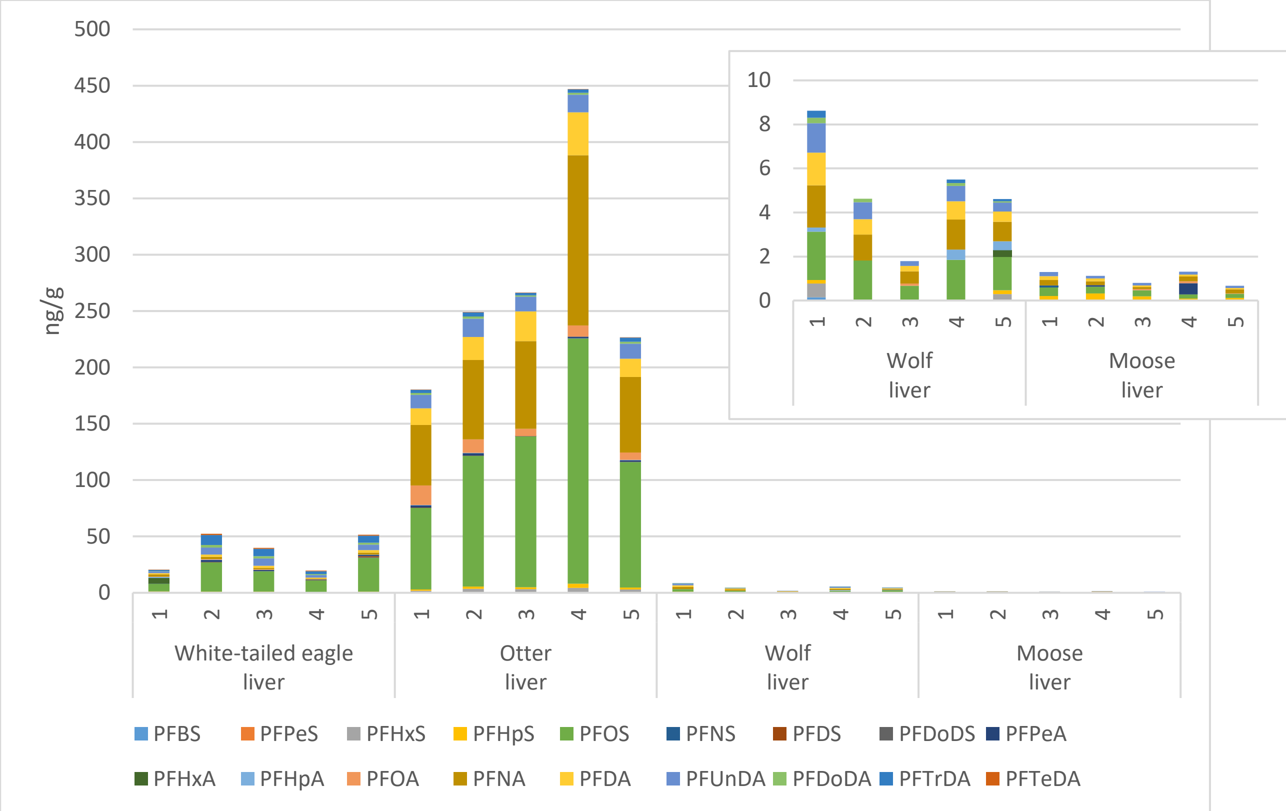


Figure 7: PFAS concentrations (ng/g) in liver samples from white-tailed eagle, otter, wolf and moose. Small graph illustrates results for wolf and moose liver on a smaller scale.

Table 16: PFAS concentrations (ng/g) in egg from glaucous gull, blood plasma (ng/mL) from polar bear and liver (ng/g) from arctic fox.

Sample type	PFHxS	PFOS	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	(Min – max) **Mean*** Detection frequency (%)						ng/g & ng/ml		
Glaucous gull, egg	(0.14-0.34) **0.25** 100	(4.82-6.61) **5.33** 100	(0.37-1.02) **0.60** 100	(1.08-2.07) **1.41** 100	(0.41-0.88) **0.56** 100	(1.06-3.42) **1.57** 100	(0.21-1.16) **0.42** 100	(0.65-3.86) **1.49** 100	(0.14-0.68) **0.30** 100
Polar bear, blood plasma	(26.0-44.1) **34.3** 100	(47.1-188) **68.5** 100	(4.34-6.72) **5.35** 100	(30.2-41.5) **36.7** 100	(6.10-13.1) **10.0** 100	(10.2-24.6) **19.1** 100	(0.90-3.04) **2.36** 100	(1.55-6.02) **4.32** 100	(<0.05-0.77) **0.61** 100
Arctic fox, liver	(1.18-9.28) **5.90** 100	(12.6-171) **86.0** 100	(0.48-1.88) **0.97** 100	(4.85-19.9) **8.15** 100	(1.73-10.7) **4.90** 100	(1.56-13.3) **5.70** 100	(0.20-1.75) **0.75** 100	(0.51-6.35) **2.38** 100	(0.15-0.90) **0.38** 100

*: For the non-detects, LOD/2 was used for calculating mean.

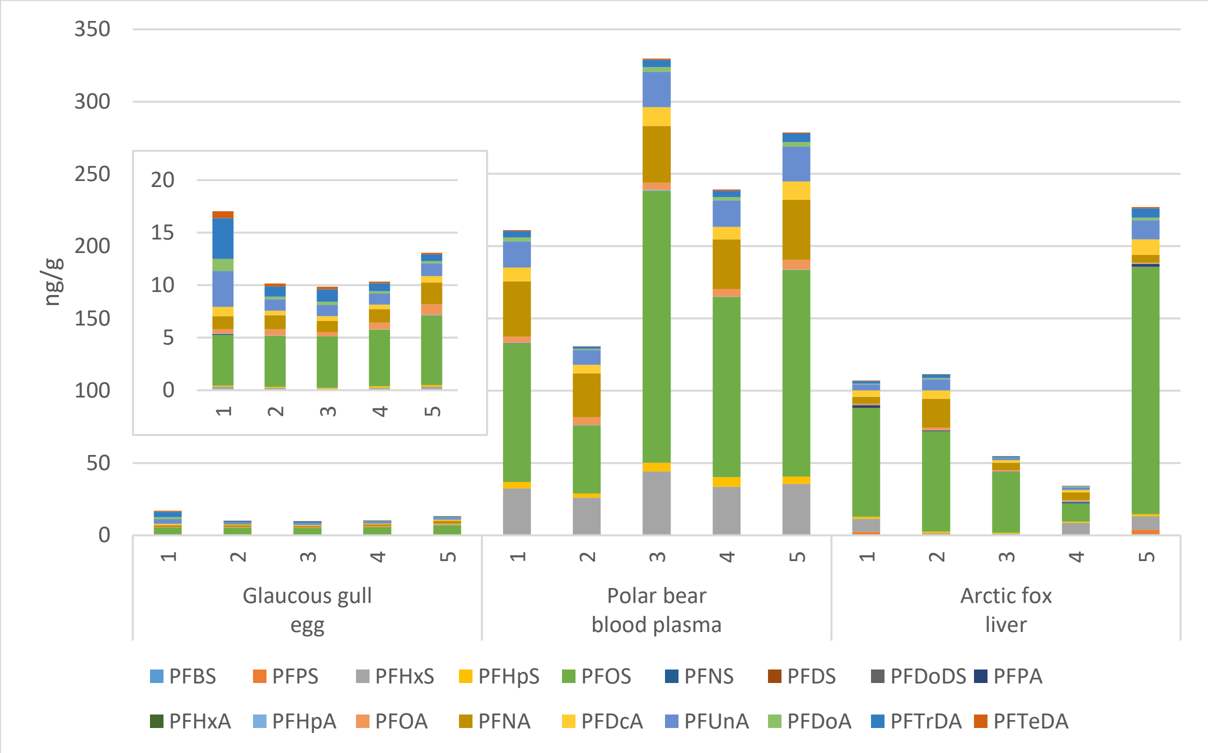


Figure 8: PFAS concentrations (ng/g) in egg from glaucous gull, blood plasma (ng/mL) from polar bear and liver (ng/g) from arctic fox. Small graph illustrates results for glaucous gull eggs on a smaller scale.

The sumPFAS concentrations in species living in the marine food chain are an order of a magnitude higher than the terrestrial food chain. The highest concentrations of conventional PFASs were reported for otter liver, followed by polar bear blood plasma, arctic fox liver, glaucous gull egg and white tailed eagle liver (Table 15, Table 16, Figure 7 and Figure 8). The most abundant compound in these samples is PFOS.

Otters living in close proximity to human settlements and preying on the marine food chain are heavily contaminated with PFASs. The PFAS concentrations reported for otter are comparable with those reported for Norwegian otter by Roos et al. (2013).

It has for several years been known that both polar bears and arctic fox areas heavily contaminated with conventional PFASs (Routti, et al. 2017), as also this study shows. Even though the differing sample matrixes are disabling a direct comparison of PFAS concentrations, some differences can be observed in the PFAS composition. Polar bear plasma contains PFOS in about 50% of the sum PFAS concentration, while the contribution in glaucous gull and arctic fox is much lower.

PFASs concentrations reported for moose liver are comparable with those reported in 2013 (Harju et al.) with sum PFAS concentrations below 2 ng/g.

For the first time, liver tissue from wolfs from Norway, were analysed. Even though the PFAS concentrations are below reported concentrations for species feeding in the marine environment, the presence of PFASs in these terrestrial top predators add to the knowledge of how ubiquitously PFASs are in the environment.

Abiotic samples from the Norwegian mainland and the Arctic were also investigated. Detection rates are shown in

Table 16, with snow from cross-country tracks and waste water from Svalbard being the samples with highest PFAS abundance.

Table 17: PFAS concentrations (ng/L) in waste water from Longyearbyen

Sample type	PFHxS	PFOS	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	(Min – max) **Mean*** Detection frequency (%)							ng/L	
LYB Waste water	(<0.05-1.04) **0.29** 20	(1.39-4.23) **2.04** 100	(5.99-113) **39.3** 100	(1.97-33.1) **8.90** 100	(0.88-5.84) **2.70** 100	(<0.10-0.95) **0.56** 60	(<0.10-0.50) **0.27** 60	(<0.10) **0.05** 0	(<0,10) **0.05** 0

*: For the non-detects, LOD/2 was used for calculating mean.

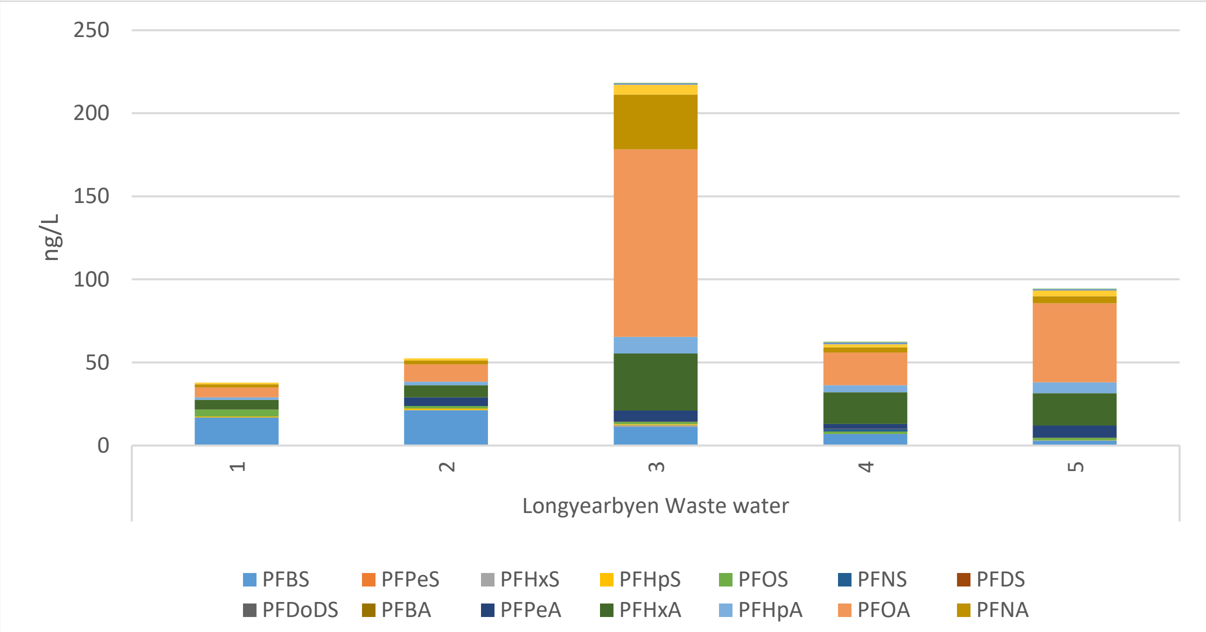


Figure 9: PFAS concentrations (ng/L) in waste water from Longyearbyen.

The PFAS concentrations in waste water samples from Longyearbyen (Figure 9) are higher compared to surface water samples from Lake Mjøsa and Alna (Figure 3). The profile is dominated by PFCAs, however in two samples PFBS was the dominating compound. The highest concentration measured was for PFOA with 113 ng/L. Sample 1 and 2 were sampled in the morning and noon. Sample 3-5 were sampled in the evening. Sample 2 and 3 from the same day, however all the samples within the same week.

Table 18: PFAS concentrations (ng/L) in snow from cross country ski testing track.

Sample type	PFHxS	PFOS	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	(Min – max) **Mean*** Detection frequency (%)							ng/L	
Snow, Ski testing track	(<0.10) **0.10** 0	(0.90-1.24) **1.08** 100	(53.2-68.2) **60.3** 100	(21.9-30.0) **25.5** 100	(72.8-107) **89.6** 100	(62.2-160) **109** 100	(223-919) **491** 100	(79.7-219) **137** 100	(602-1963) **1041** 100
Background	(<0.10)	(<0.10)	0.68	0.62	0.42	<0.10	<0.10	<0.10	<0.05

*: For the non-detects, LOD was used for calculating mean.

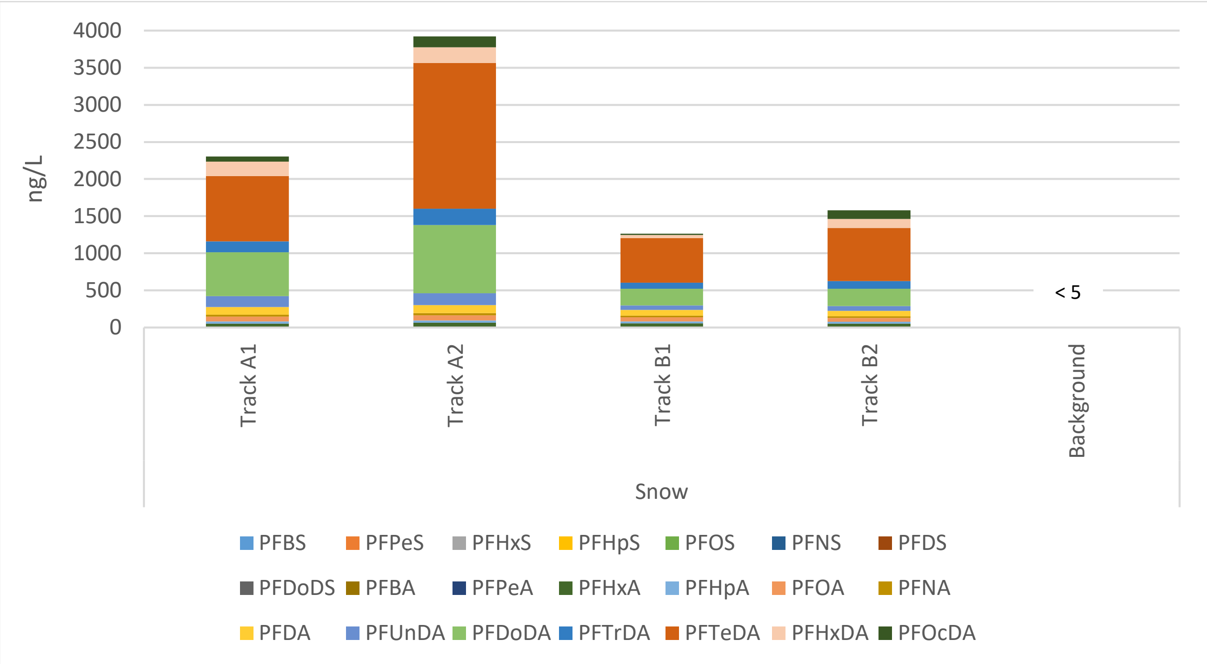


Figure 10: PFAS concentrations (ng/L) in snow from cross country ski testing track and background sample.

PFAS concentrations in snow samples from cross country ski testing track have not been reported in Norway previously. The snow was sampled after the testing had been completed. It is estimated that 3000 pair of skis were tested in this area. The results (Figure 10) are higher compared to snow sampled in tracks from Vasaloppet, where the highest reported sum PFAS concentration was 1400 ng/L (∑C6-22 PFCAs) (Plassmann and Berger, 2013).

The long chain PFCAs are dominating the profile, as reported for snow samples from Vasaloppet. In this screening PFTeDA was the most prominent compound in the snow samples, and in addition to the conventional PFASs listed in Table 2, two long chain PFCAs were detected in these samples, PFHxDA and PFOcDA. Concentrations are given in appendix (p. 72).

Even though the PFAS concentrations in these snow samples exceed the limits set for drinking water (0.5 µg/L) (EU, Environment), the absence of drinking reservoir in the area minimise the risk of human contamination through drinking water.

The results from this screening confirm the observed content of PFASs in earthworm collected from other areas where cross country ski testing and cross country skiing activities in general have been performed (Herzke et al., 2016).

Table 19: PFAS concentrations (ng/sample) in dust.

Sample type/area	PFHxS	PFOS	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	(Min – max) **Mean*** Detection frequency (%)							ng/m	
Dust	(<0.04-1.57) **0.33** 20	(<0.04-3.37) **0.83** 60	(<0.02-1.63) **0.39** 80	(0.02-1.50) **0.34** 100	(<0.02-0.85) **0.20** 80	(<0.02-0.70) **0.15** 60	(<0.02-0.49) **0.11** 40	(<0.02-0.37) **0.08** 20	(<0.02) **0.01** 0

*: For the non-detects, LOD/2 was used for calculating mean.

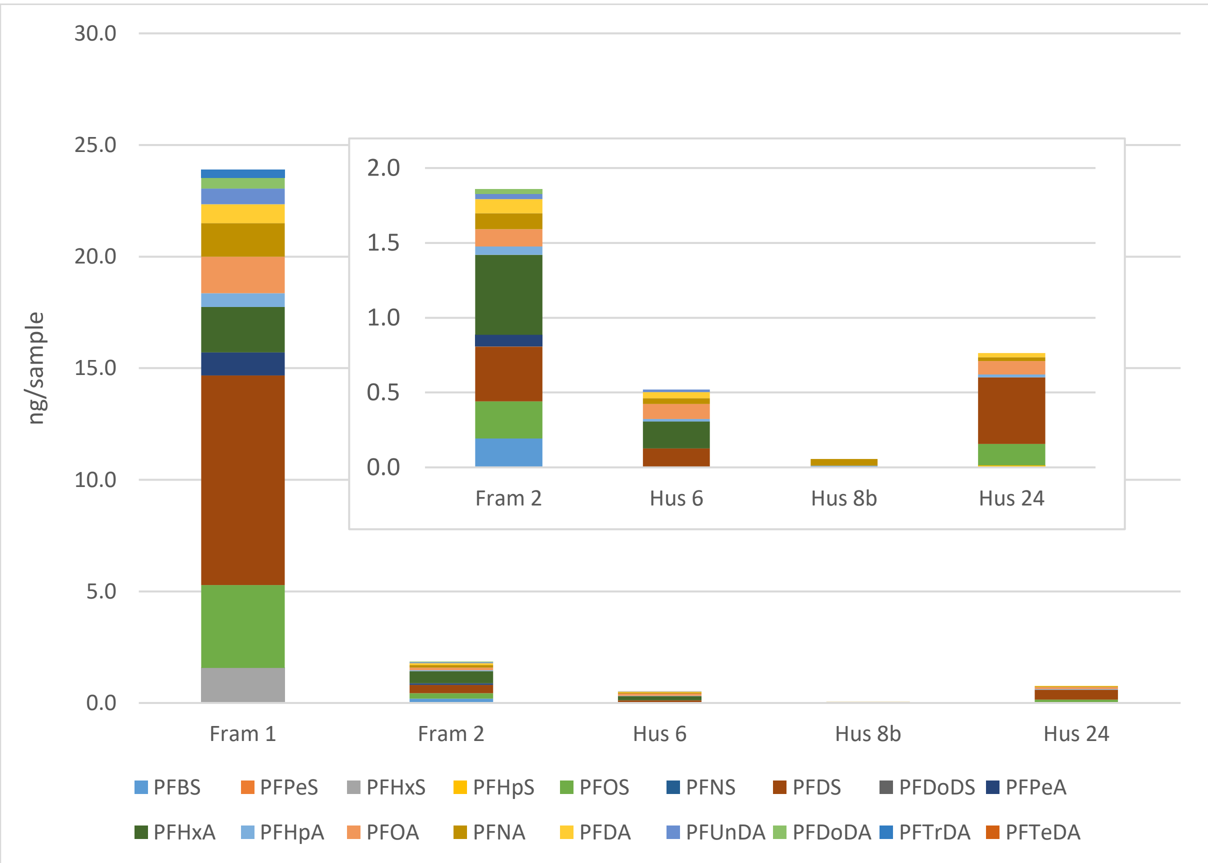


Figure 11: PFAS concentrations (ng/sample) in dust samples. Sample Fram 1 and Fram 2 are from GFF filters. Sample Hus5, Hus 8b and Hus 24 are from vacuuming. Small graph illustrates results on a smaller scale.

There are some variation in PFAS concentrations between houses, however the overall concentration is low compared to a previous study on house dust in Norway (Bohlin-Nizzetto et al., 2015). The highest concentration was found in one office sample (Fram 1). In this office textiles, paper wrapping and other consumer products that contained PFASs have been in been kept for some periods. The office in Fram 2 shows a similar PFAS profile as the office in Fram 1. The office in Fram 2 has been in use for less than a year before the sample was collected. Also in this office some consumer products containing PFASs have been stored. Even though this study have a limited amount of samples, it indicate a clear connection between PFASs in house dust and consumer products.

3.2 New PFASs (sulfonate ethers, FTSs, carboxylic ethers and PAPs)

The detection frequencies of sulfonate ethers, FTSs, carboxylic ethers and PAPs are presented inTable 20, Table 21 and Table 22.

Table 20: Detection frequency (%) of new PFASs (nr 19-47) in surface water Hamar/HIAS/Minnesund (Lake Mjøsa), surface water (household waste water Hellerud and industry and River Alna), sediment (North Sea, Lake Mjøsa and River Alna), soil (River Alna) Perch (Lake Mjøsa), blue mussel and fish (North Sea) and passive water samples (POCIS) from Lake Mjøsa and River Alna.

Nr	Matrix	Surface water Lake Mjøsa	Surface water, River Alna	Sediment, North Sea	Sediment, Lake Mjøsa	Sediment, Alna	Soil, Alna	Perch, Lake Mjøsa	Blue mussel and fish, North Sea	POCIS
19	short F53 B	0	0	0	0	0	0	0	0	0
20	F53B	0	0	0	0	0	0	0	0	0
21	long F53B	0	0	0	0	0	0	0	0	0
22	6:2 FTS	0	50	0	0	0	0	0	0	100
23	8:2 FTS	0	33	0	0	0	0	0	0	100
24	10:2 FTS	0	0	0	0	0	0	0	0	0
25	377-73-1	0	0	0	0	0	0	0	0	0
26	863090-89-5	0	0	0	0	0	0	0	0	0
27	Gen X	0	0	0	0	0	0	0	0	0
28	378-03-0	0	0	0	0	0	0	0	0	0
29	801212-59-9	0	0	0	0	0	0	0	0	0
30	96513-97-2	0	0	0	0	0	0	0	0	0
31	948014-44-6	0	0	0	0	0	0	0	0	0
32	151772-58-6	0	0	0	0	0	0	0	0	0
33	ADONA	0	0	0	0	0	0	0	0	0
34	13252-14-7	0	0	0	0	0	0	0	0	0
35	151772-59-7	0	0	0	0	0	0	0	0	0
36	65294-16-8	0	0	0	0	0	0	0	0	0
37	1212077-14-9	0	0	0	0	0	0	0	0	0
38	65150-95-0	0	0	0	0	0	0	0	0	0
39	52481-85-3	0	0	0	0	0	0	0	0	0
40	65578-62-3	0	0	0	0	0	0	0	0	0
41	144808-89-9	0	0	0	0	0	0	0	0	0
42	374-88-9	0	0	0	0	0	0	0	0	0
43	10:2 mono PAP	0	0	0	0	0	0	0	0	0
44	12:2 mono PAP	0	0	0	0	0	0	0	0	0
45	14:2 mono PAP	0	0	0	0	0	0	0	0	0
46	16:2 mono PAP	0	0	0	0	0	0	0	0	0
47	101896-22-4	0	0	0	0	0	0	0	0	0

Two of the fluorotelomer sulfonated, 6:2 FTS and 8:2 FTS, were detected in the household waste water samples from industry (Alna area) and in all of the passive water sampler extract. There two compound are known ingredients in Aqueous Film-Forming Foams (AFFFs). The water concentration of 6:2 FTS in samples from River Alna ranged from 1.28-8.60 ng/L and 8:2 FTS concentrations ranged from 0.42-1.33 ng/L. The corresponding ranges from passive sampling were 0.62-1.83 ng/mL extract and 0.05-0.46 ng/mL extract, respectively.

None of the other compounds in the different matrices in Table 20 were reported above the detection limit. The LODs varied from 0.5 ng/g to 2 ng /g, details are presented in the appendix. Comparisons between sum conventional PFASs, 6:2 FTS and 8:2 FTS for fresh water samples are presented in Figure 12 and Figure 13. In samples from River Alna the 6:2 FTS concentration varied between 6-88 % of the sum of conventional PFASs. The 8:2 FTS concentrations was detectable, however lower than 6:2 FTS. The water samples were filtered before extraction. The long chain FTS, such as 8:2 FTS and 10:2 FTS tend to be more particle bound than water soluble, however none of the FTSs were detected in sediment samples from the same area.

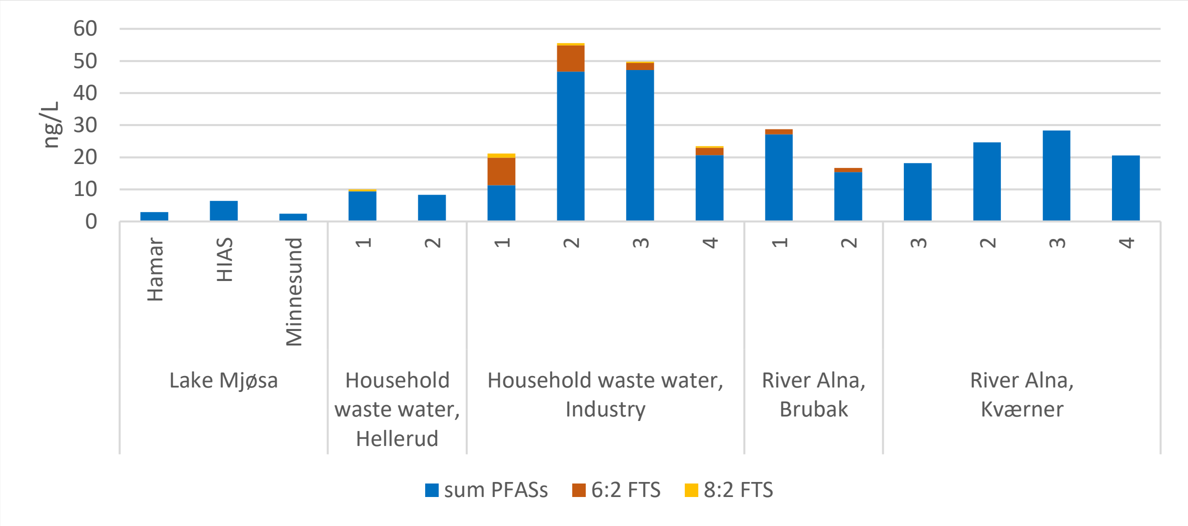


Figure 12: Sum conventional PFAS concentrations (ng/L), 6:2 FTS concentration (ng/L) and 8:2 FTS concentration (ng/L) in surface water samples from Lake Mjøsa, househould waste water (Hellerund and industry) and River Alna.

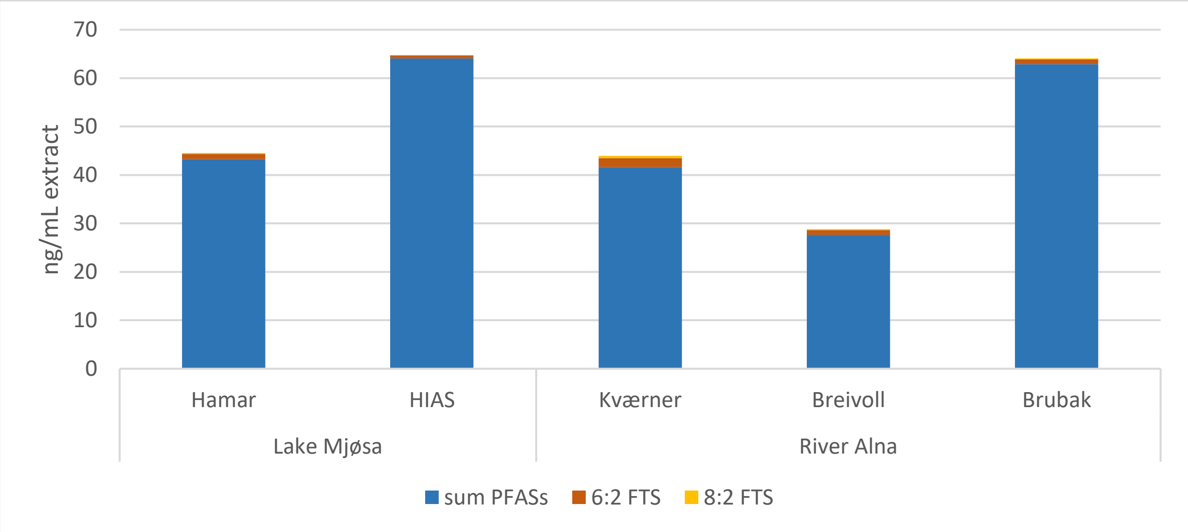


Figure 13: Sum conventional PFAS concentrations (ng/mL extract), 6:2 FTS concentration (ng/mL extract) and 8:2 FTS concentrations in (ng/mL extract) in passive water samples (POCIS) from Lake Mjøsa and River Alna.

Table 21: Detection frequency (%) of new PFASs (nr 19-47) in white-tailed eagle (liver), otter (liver), wolf (liver), moose glaucous gull (egg), polar bear (plasma), arctic fox(liver) and snow bunting (egg)

Nr	Matrix	White-tailed eagle, liver	Otter, liver	Wolf, liver	Moose, liver	Glaucous gull, egg	Polar bear, blood plasma	Arctic fox, liver	Snow bunting, egg
19	short F53 B	0	0	0	0	0	0	0	0
20	F53B	0	0	0	0	0	0	0	0
21	long F53B	0	0	0	0	0	0	0	0
22	6:2 FTS	100	100	0	0	0	0	20	0
23	8:2 FTS	80	100	0	0	0	0	20	0
24	10:2 FTS	0	0	0	0	0	0	0	0
25	377-73-1	0	0	0	0	0	0	0	0
26	863090-89-5	0	0	0	0	0	0	0	0
27	Gen X	0	0	0	0	0	0	0	0
28	378-03-0	0	0	0	0	0	0	0	0
29	801212-59-9	0	0	0	0	0	0	0	0
30	96513-97-2	0	0	0	0	0	0	0	0
31	948014-44-6	0	0	0	0	0	0	0	0
32	151772-58-6	0	0	0	0	0	0	0	0
33	ADONA	0	0	0	0	0	0	0	0
34	13252-14-7	0	0	0	0	0	0	0	0
35	151772-59-7	0	0	0	0	0	0	0	0
36	65294-16-8	0	0	0	0	0	0	0	0
37	1212077-14-9	0	0	0	0	0	0	0	0
38	65150-95-0	0	0	0	0	0	0	0	0
39	52481-85-3	0	0	0	0	0	0	0	0
40	65578-62-3	0	0	0	0	0	0	0	0
41	144808-89-9	0	0	0	0	0	0	0	0
42	374-88-9	0	0	0	0	0	0	0	0
43	10:2 mono PAP	0	0	0	0	0	0	0	0
44	12:2 mono PAP	0	0	0	0	0	0	0	0
45	14:2 mono PAP	0	0	0	0	0	0	0	0
46	16:2 mono PAP	0	0	0	0	0	0	0	0
47	101896-22-4	0	0	0	0	0	0	0	0

Both 6:2 FTs and 8:2 FTS were detected in liver samples from white-tailed eagle, otter and arctic fox (Table 21). The 6:2 FTS concentrations ranged from 5.2-25.1 ng/g in white-tailed eagle, 11.2-27.8 ng/g in otter; whereas in one fox liver sample the concentration was 1.5 ng/g. For corresponding 8:2 FTS concentrations ranges were <0.2 ng/g-77.5 ng/g, 38.3-76.8 ng/g and another fox liver sample had 114 ng/g. The 8:2 FTS concentration in white tailed eagle exceeded the PFOS concentrations.

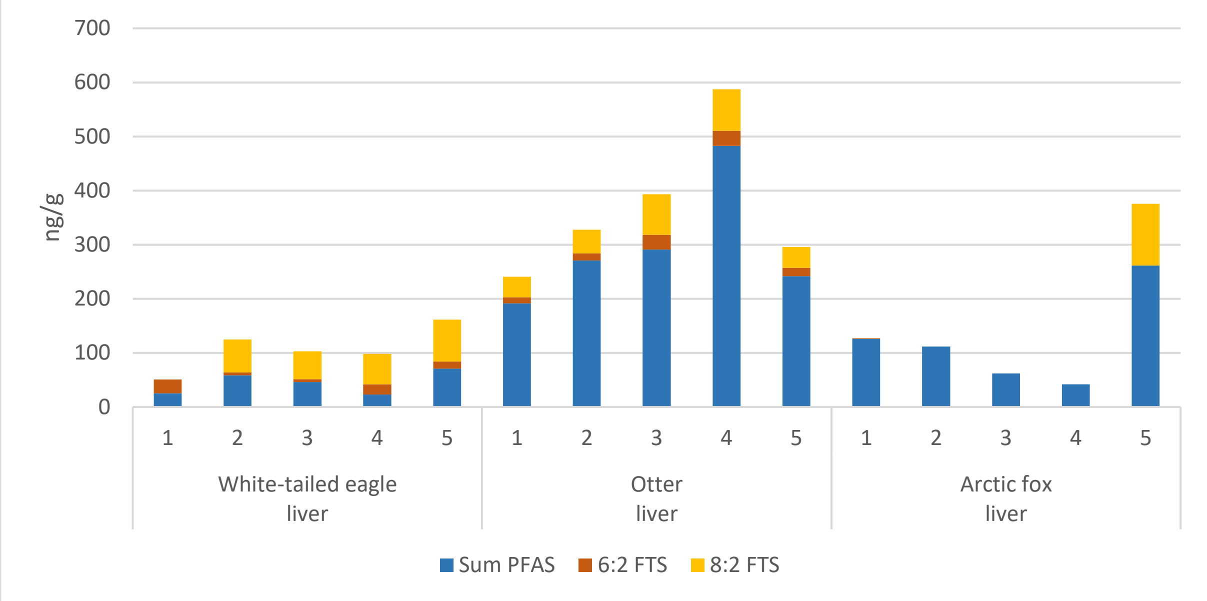


Figure 14: Sum conventional PFAS concentrations (ng/g), 6:2 FTS concentration (ng/g) and 8:2 FTS concentrations in (ng/g) in liver samples from white-tailed eagle, otter and arctic fox.

In the biological samples in Figure 14, 8:2 FTS was more prominent compared to 6:2 FTS. Some studies have shown that 6:2 FTS can bioaccumulation in aquatic organisms (Langberg et al., 2019), however data of the potential bioaccumulation of 8:2 FTS are scarce.

Table 22: Detection frequency (%) of new PFASs (nr 19-47) in waste water (Longyearbyen), snow, air (hot spots), dust and arctic air (Zeppelin station).

Nr	Matrix	Waste water LYB	Snow, test track	Air, Hot spot	Dust, hot spots	Arctic air, Zeppelin
19	short F53 B	0	0	0	0	0
20	F53B	0	0	0	0	0
21	long F53B	0	0	0	0	0
22	6:2 FTS	40	100	0	0	0
23	8:2 FTS	60	75	0	0	0
24	10:2 FTS	0	0	0	0	0
25	377-73-1	0	100	0	0	0
26	863090-89-5	0	0	0	0	0
27	Gen X	0	0	0	0	0
28	378-03-0	0	0	0	0	0
29	801212-59-9	0	0	0	0	0
30	96513-97-2	0	0	0	0	0
31	948014-44-6	0	0	0	0	0
32	151772-58-6	0	0	0	0	0
33	ADONA	0	0	0	0	0
34	13252-14-7	0	0	0	0	0
35	151772-59-7	0	0	0	0	0
36	65294-16-8	0	0	0	0	0
37	1212077-14-9	0	0	0	0	0
38	65150-95-0	0	0	0	0	0
39	52481-85-3	0	0	0	0	0
40	65578-62-3	100	0	0	0	0
41	144808-89-9	0	0	0	0	0
42	374-88-9	0	0	0	0	0
43	10:2 mono PAP	0	0	0	0	0
44	12:2 mono PAP	0	0	0	0	0
45	14:2 mono PAP	0	0	0	0	0
46	16:2 mono PAP	0	0	0	0	0
47	101896-22-4	0	0	0	0	0

The concentrations range for 6:2 FTS in waste water and in snow from test track (Table 22) were <0.20-1.21 ng/L, and <0.20-0.30 ng/L respectively. The corresponding 8:2 FTS concentration range were <0.20-24.7 ng/L and <0.20-0.74 ng/L respectively.

The carboxylic ether (nr 25) was also detected in snow samples with concentration range 1.62-2.98 ng/L.

In waste water samples from Longyearbyen, perfluorinated 2-furancarboxylic acid (compound nr 40) was detected in all samples. The concentration range, 1.28-3.29 ng/L, is comparable to the reported

PFOS concentrations in the samples. At presence, nothing is known about the use of the chemical, and no explanations how this compound is ending up in waste water from Longyearbyen can be given.

3.3 Semi volatile and volatile PFASs (FTOHs, amides and acrylates)

The detection frequencies of volatile PFASs are presented in Table 23, Table 24 and Table 25. Several of these are considered as precursors to the conventional PFASs. They could be industrial, environmental, or metabolic precursors or transformation products of one another (Buck et al., 2011, Benskin et al., 2009).

Table 23: Detection frequency (%) of semi volatile and volatile PFASs (nr 48-60 and 69-73) in waste waterHamar/HIAS/Minnesund (Lake Mjøsa), surface water (Alna), sediment (North Sea, WWT and Alna), soil (Alna) Perch (Lake Mjøsa), blue mussel and fish (North Sea) and passive water samples.

Nr	Matrix	Surface water Lake Mjøsa	Surface water, Alna	Sediment, North Sea	Sediments, Lake Mjøsa	Sediment, Alna	Soil, Alna	Perch liver, Lake Mjøsa	Blue mussel and fish, North Sea	POCIS
48	FBSA	0	0	0	0	0	0	0	0	0
49	N-Me FBSE	0	0	0	0	0	0	0	0	0
50	N-Et- FBSE	0	0	0	0	0	0	0	0	0
51	N-Me FHxSA	0	0	0	0	0	0	0	0	0
52	N-Me FHxSE	0	0	0	0	0	0	0	0	0
53	38850-58-7	0	0	0	0	0	0	0	0	0
54	FOSA	0	0	0	0	0	0	0	0	0
55	N-Me-FOSA	0	0	0	0	0	0	0	0	0
56	N-Et-FOSA	0	0	0	0	0	0	0	0	0
57	N-Me-FOSE	0	0	0	0	0	0	0	0	0
58	N-Et-FOSE	0	0	0	0	0	0	0	0	0
59	N-Me-FOSAA	0	0	0	0	0	0	0	0	0
60	N-Et-FOSAA	0	0	0	0	0	0	0	0	20
61	67584-55-8	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
62	17329-79-2	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
63	67584-57-0	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
64	1893-52-3	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
65	67584-61-6	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
66	67906-70-1	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
67	67584-59-2	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
68	67939-33-7	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
69	10:2 FTOH	0	0	0	0	0	0	0	0	0
70	12:2 FTOH	0	0	0	0	0	0	0	0	0
71	14:2 FTOH	0	0	0	0	0	0	0	0	0
72	16:2 FTOH	0	0	0	0	0	0	0	0	0
73	18:2 FTOH	0	0	0	0	0	0	0	0	0

n.a: not analysed

Compound nr 60, N-Et-FOSAA was detected in one passive water sample from Kværner. The concentration was 1.25 ng/ml extract. None of the other samples had detectable amount of the listed PFASs.

For compound nr 61-68, there were no available standards, also the available extracts from samples in Table 23 were in a solvent not suitable for gas chromatography. Based on the analysis and results of these compounds in the other samples matrices in this study (Table 24 and Table 25), we did not pursue this further.

Table 24: Detection frequency (%) of semi volatile and volatile PFASs (nr 48-73) in white-tailed eagle, otter, wolf, moose glaucous gull, polar bear and arctic fox.

Nr	Matrix	White-tailed eagle, liver	Otter, liver	Wolf, liver	Moose, liver	Glaucous gull, egg	Polar bear, blood plasma	Arctic fox, liver
48	FBSA	0	0	0	0	0	0	0
49	N-Me FBSE	0	0	0	0	0	0	0
50	N-Et- FBSE	0	0	0	0	0	0	0
51	N-Me FHxSA	0	0	0	0	0	0	0
52	N-Me FHxSE	0	0	0	0	0	0	0
53	38850-58-7	0	0	0	0	0	0	0
54	FOSA	100	100	0	0	0	0	80
55	N-Me-FOSA	0	0	0	0	0	0	0
56	N-Et-FOSA	0	0	0	0	0	0	0
57	N-Me-FOSE	0	0	0	0	0	0	0
58	N-Et-FOSE	0	0	0	0	0	0	0
59	N-Me-FOSAA	0	0	0	0	0	0	0
60	N-Et-FOSAA	0	0	0	0	0	0	0
61	67584-55-8	0	0	0	0	0	0	0
62	17329-79-2	0	0	0	0	0	0	0
63	67584-57-0	0	0	0	0	0	0	0
64	1893-52-3	0	0	0	0	0	0	0
65	67584-61-6	0	0	0	0	0	0	0
66	67906-70-1	0	0	0	0	0	0	0
67	67584-59-2	0	0	0	0	0	0	0
68	67939-33-7	0	0	0	0	0	0	0
69	10:2 FTOH	0	0	0	0	0	0	0
70	12:2 FTOH	0	0	0	0	0	0	0
71	14:2 FTOH	0	0	0	0	0	0	0
72	16:2 FTOH	0	0	0	0	0	0	0
73	18:2 FTOH	0	0	0	0	0	0	0

FOSA was the only compound reported above LOD in these samples. FOSA is considered a precursor to PFOS, and can be transformed to PFOS in biological systems (Benskin et al., 2009). The presence of this compound indicate a resent exposure to sulphonamides synthesised by the ECF method (Buck et al. 2011).

The FOSA concentration in white-tailed eagle, otter and arctic fox ranged from: 0.42-9.2 ng/g, 8.9-32 ng/g and <0.10-23 ng/g, respectively. The concentration was from 0-35% of the reported PFOS concentration. There was no FOSA reported for polar bear blood plasma. Analysis of human samples have shown that the concentration of FOSA is 6-8 times higher in whole blood compared to serum and plasma. This has led to the conclusion that a large fraction of FOSA is associated with the cell fraction (Hanssen et al., 2013).

Table 25: Detection frequency (%) of semi volatile and volatile PFASs (nr 48-73) in waste water (Longyearbyen), snow, air (hot spots), dust and arctic air (Zeppelin station).

Nr	Matrix	Waste water LYB	Snow, test track	Air, Hot spot	Dust, hot spots	Arctic air, Zeppelin
48	FBSA	40	0	0	0	0
49	N-Me FBSE	0	0	0	0	0
50	N-Et- FBSE	0	0	0	0	0
51	N-Me FHxSA	0	0	0	0	0
52	N-Me FHxSE	0	0	0	0	0
53	38850-58-7	0	0	0	0	0
54	FOSA	0	0	0	0	0
55	N-Me-FOSA	0	0	0	0	0
56	N-Et-FOSA	0	0	0	0	0
57	N-Me-FOSE	0	0	0	0	0
58	N-Et-FOSE	0	0	0	0	0
59	N-Me-FOSAA	60	0	0	0	0
60	N-Et-FOSAA	80	0	0	0	0
61	67584-55-8	0	0	0	0	0
62	17329-79-2	0	0	0	0	0
63	67584-57-0	0	0	0	0	0
64	1893-52-3	0	0	0	0	0
65	67584-61-6	0	0	0	0	0
66	67906-70-1	0	0	0	0	0
67	67584-59-2	0	0	0	0	0
68	67939-33-7	0	0	0	0	0
69	10:2 FTOH	0	20	20	0	0
70	12:2 FTOH	0	0	0	0	0
71	14:2 FTOH	0	0	0	0	0
72	16:2 FTOH	0	0	0	0	0
73	18:2 FTOH	0	0	0	0	0

Several of the sulphonamides were present in waste water from Longyearbyen. The detection frequency ranged from 40-80 %. Concentrations were: FBSA, 0.43-2.6 ng/L; N-Me-FOSAA, 0.71-0.78 ng/L; and N-Et-FOSAA, 0.95-1.1 ng/L.

Only 10:2 FTOH was detected in one snow sample. The concentration was 279 ng/L. This sample had also the highest concentration of conventional PFASs, 3924 ng/L.

Also for one air sample, only 10:2 FTOH was detected with concentration at 27 ng/sample, however other FTOHs, not part of this screening, were also present in this sample; 6:2 FTOH (> 500 ng/sample) and 8:2 FTOH (> 200 ng/sample). The presence of these compounds can be explained by backpacks situated close to the sampler. These backpacks have been investigated for ionic and volatile PFASs. Analysis of them showed very high concentrations of 8:2 FTOH (>200 ng/m^3). This confirm that consumer products containing FTOHs will emit them to air.

3.4 Very volatile PFASs

There are several challenges with respect to sampling and analysis of the very volatile PFASs listed in Table 5. They are extremely volatile, and hence challenging to sample on standardised air sampling equipment. We had several approaches with respect to analysis. In the first attempt we used ethylacetat as solvent for extraction, since we wanted to combine both volatile and very volatile PFASs in one extract. This was not successful. In gas chromatography very volatile PFASs can elute before and toghther with the solvent. A second attempt was done, where small amounts of hexane was used as eluent. Non of the very volatile PFASs were detected above detection limits in the investigated samples. The LODs are presented in appendix, except for perfluorooctanoylchloride (Cas nr 335-64-8). This compound is a chloranhydride of a strong carboxylic acid and it can not exist in a moist air.
For future studies, type of sampler should be evaluated. Solvent used for extraction should be non-polar and volatile (e.g. pentane).

3.5 Ultra short chain PFASs

Ultra short chain PFASs are present in AFFFs (Barzen-Hansen et al., 2015), and use of AFFFs has shown to contaminate groundwater. Other sources of trifluoroacetate TFA and other short-chain PFASs in the environment are not entirely clear, however also as a result of the atmospheric degradation of several hydrofluorocarbons and hydrochlorofluorocarbons, TFA will be formed (Berends et al., 1999; Berg et al., 2000; Wujcik et al., 1999). Thermolysis of fluoropolymers had also been shown as a potential sources of halogenated acids including TFAs (Kärrman et al., 2019).

This screening, where a number of different matrices are included, gives an overview of the presence of these compounds in the environment. In Table 26, the detection frequency of the ultra short chain acids containing 1 – 3 pefluorinated carbons, trifluoroacetic acid (TFA), perfluoropropanoic acid (PFPrA), perfluoroethanoic sulphonate (PFEtS) and perfluoropropanoic sulphonate (PFPrS), are presented.

Table 26: Detection frequency (%) of ultra short chain PFASs (nr 79-82) in surface water from Lake Mjøsa, surface water River Alna, sediment (North Sea, Lake Mjøsa and River Alna), soil (Alna), perch liver from Lake Mjøsa, blue mussel and fish (North Sea), passive water samples, white-tailed eagle liver, otter liver, wolf liver, moose liver, glaucous gull egg, polar bear blood serum, arctic fox liver, waste eater from Longyearbyen, snow, air (hot spots), dust and arctic air.

Nr.	79	80	81	82
Matrix	TFA	PFPrA	PFEtS	PFPrS
Surface water Lake Mjøsa	0	0	0	0
Surface water, Alna	0	0	0	0
Sediment, North Sea	0	0	0	0
Sediment, Lake Mjøsa	33	0	0	0
Sediment, River Alna	100	0	0	0
Soil, Alna	0	0	0	0
Perch, Lake Mjøsa	0	0	0	0
Blue mussel and fish, North Sea	0	0	0	0
White-tailed eagle, liver	100	0	0	0
Otter, liver	100	0	0	0
Wolf, liver	100	0	0	0
Moose, liver	100	0	0	0
Glaucous gull, egg	100	0	0	80
Polar bear, blood plasma	0	0	0	0
Arctic fox, liver	100	60	0	0
Waste water Longyearbyen	0	0	0	0
Snow, test track	100	100	0	0
Air, Hot spot	100	100	0	0
Dust	80	80	0	0
Arctic air, Zeppelin	0	67	0	0

The prevalence of ultra short chain PFASs in biological samples was low (Table 26). Only PFPrS was reported above LOD in eggs from glaucous gull, and PFPrA in liver from arctic fox,. PFPrA was also reported in some "Hot spot" areas such as snow (test track), air (indoor and outdoor), dust and in two air samples from the Zeppelin station. In contrast, TFA was reported for several biological matrices such as liver and egg, snow and air. The highest concentration was reported for arctic fox liver at 222 ng/g. There was no trend in detection frequency for the other ultra-short chain PFASs. The LOD varied between matrices. PFPrS was only detected in glaucous gull, where concentrations were <0.5 ng/g. The highest concentrations for PFPrA were in air and dust samples from potential hot spots, where max concentration was 8.86 ng/mL extract. There is limited information about biological effects (https://echa.europa.eu/da/registration-dossier/-/registered-dossier/5203/1).

3.6 Extractable organofluorine (EOF)

The structural diversity among the over 5000 known PFAS compounds is large. New organofluorine substances are used as replacements for already regulated PFASs. Extractable organofluorine (EOF) is a method where the total organofluorine content in a sample is converted to F-concentration. (Kärrman et al., 2019).

The amount of fluorine in conventional PFAS compounds is on average 65 % of the total molecular weight. The calculated concentration of fluorine in the sample presented in the figures below is a theoretical value where sumPFASs concentration of conventional PFASs are multiplied with 65 %. For samples where EOF is higher than calculated F-concentration, there is an unknown amount of organic fluorine in the sample. This can originate from unknown PFASs and/or other fluorine containing organic compounds (e.g. pharmaceuticals).

The measured EOF (range, mean and detection frequency) in different sample types are presented in Table 27**Error! Reference source not found.** together with the mean sum PFASs.

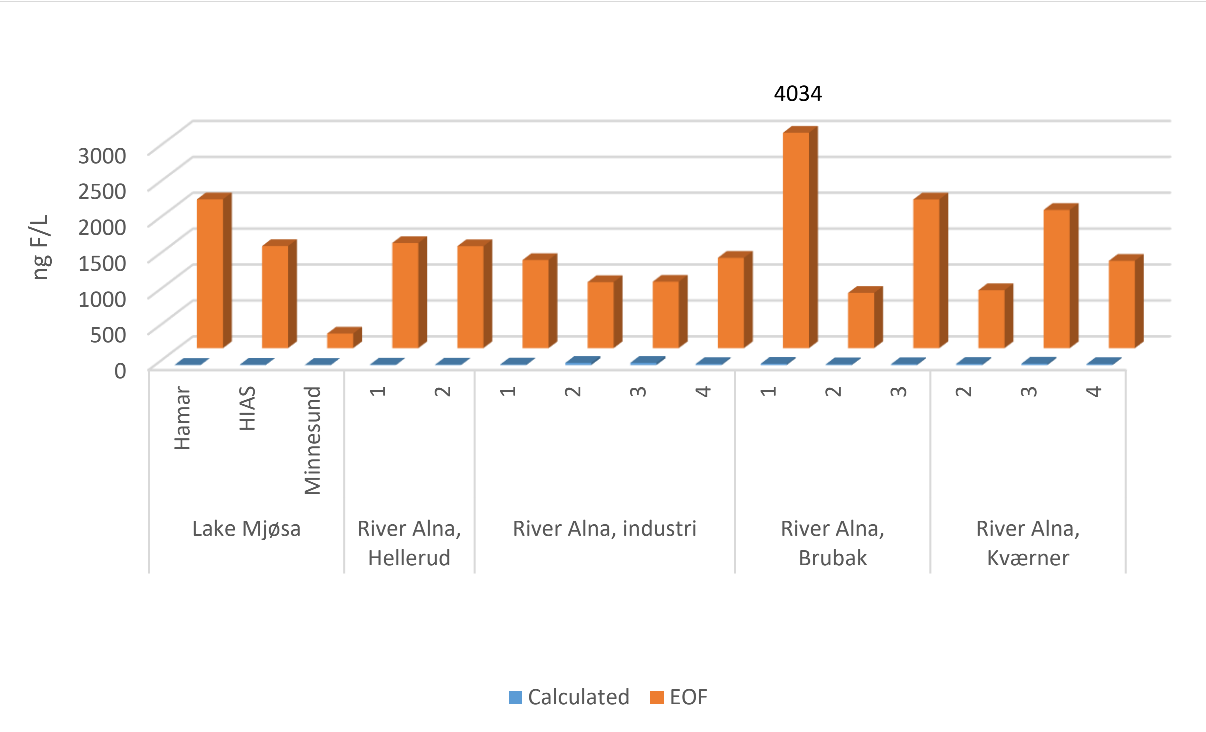


Figure 15: Calculated fluorine concentrations (ng F/L) (blue bar) vs measured EOF concentrations (ng F/L) (orange bar) in surface water samples from Lake Mjøsa and River Alna.

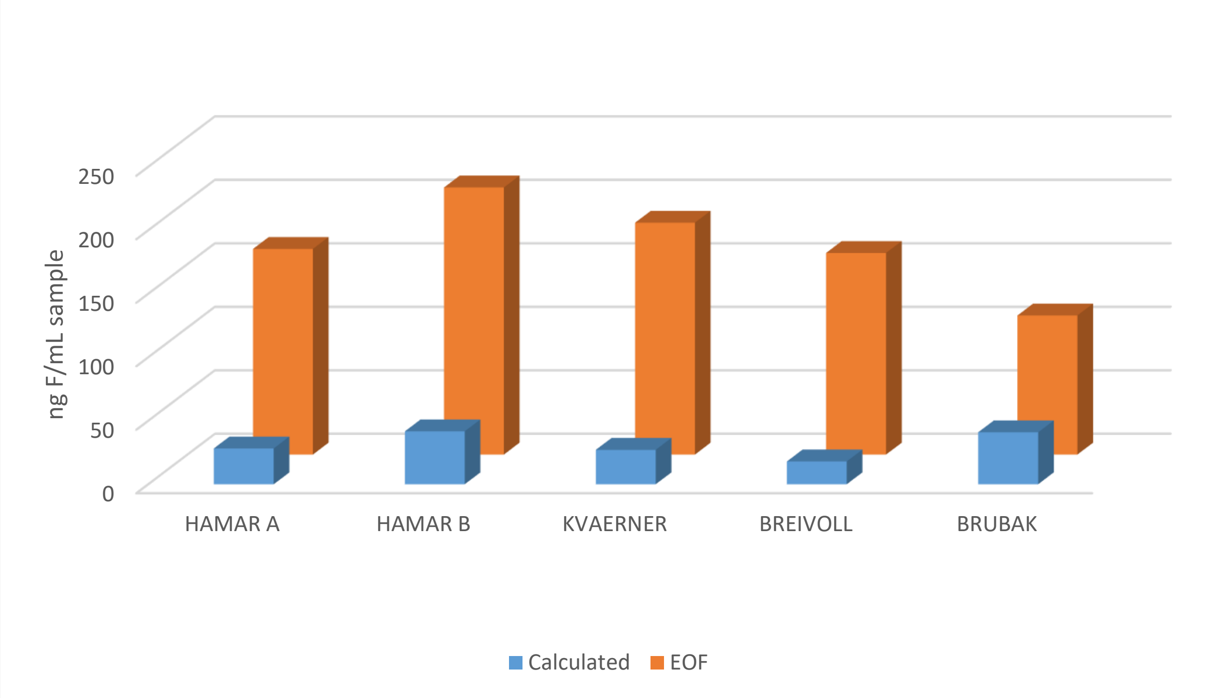


Figure 16: Calculated fluorine concentrations (ng F/L) (blue bar) vs measured EOF concentrations (ng F/L) (orange bar) in passive water samples from Lake Mjøsa and River Alna.

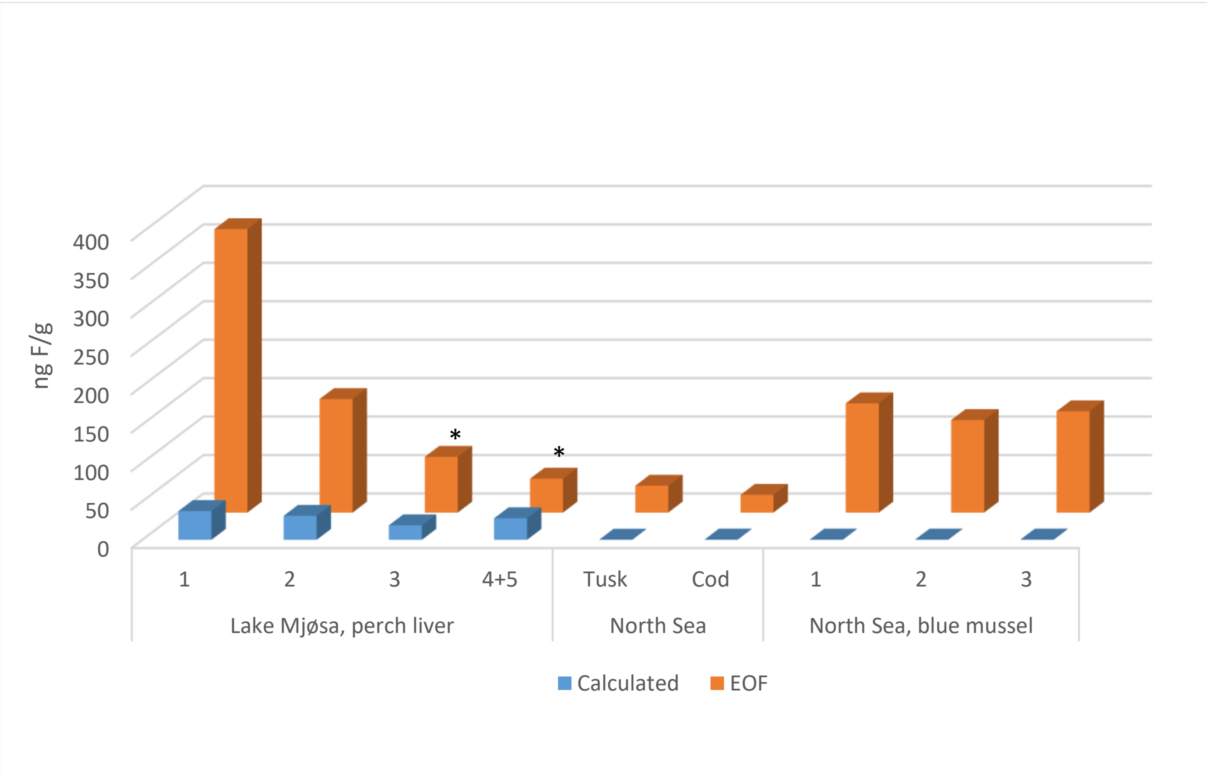


Figure 17: Calculated fluorine concentrations (ng F/L) (blue bar) vs measured EOF concentrations (ng F/L) (orange bar) in perch liver samples from Lake Mjøsa and the North Sea (blue mussel, cod and tusk). For sample 3 and 4+5 from Lake Mjøsa, the EOF are equal to LOD and marked with an "".*

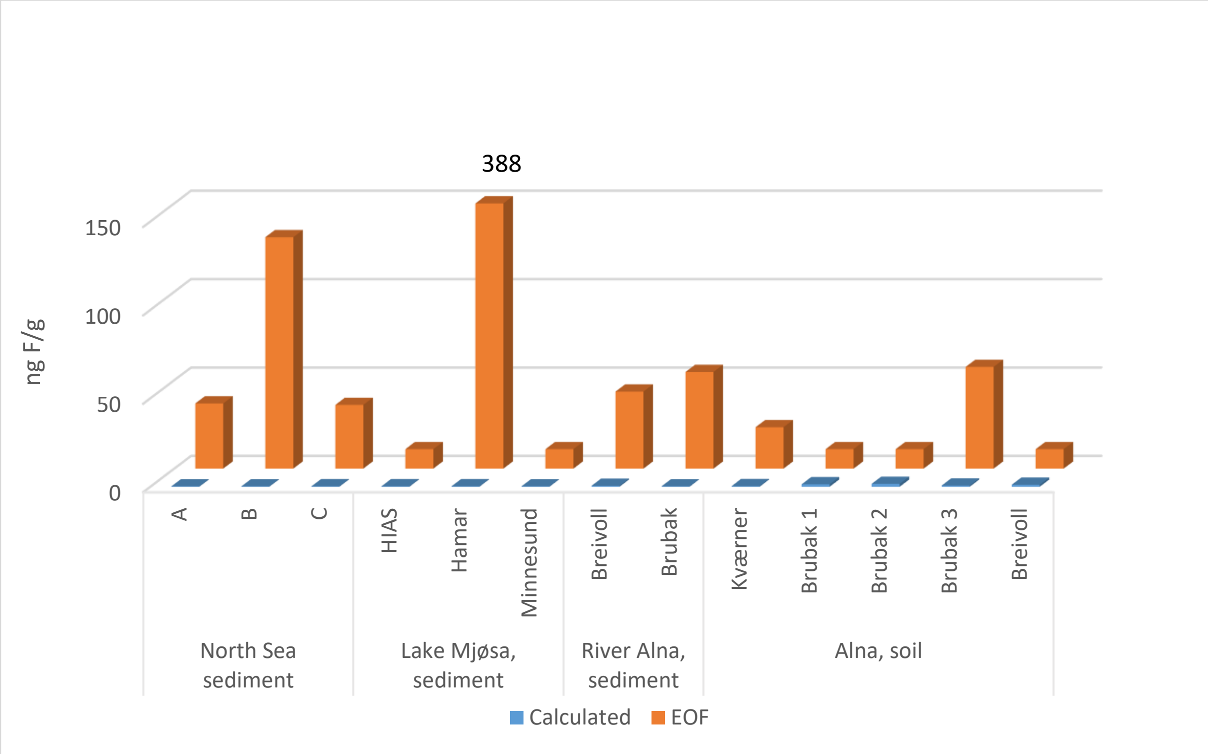


Figure 18: Calculated fluorine concentrations (ng F/L) (blue bar) vs measured EOF concentrations (ng F/L) (orange bar) in sediment from the North Sea, Lake Mjøsa and River Alna, together with soil from the Alna area.

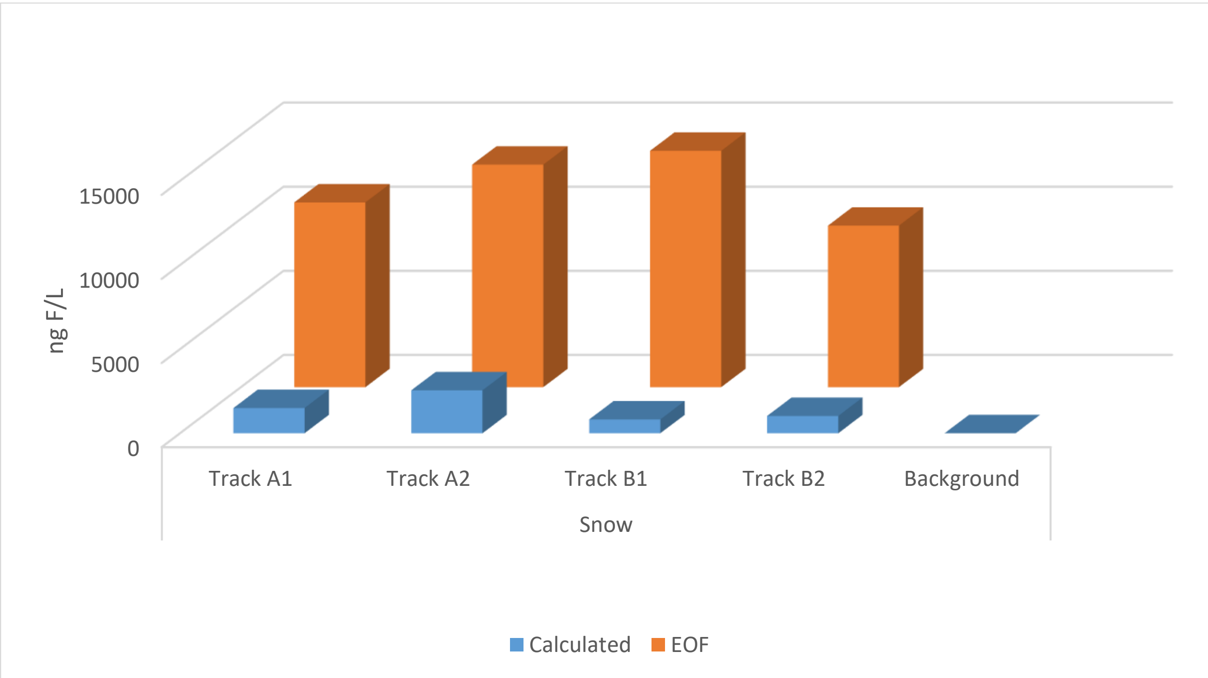


Figure 19: Calculated fluorine concentrations (ng F/L) (blue bar) vs measured EOF concentrations (ng F/L) (orange bar) in snow from cross country ski testing track. EOF for background sample is <LOD (0.2 ng F/L).

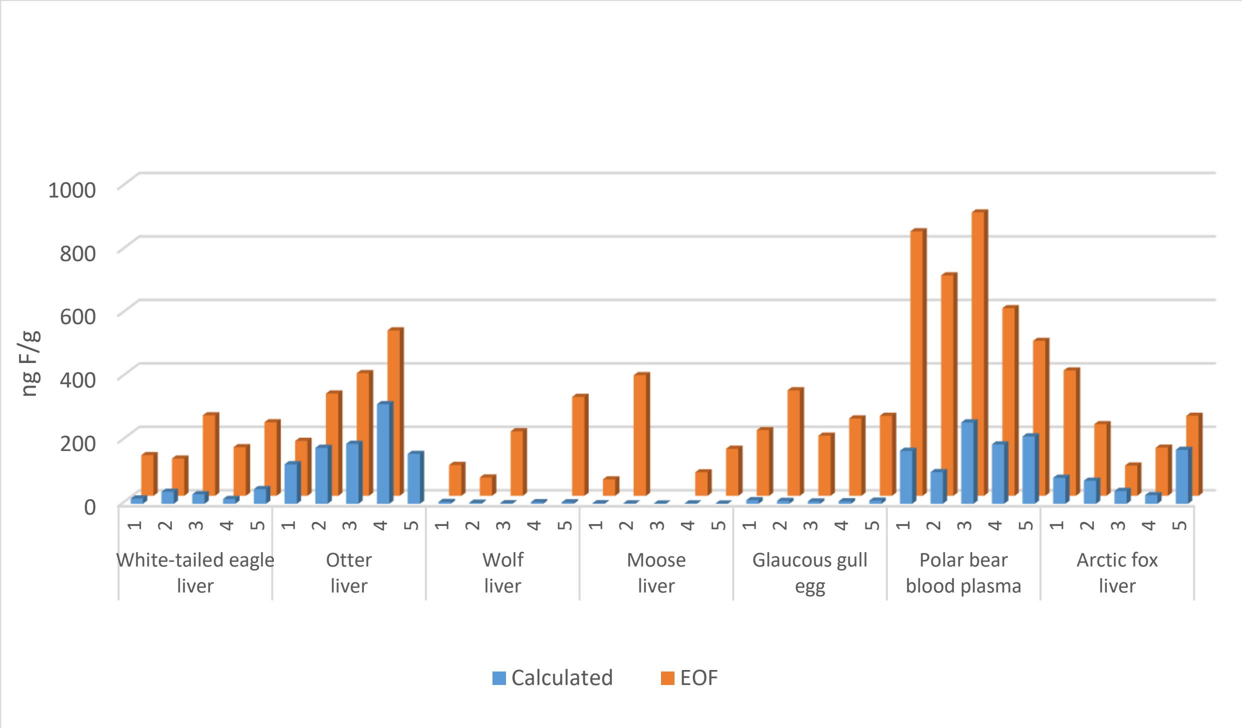


Figure 20: Calculated F-concentration (ng F/g) (blue bar) vs measured EOF concentrations (ng F/g) (orange bars) in liver samples from white-tailed eagle, otter, wolf, moose, and arctic fox; blood plasma samples from polar bear and egg samples from glaucous gull. One wolf, moose and otter sample had EOF<LOD. See appendix for the specific LODs.

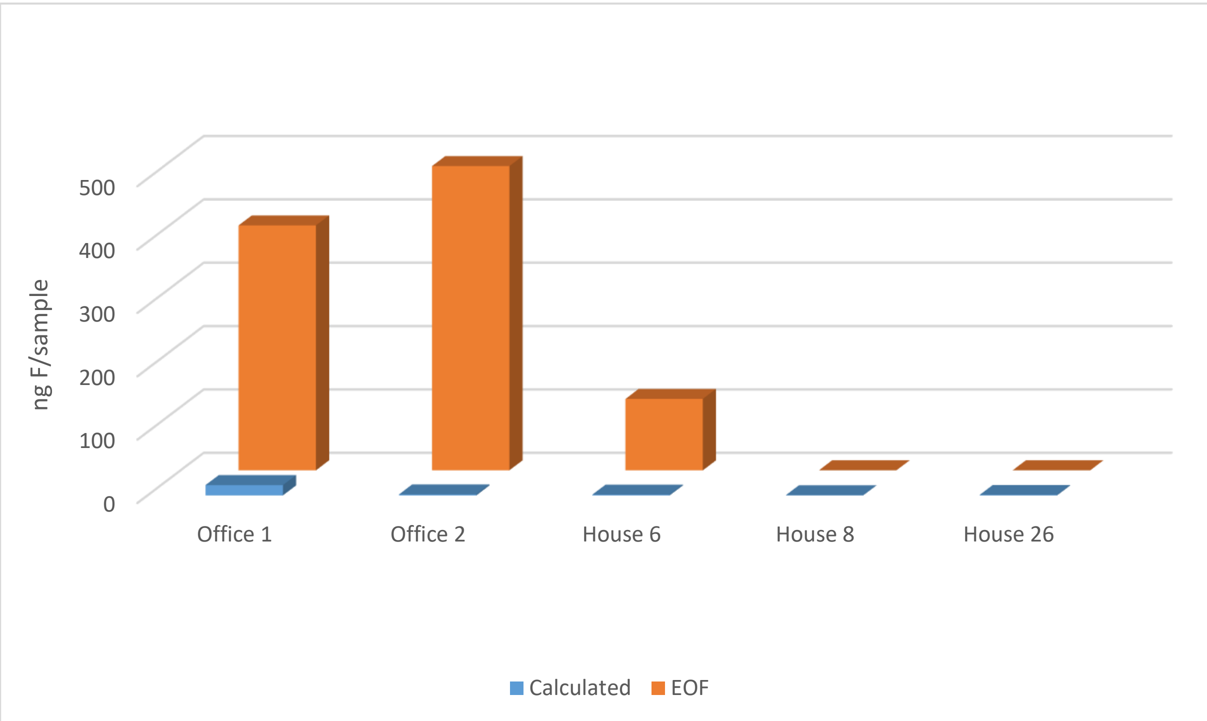


Figure 21: Calculated F-concentration (ng F/g) (blue bar) vs measured EOF concentrations (ng F/g) (orange bars) in dust samples. House 8 and 26 hade EOF<LOD (95 ng/F sample).

The calculated fluorine concentration and EOF for each sample (except air) are presented in Figure 15 to Figure 21 above. For some samples the EOF was below LOD, however, the reported LOD are higher than the calculated fluorine concentrations in the sample. The LODs are reported in the appendix. In the abiotic samples the highest EOF was for snow samples. Among the biological samples, polar bear was the highest EOF. The high amount of EOF in the polar bear samples indicate that there is a fraction that contain organofluorine substances not accounted for in this screening. One study has shown the presence of the compound perfluoro-4- ethylcyclohexanesulfonate (PFECHS) in liver from polar bears (Letcher et al., 2018), however, the reported concentrations of this compound does not account for the observed difference between calculated and measured EOF.

Table 27: EOF (extractable organic fluorine) content in surface water from Lake Mjøsa, house hold waste water and surface water (Alna), sediment (North Sea, Lake Mjøsa and River Alna), soil (Alna) Perch (Lake Mjøsa), blue mussel and fish (North Sea), passive water samples, white-tailed eagle, otter, wolf, moose glaucous gull, polar bear and arctic fox.

Location/Species	Matrix	EOF Range	EOF Mean*		Mean sum PFASs		Detection frequency
Lake Mjøsa	Water	202-2073	1232	ng F/L	3.91	ng/L	100
Alna	Waste water and surface water	770-4034	1503	ng F/L	23.4	ng/L	100
North Sea	Sediment	36-131	68	ng F/g	0.35	ng/g	100
Lake Mjøsa	Sediment	<22-338	137	ng F/g	0.37	ng/g	33
Alna	Sediment	<22-55	41	ng F/g	0.59	ng/g	100
Alna	Soil	<22-58	23	ng F/g	1.58	ng/g	25
Lake Mjøsa/Perch	Liver	148-369	158	ng F/g	44	ng/g	50
North Sea	Whole mussel homogenate	23-142	90	ng F/g	0.41	ng/g	100
POCIS	Water	159-210	176	ng F/L	47.9		100
White-tailed eagle	Liver	117-254	166	ng F/g	44.9	ng/g	100
Otter	Liver	173-521	294	ng F/g	295	ng/g	80
Wolf	Liver	58-312	119	ng F/g	6.21	ng/g	80
Moose	Liver	52-380	158	ng F/g	1.74	ng/g	80
Glaucous gull	Egg	189-332	243	ng F/g	14.0	ng/g	100
Polar bear	Blood plasma	488-893	807	ng F/g	284	ng/mL	100
Arctic fox	Liver	95-395	239	ng F/g	121	ng/g	100
Longyearbyen	Waste water	1017-1855	1320	ng F/L	93.8	ng/L	60
Nannestad	Snow	9602-14050	11966	ng F/L	2267	ng/L	100
Tromsø/Kjeller/Helsfyr	Hot spot air	<45-294	90	ng F/sample	-	ng/m3	80
Tromsø/Kjeller	Dust	<95-480	327	ng F/sample	6.1	ng/sample	60
Zeppelin	Arctic air	<95	48	ng F/sample	-	ng/m3	0

*: For the non-detects, LOD/2 was used for calculating mean.

In Table 27, the amount of conventional PFASs is compared to EOF, however as presented in chapter 0, 3.3 and 3.5, some of the newer PFASs which are part of this screening could contribute to the EOF and are not included in this table or in Figure 15 to Figure 21.

3.7 Synthesis of standards

Deuturated surrogate standards for FBSE, FHxSE and also methyl FBSA and methyl FHxSA were prepared. Before the synthesis of these standards, unlabelled material was studied. It was found that commercial specimen of FBSA and FHxSA contained detectable amounts of CF2 homologs. This information and specimen can be used for identification of those yet undiscovered compounds.

4 Conclusions

The ubiquitous presence of conventional PFASs in the investigated samples should be of concern. Even though some have been phased-out and banned, the exposure to wildlife continues. The conventional PFASs were detected in all of the investigated matrices, and were the dominating group of compounds. Among abiotic samples, snow collected from cross-country ski testing track had the highest concentrations, where also the long chain PFASs (C>12) were the most prominent compounds. Areas where ski testing activity are common are a potential “hot spot” where PFASs can enter the food chain. Conventional PFASs were also detected in waste water samples from Longyearbyen, where the concentrations were higher than compare to water samples from urban areas. In biological samples, highest concentrations of conventional PFASs were found in liver from otters, followed by blood plasma samples from polar bears. The conventional PFASs were also detected in liver from moose, and for the first time also reported in liver from Norwegian wolf. The presence of conventional PFASs in terrestrial top predators add to the knowledge of how ubiquitously PFASs are in the environment.

In abiotic samples, water and soil, the PFCAs are the dominating compound. Even though PFOS are the most prominent compound in the majority of the biological samples, the amount of long chained PFCAs as a group are almost as high or even higher than PFOS concentrations in some samples.

Analysis of dust samples showed indirectly that consumer products containing PFASs are a source for these compounds in the surrounding area, and hence a possible exposure source for humans.

A diverse group of novel PFASs, sulfonate ethers, carboxylate ethers, fluorotelomer alcohols, fluorotelomer sulfonates, PAPs, amides and acrylates was also analysed in this study. Compounds known as ingredients in AFFFs, 6:2 FTS and 8:2FTS, were detected in both household waste water from industrialised areas, and in biological samples. In waste water samples from Longyearbyen, a PFAS previously not detected was reported. A fully fluorinated furan carboxylic acid was detected in all of the samples. The source of this compound is unknown.

The EOF was investigated and compared to a calculated value for fluorine, based on sum of conventional PFASs for all investigated samples. This indicate the presence of unknown organofluorine compounds in the samples.

A strength of this study is the diversity of samples. Waste water can reveal local hot spots to the environment. Air samples reveal potential exposure to humans, and top predators in both the marine and terrestrial food chain give valuable information on the ubiquitous distribution and potential biomagnification of the compounds in question. The difference in PFAS profile between the samples indicate that the diversity in samples are necessary to reveal the complete picture of PFASs in the environment.

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6 References

Ahrens, L., Shoeib, M., Del Vento, S., Codling, G., & Halsall, C. (2011) Polyfluoroalkyl compounds in the Canadian Arctic atmosphere. Environmental Chemistry, 8, 399-406.

AMAP Assessment (2015) Temporal Trends in Persistent Organic Pollutants in the Arctic. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.

Barzen-Hanson, K. A., & Field, J. A., (2015) Discovery and implications of C2 and C3 perfluoroalkyl sulfonates in aqueous film-forming foams and groundwater. Environmental Science and Technology Letters, 2, 95-99.

Benskin J.P., Holt A., Martin J.W. (2009) Isomer-specific biotransformation rates of a perfluorooctane sulfonate (PFOS)-precursor by cytochrome P450 isozymes and human liver microsomes. Environ Sci Technol., 15, 43, 8566-72.

Berends, A.G., Boutonnet, J.C., De Rooij, C.G., Thompson, R.S., (1999) Toxicity of trifluoroacetate to aquatic organism. Environmental Toxicology and Chemistry, 18, 1053-1059.

Berg, M., Müller, S.R., Mühlemann, J., Wiedmer, A., Schwarzenbach, R.P. (2000) Concentrations and mass fluxes of chloroacetic acids and trifluoroacetic acid in rain and natural waters in Switzerland. Environ. Sci. Technol., 34, 2675-2683.

Blom, C., Hanssen, L. (2015) Analysis of per- and polyfluorinated substances in articles. Copenhagen, Nordic Council of Ministers (Nordiske Arbejdspapirer, 2015:911).

Bohlin-Nizzetto, P., Hanssen, L., Herzke, D. (2015) PFASs in house dust. Kjeller, NILU (Norwegian Environment Agency report, M-430|2015) (NILU OR, 29/2015).

Nizzetto, P. B., Aas,W., Warner, N. (2018) Monitoring of environmental contaminants in air and precipitation, annual report 2017. Kjeller, NILU (Norwegian Environment Agency report, M-1062|2018) (NILU report, 13/2018).

Brinch, A., Jensen, A.A., Christensen, F. (2018) Risk assessment of fluorinated substances in cosmetic products. Survey of chemical substances in consumer products No. 169. The Danish Environmental Protection Agency.

Buck, R.C., Franklin, J., Berger, U., Conder, J.M., Cousins, I.T., De Voogt, P., van Leeuwen, S.P. (2011) Perfluoroalkyl and polyfluoroalkyl substances in the environment: terminology, classification, and origins. Integrated environmental assessment and management, 7, 513-541.

EU, Environment. https://ec.europa.eu/environment/water/water-drink/review_en.html
https://ec.europa.eu/environment/water/water-drink/pdf/revised_drinking_water_directive.pdf
[Accessed 03.10.2019]

Fjeld, E., Bæk, K., Rundberget, J.T., Schlabach, M., Warner, N.A. (2017) Miljøgifter i store norske innsjøer, (2016). Forekomst og biomagnifisering i fisk og zooplankton. Oslo, NIVA (Miljødirektoratet, M-807/2017) (NIVA-rapport, 7184-2017).

Hanssen, L., Dudarev, A., Huber, S., Odland, J.O., Nieboer, E., Sandanger, T.M. (2013) Partition of perfluoroalkyl substances (PFASs) in whole blood and plasma, assessed in maternal and umbilical cord samples from inhabitants of arctic Russia and Uzbekistan. Sci. Total Environ., 447, 430-437.

Harju, M., Herzke, D., Kaasa, H. (2013) Perfluorinated alkylated substances (PFAS), brominated flame retardants (BFR) and chlorinated paraffins (CP) in the Norwegian environment – Screening 2013. Oslo, Norwegian Climate and Pollution Agency (Statlig program for foruensningsovervåking. Report nr. M 40-2013.

Heimstad, E.S., Nygård, T., Hezke, D., Bohlin-Nizzetto, P. (2018) Environmental pollutants in the terrestrial and urban environment, 2017. Kjeller, NILU (Norwegian Environment Agency report, M-1076|2018) (NILU report, 20/2018).

Herzke, D., Nygård, T., Heimstad, E.S., Uggerud, H. (2016) Environmental pollutants in the terrestrial and urban environment, 2015. Kjeller, NILU (Norwegian Environment Agency report, M-570|2016) (NILU report, 27/2016).

Herzke, D., Nygård, T., Heimstad, E.S., Uggerud, H. (2015) Environmental pollutants in the terrestrial and urban environment. Kjeller, NILU. (Norwegian Environment Agency report, M-354|2015) (NILU OR, 24/2015).

Iversen, P.E., Lind, M.J., Ersvik, M., Rønning, I., Skaare, B.B., Green, A.M.V., Bakke, T., Lichtenthaler, R., Klungsøyr, J., Hylland, K. (2015) Retningslinjer for miljøovervåking av petroleumsvirksomheten til havs. Oslo, Miljødirektoratet (M-408|2015).

Kissa, E. (2001) Fluorinated surfactants and repellents (2nd edition revised and expanded) (Surfactant science series, 97). New York (NY), Marcel Dekker.

Kärrman, A., Wang, T., Kallenborn R., (2019) PFASs in the Nordic environment Screening of Poly- and Perfluoroalkyl Substances (PFASs) and Extractable Organic Fluorine (EOF) in the Nordic Environment. Copenhagen, Nordic Council of Ministers (TemaNord, 2019:515).

Langberg, H.A, Breedveld, G.D, Grønning, H.M, Kvennås, M, Jenssen, B.M, Hale, S.E. (2019) Bioaccumulation of Fluorotelomer Sulfonates and Perfluoroalkyl Acids in Marine Organisms Living in Aqueous Film-Forming Foam Impacted Waters. Environ. Sci. Technol., 53, 10951−10960.

Letcher, R. J., Morris, A. D., Dyck, M., Sverko, E., Reiner, E. J., Blair, D. A. D., Chu, S. G. Shen, L. (2018) Legacy and new halogenated persistent organic pollutants in polar bears from a contamination hotspot in the Arctic, Hudson Bay Canada. Science of The Total Environment, 610-611, 121–136.

OECD (2013) OECD/UNEP Global PFC Group, Synthesis paper on per- and polyfluorinated chemicals (PFCs), Environment, Health and Safety, Environment Directorate, OECD.

OECD (2018) OECD Environment, Health and Safety Publications Series on Risk Management No. 39. ENV/JM/MONO(2018)7. Toward a new comprehensive global database of per-and polyfluoralkyl substances (PFASs): Summary report on updating the OECD 2007 list of per-and polyfluoralkyl substances (PFASs).

OSPAR (2009) JAMP Guidelines for Monitoring Contaminants in Biota (Ref. no. 1992-2). London, OSPAR Commission.

Plassmann, M.M., Berger, U. (2013) Perfluoroalkyl carboxylic acids with up to 22 carbon atoms in snow and soil samples from a ski area. Chemosphere, 91, 832–837.

Roos, A, Berger, U, Järnberg, U, van Dijk, J, Bignert, A. (2013) Increasing concentrations of perfluoroalkyl acids in Scandinavian otters (Lutra lutra) between 1972 and 2011: a new threat to the otter population? Environ Sci Technol., 15;47(20):11757-65.

Routti, H, Aars, J, Fuglei, E, Hanssen, L, Lone, K, Polder, A, Pedersen, ÅØ, Tartu, S, Welker, JM, Yoccoz, NG. (2017) Emission Changes Dwarf the Influence of Feeding Habits on Temporal Trends of Per- and Polyfluoroalkyl Substances in Two Arctic Top Predators. Environ Sci Technol., 51, 11996-12006.

Schlabach, M., van Bavel, B., Lomba, J.A.B., Borgen, A., Gabrielsen, G.W., Götsch, A., Halse, A-K., Hanssen, L., Krogseth, I.S., Nikiforov, V., Nygård, T. Bohlin Nizzetto, P.,Reid, M., Rostkowski, P., Samanipour, S. (2017) Screening Programme 2017. AMAP Assessment compounds. Kjeller, NILU (Norwegian Environment Agency report, M-1080|2018) (NILU report, 21/2018).

Schultes, L., Vestergren, R. , Volkova, K. , Westberg, E. , Jacobson, T. , Benskin, J. (2018) Per- and polyfluoroalkyl substances and fluorine mass balance in cosmetic products from the Swedish market: implications for environmental emissions and human exposure. Environ Sci Process Impacts, 20, 1680-1690.

Wang, Z., DeWitt, J. C., Higgins, C. P., & Cousins, I. T. (2015) A never-ending story of per-and polyfluoroalkyl substances (PFASs)? Environ. Sci. Technol., 51, 2508-2518.

Wujcik, C.E., Cahill, T.M., Seiber, J.N. (1999) Determination of trifluoroacetic acid in1996–1997 precipitation and surface waters in California and Nevada. Environ. Sci. Technol., 33, 1747-1751. doi:10.1021/es980697c.

7 Appendix

Complete results conventional PFASs (compound nr. 1-18)

		PFBS	PFPeS	PFHxS	PFHpS	PFOS-99*	PFNS	PFDS	PFDoDS	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	Cas nr	375-73-5	2706-91-4	355-46-4	375-92-8	1763-23-1	474511-07-4	335-77-3	79780-39-5	2706-90-3	335-77-3	79780-39-5	2706-90-3	307-24-4	375-85-9	335-67-1	375-95-1	335-76-2	2058-94-8
Sample ID:	Sample type																		
118084/77	Water (ng/L)	<0.25	<0.25	<0.25	<0.63	<0.20	<0.06	<0.05	<0.13	0.29	0.41	0.32	0.45	0.24	<0.21	<0.13	<0.06	<0.06	<0.09
118084/78	Water (ng/L)	<0.30	<0.30	<0.30	<0.75	<0.23	<0.08	<0.05	<0.15	0.35	1.07	0.89	2.11	0.30	0.35	<0.16	<0.08	<0.08	<0.11
118084/79	Water (ng/L)	<0.25	<0.25	<0.25	<0.64	<0.20	<0.06	<0.05	<0.13	0.30	<0.33	0.28	0.36	0.18	<0.21	<0.13	<0.06	<0.06	<0.09
118084/80	Water (ng/L)	1.01	<0.26	<0.26	<0.64	0.57	<0.06	<0.05	<0.13	1.68	1.02	0.71	1.92	0.70	0.69	0.19	0.10	<0.07	<0.09
118084/81	Water (ng/L)	0.87	<0.27	<0.27	<0.67	0.48	<0.07	<0.05	<0.13	1.61	1.15	0.75	1.72	0.47	0.50	<0.14	<0.07	<0.07	<0.09
118084/82	Water (ng/L)	0.49	<0.24	0.43	<0.59	0.98	<0.06	<0.04	<0.12	2.59	1.77	0.97	2.26	0.67	0.36	0.13	<0.06	<0.06	<0.08
118084/83	Water (ng/L)	2.16	<0.26	0.58	<0.64	4.34	<0.06	<0.05	<0.13	8.65	7.78	5.84	10.1	2.81	3.20	0.45	0.14	<0.07	<0.09
118084/84	Water (ng/L)	2.33	<0.25	0.66	<0.64	4.34	<0.06	<0.05	<0.13	8.85	7.79	5.86	9.84	3.15	3.13	0.37	0.15	<0.06	<0.09
118084/85	Water (ng/L)	1.20	<0.38	0.54	<0.96	1.65	<0.10	<0.07	<0.19	3.94	3.89	1.84	4.00	1.28	1.03	<0.20	0.11	<0.10	0.18
118084/86	Water (ng/L)	1.05	<0.25	0.80	<0.63	3.17	<0.06	<0.05	<0.13	4.95	5.32	2.88	5.35	1.26	1.17	0.30	0.17	<0.06	0.10
118084/87	Water (ng/L)	0.82	<0.26	0.64	<0.64	1.82	<0.06	<0.05	<0.13	2.88	2.77	1.54	2.75	0.81	0.47	0.16	0.09	<0.07	<0.09
118084/88	Water (ng/L)	1.27	<0.25	0.94	<0.63	2.14	<0.06	<0.05	<0.13	3.76	3.28	1.85	3.05	0.70	0.45	<0.13	<0.06	<0.06	<0.09
118084/89	Water (ng/L)	1.23	<0.25	0.90	<0.64	2.55	<0.06	0.06	<0.13	3.74	4.74	2.47	5.40	1.87	0.67	0.30	0.08	<0.06	<0.09
118084/90	Water (ng/L)	1.29	<0.29	1.04	<0.72	3.76	<0.07	0.06	<0.14	4.86	5.08	2.89	5.50	1.44	1.34	0.29	0.13	<0.07	<0.10
118084/91	Water (ng/L)	1.05	<0.26<	0.85	<0.64	2.42	<0.06	<0.05	<0.13	3.71	3.95	2.09	3.74	1.03	0.75	0.22	0.10	<0.07	<0.09

*linear PFOS

		PFBS	PFPeS	PFHxS	PFHpS	PFOS-99*	PFNS	PFDS	PFDoDS	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	Cas nr	375-73-5	2706-91-4	355-46-4	375-92-8	1763-23-1	474511-07-4	335-77-3	79780-39-5	2706-90-3	335-77-3	79780-39-5	2706-90-3	307-24-4	375-85-9	335-67-1	375-95-1	335-76-2	2058-94-8
Sample ID:	Sample type																		
118084/92	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	NR	<0.02	<0.10	<0.05	<0.02	<0.02	0.03	<0.004	<0.01	<0.01
118084/93	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	<0.02	<0.02	0.02	<0.004	<0.01	<0.01
118084/94	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	0.08	<0.01	<0.01	<0.02	NR	<0.02	<0.10	<0.05	<0.02	<0.02	<0.01	<0.004	<0.01	<0.01
118084/95	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	0.07	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	<0.02	0.04	<0.01	<0.004	<0.01	<0.01
118084/96	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	<0.02	0.05	<0.01	<0.004	<0.01	<0.01
118084/97	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	<0.02	<0.02	0.02	<0.004	<0.01	<0.01
118084/98	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	<0.02	<0.02	0.02	<0.004	<0.01	<0.01
118084/99	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	<0.02	<0.02	0.02	<0.004	<0.01	<0.01
118084/100	Sediment (ng/g)	<0.05	<0.05	<0.05	<0.13	0.14	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	0.06	<0.02	0.05	<0.01	<0.004	<0.01	<0.01
118084/101	Soil (ng/g)	<0.05	<0.05	0.05	<0.13	0.89	<0.01	<0.01	<0.02	<0.05	0.08	<0.10	0.51	0.21	0.18	<0.01	<0.004	<0.01	<0.01
118084/102	Soil (ng/g)	<0.05	<0.05	0.06	<0.13	1.37	<0.01	<0.01	<0.02	NR	0.03	<0.10	0.49	0.19	0.18	<0.01	<0.004	<0.01	<0.01
118084/103	Soil (ng/g)	<0.05	<0.05	<0.05	<0.13	0.85	<0.01	<0.01	<0.02	<0.05	0.03	<0.10	0.22	0.15	0.21	<0.01	<0.004	<0.01	<0.01
118084/104	Soil (ng/g)	<0.05	<0.05	<0.05	<0.13	0.32	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	0.10	0.09	0.19	0.06	<0.004	<0.01	<0.01
118084/105	Fish (ng/g)	<0.79	<0.79	<0.79	<1.99	17.74	<0.20	<0.20	<0.39	<0.79	<0.39	<1.53	<0.72	<0.39	3.45	5.77	8.70	8.26	8.81
118084/106	Fish (ng/g)	<0.27	<0.27	<0.27	<0.68	34.70	<0.07	<0.07	<0.13	<0.27	<0.13	<0.52	0.30	0.35	2.52	2.57	2.66	2.64	0.93
118084/107	Fish (ng/g)	<0.32	<0.32	<0.32	<0.80	20.61	<0.08	<0.08	<0.16	<0.32	<0.16	<0.62	0.41	0.16	2.39	3.73	<0.004	<0.004	<0.01
118084/108	Fish (ng/g)	<0.20	<0.20	<0.20	<0.50	34.03	<0.05	<0.05	<0.10	<0.20	<0.10	<0.39	0.52	0.41	3.24	1.72	1.14	0.58	0.42
118084/109	Fish (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	<0.02	<0.02	<0.01	<0.004	<0.004	<0.01
118084/110	Fish (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	0.06	<0.02	<0.01	<0.004	<0.004	<0.01
118084/111	Blue mussel homogenate (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	<0.05	<0.02	<0.02	<0.01	<0.004	<0.01	<0.01
118084/112	Blue mussel homogenate (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	0.08	<0.02	<0.02	<0.01	<0.004	0.05	0.03
118084/113	Blue mussel homogenate (ng/g)	<0.05	<0.05	<0.05	<0.13	<0.06	<0.01	<0.01	<0.02	<0.05	<0.02	<0.10	0.11	<0.02	0.06	<0.01	<0.004	0.07	<0.01

*linear PFOS

		PFBS	PFPeS	PFHxS	PFHpS	PFOS-99*	PFNS	PFDS	PFDoDS	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	Cas nr	375-73-5	2706-91-4	355-46-4	375-92-8	1763-23-1	474511-07-4	335-77-3	79780-39-5	2706-90-3	335-77-3	79780-39-5	2706-90-3	307-24-4	375-85-9	335-67-1	375-95-1	335-76-2	2058-94-8
Sample ID:	Sample type																		
118084/114	POCIS (ng/mL in extract)	5.28	0.45	3.21	<0.27	7.79	<0.03	<0.03	<0.05	8.56	11.76	6.17	15.25	2.32	1.45	0.31	0.13	<0.03	<0.03
118084/115	POCIS (ng/mL in extract)	2.10	0.36	1.64	<0.27	3.10	<0.03	<0.03	<0.05	1.79	4.01	10.43	13.00	5.12	1.11	0.42	<0.03	<0.03	<0.03
118084/116	POCIS (ng/mL in extract)	1.82	0.17	1.11	<0.27	2.71	<0.03	<0.03	<0.05	4.23	4.61	2.69	8.03	1.03	0.72	0.19	0.09	<0.03	<0.03
118084/117	POCIS (ng/mL in extract)	1.96	0.17	1.20	<0.27	4.28	<0.03	<0.03	<0.05	6.97	6.36	4.58	11.31	2.06	1.85	0.45	0.27	<0.03	<0.03
118084/118	POCIS (ng/mL in extract)	2.70	0.54	2.45	<0.27	5.37	<0.03	<0.03	<0.05	3.67	5.48	15.53	16.91	8.65	1.91	0.63	<0.03	<0.03	<0.03

*linear PFOS

		PFBS	PFPeS	PFHxS	PFHpS	PFOS**	PFNS	PFDS	PFDoDS	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	Cas nr	375-73-5	2706-91-4	355-46-4	375-92-8	1763-23-1	474511-07-4	335-77-3	79780-39-5	2706-90-3	335-77-3	79780-39-5	2706-90-3	307-24-4	375-85-9	335-67-1	375-95-1	335-76-2	2058-94-8
Sample ID:	Sample type																		
118084/1	White-tailed eagle Liver (ng/g)	<0.05	<0.05	1.02	0.300	6.71	0.130	<0.10	<0.10	<0.05	5.02	0.75	0.30	2.04	1.22	1.37	0.44	1.01	0.22
118084/2	White-tailed eagle Liver (ng/g)	<0.05	<0.05	0.622	0.378	26.0	0.132	0.204	<0.10	1.77	<0.10	0.37	0.37	2.06	2.10	6.34	2.08	8.85	1.09
118084/3	White-tailed eagle Liver (ng/g)	<0.05	<0.05	0.514	0.367	18.2	<0.10	<0.10	<0.10	1.26	<0.10	<0.10	0.44	1.32	2.00	6.51	1.84	6.74	0.69
118084/4	White-tailed eagle Liver (ng/g)	<0.05	<0.05	0.561	0.194	10.2	<0.10	0.198	<0.10	0.69	<0.10	<0.10	0.21	0.68	0.89	2.22	0.78	2.69	0.37
118084/5	White-tailed eagle Liver (ng/g)	<0.05	<0.05	0.629	0.325	30.3	0.183	0.960	<0.10	1.17	<0.10	0.27	0.17	1.72	2.09	4.89	1.75	6.35	0.78
118084/6	Otter, liver (ng/g)	0.121	<0.05	1.80	1.16	72.2	0.145	0.299	<0.10	1.81	<0.10	0.25	17.50	53.69	14.71	11.97	1.65	2.73	0.29
118084/7	Otter, liver (ng/g)	0.070	<0.05	3.34	2.24	116	<0.10	<0.10	<0.10	2.14	<0.10	0.31	11.85	70.53	20.50	16.22	1.74	3.89	0.29
118084/8	Otter, liver (ng/g)	<0.05	<0.05	3.13	1.85	134	0.263	0.149	<0.10	<0.05	<0.10	<0.10	6.30	77.98	26.47	12.90	1.29	2.25	0.26
118084/9	Otter, liver (ng/g)	<0.05	<0.05	4.36	3.73	218	0.214	<0.10	<0.10	1.47	<0.10	<0.10	9.89	150.90	38.15	15.69	1.52	3.20	0.29
118084/10	Otter, liver (ng/g)	<0.05	<0.05	2.84	1.80	111	0.160	0.190	<0.10	1.45	<0.10	0.19	6.45	67.12	16.08	13.52	1.68	3.63	0.37
118084/11	Wolf, liver (ng/g)	0.141	<0.05	0.638	0.155	2.20	<0.10	<0.10	<0.10	<0.05	<0.10	0.19	<0.05	1.91	1.49	1.33	0.25	0.32	<0.10
118084/12	Wolf, liver (ng/g)	<0.05	<0.05	<0.05	<0.05	1.81	<0.10	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05	1.18	0.70	0.77	0.16	<0.10	<0.10
118084/13	Wolf, liver (ng/g)	<0.05	<0.05	<0.05	<0.05	0.68	<0.10	<0.10	<0.10	<0.05	<0.10	<0.10	0.09	0.55	0.25	0.22	<0.05	<0.10	<0.10
118084/14	Wolf, liver (ng/g)	<0.05	<0.05	<0.05	<0.05	1.84	<0.10	<0.10	<0.10	<0.05	<0.10	0.48	<0.05	1.35	0.83	0.70	0.14	0.15	<0.10
118084/15	Wolf, liver (ng/g)	<0.05	<0.05	0.298	0.163	1.51	<0.10	<0.10	<0.10	<0.05	0.32	0.40	<0.05	0.89	0.46	0.41	0.05	0.10	<0.10

**sum PFOS

		PFBS	PFPeS	PFHxS	PFHpS	PFOS**	PFNS	PFDS	PFDoDS	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	Cas nr	375-73-5	2706-91-4	355-46-4	375-92-8	1763-23-1	474511-07-4	335-77-3	79780-39-5	2706-90-3	335-77-3	79780-39-5	2706-90-3	307-24-4	375-85-9	335-67-1	375-95-1	335-76-2	2058-94-8
Sample ID:	Sample type																		
118084/16	Moose, liver (ng/g)	<0.05	<0.05	<0.05	0.209	0.39	0.085	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05	0.25	0.18	0.19	<0.05	<0.10	<0.10
118084/17	Moose, liver (ng/g)	<0.05	<0.05	<0.05	0.323	0.30	<0.10	<0.10	<0.10	0.07	<0.10	<0.10	<0.05	0.18	0.13	0.11	<0.05	<0.10	<0.10
118084/18	Moose, liver (ng/g)	0.032	<0.05	<0.05	0.163	0.27	<0.10	<0.10	<0.10	<0.05	<0.10	<0.10	0.05	0.09	0.08	0.10	<0.05	<0.10	<0.10
118084/19	Moose, liver (ng/g)	<0.05	<0.05	<0.05	0.094	0.18	<0.10	<0.10	<0.10	0.52	<0.10	<0.10	0.08	0.22	0.09	0.13	<0.05	<0.10	<0.10
118084/20	Moose, liver (ng/g)	<0.05	<0.05	<0.05	0.120	0.18	<0.10	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05	0.18	0.06	0.11	<0.05	<0.10	<0.10
118084/21	Glaucous gull, egg (ng/g)	<0.05	<0.05	0.337	0.097	4.82	0.087	<0.10	<0.10	<0.05	<0.10	0.03	0.42	1.26	0.88	3.42	1.16	3.86	0.68
118084/22	Glaucous gull, egg (ng/g)	<0.05	<0.05	0.220	0.102	4.88	<0.10	<0.10	<0.10	<0.05	<0.10	0.03	0.57	1.33	0.43	1.12	0.23	0.98	0.26
118084/23	Glaucous gull, egg (ng/g)	<0.05	<0.05	0.140	0.084	4.90	<0.10	<0.10	<0.10	<0.05	<0.10	0.02	0.37	1.08	0.47	1.06	0.29	1.20	0.25
118084/24	Glaucous gull, egg (ng/g)	<0.05	<0.05	0.228	0.136	5.42	<0.10	<0.10	<0.10	<0.05	<0.10	0.03	0.62	1.30	0.41	1.07	0.21	0.77	0.18
118084/25	Glaucous gull, egg (ng/g)	<0.05	<0.05	0.342	0.163	6.61	<0.10	<0.10	<0.10	<0.05	<0.10	0.05	1.02	2.07	0.60	1.21	0.21	0.65	0.14
118084/26	Polar bear, blood plasma (ng/mL)	0.123	<0.05	32.3	4.580	95.8	<0.10	<0.10	<0.10	0.14	<0.10	0.22	4.34	38.2	9.49	18.29	2.61	4.42	0.75
118084/27	Polar bear, blood plasma (ng/mL)	0.093	<0.05	26.0	2.871	47.1	<0.10	<0.10	<0.10	<0.05	<0.10	0.32	5.27	30.2	6.10	10.20	0.90	1.55	<0.10
118084/28	Polar bear, blood plasma (ng/mL)	0.139	<0.05	44.1	5.855	188	<0.10	<0.10	<0.10	<0.05	<0.10	0.49	4.94	39.2	13.07	24.60	3.00	5.18	0.77
118084/29	Polar bear, blood plasma (ng/mL)	0.119	<0.05	33.5	6.688	125	<0.10	<0.10	<0.10	<0.05	<0.10	0.23	5.49	34.2	8.74	18.28	2.25	4.45	0.75
118084/30	Polar bear, blood plasma (ng/mL)	0.103	<0.05	35.4	5.150	143	<0.10	<0.10	<0.10	<0.05	<0.10	0.26	6.72	41.5	12.56	24.25	3.04	6.02	0.70

**sum PFOS

		PFBS	PFPeS	PFHxS	PFHpS	PFOS**	PFNS	PFDS	PFDoDS	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	Cas nr	375-73-5	2706-91-4	355-46-4	375-92-8	1763-23-1	474511-07-4	335-77-3	79780-39-5	2706-90-3	335-77-3	79780-39-5	2706-90-3	307-24-4	375-85-9	335-67-1	375-95-1	335-76-2	2058-94-8
118084/31	Arctic fox, liver (ng/g)	0.196	2.113	9.28	1.131	75.3	0.121	0.111	<0.10	1.90	<0.10	<0.10	0.83	4.85	4.32	4.24	0.59	1.80	0.30
118084/32	Arctic fox, liver (ng/g)	<0.05	<0.05	1.50	1.062	69.4	<0.10	0.080	<0.10	0.53	<0.10	0.19	1.88	19.9	5.85	7.63	0.88	2.45	0.33
118084/33	Arctic fox, liver (ng/g)	<0.05	<0.05	1.18	0.572	42.1	0.115	0.068	<0.10	<0.05	<0.10	0.30	0.77	5.06	1.86	1.56	0.20	0.80	0.22
118084/34	Arctic fox, liver (ng/g)	<0.05	<0.05	8.50	1.068	12.6	0.149	0.085	<0.10	0.61	<0.10	0.37	0.91	5.40	1.73	1.78	0.35	0.51	0.15
118084/35	Arctic fox, liver (ng/g)	0.882	3.028	9.06	1.545	171	0.175	0.264	<0.10	1.82	<0.10	0.23	0.48	5.58	10.73	13.31	1.75	6.35	0.90
118084/36	Waste water LYB (ng/L)	16.9	<0.20	<0.20	0.628	4.23	<0.10	<0.10	<0.10	<0,10	5.59	1.61	5.99	1.97	0.88	0.05	<0.05	<0.10	<0.10
118084/37	Waste water LYB (ng/L)	21.4	<0.20	<0.20	0.905	1.56	<0.10	<0.10	<0.10	5.16	7.28	2.04	10.6	2.18	1.41	0.05	<0.05	<0.10	<0.10
118084/38	Waste water LYB (ng/L)	11.2	<0.20	1.039	0.547	1.39	<0.10	<0.10	<0.10	6.74	34.5	9.96	113	33.1	5.84	0.88	0.35	<0.10	<0.10
118084/39	Waste water LYB (ng/L)	7.01	<0.20	<0.20	<0.20	1.42	1.46	<0.10	<0.10	2.95	19.2	4.11	19.7	3.19	1.89	0.95	<0.05	<0.10	<0.10
118084/40	Waste water LYB (ng/L)	3.07	<0.20	<0.20	<0.20	1.59	1.17	<0.10	<0.10	7.21	19.6	6.48	47.7	4.07	3.48	0.89	0.38	<0.10	<0.10
118084/41	Snow, Test track (ng/L)	<0.20	<0.20	<0.20	0.676	0.90	<0.10	<0.10	<0.10	4.99	44.4	32.3	62.8	27.9	103	148	587	147	883
118084/42	Snow, Test track (ng/L)	<0.20	<0.20	<0.20	<0.20	1.24	1.05	<0.10	<0.10	7.17	53.4	33.9	68.2	30.1	107	160	919	219	1963
118084/43	Snow, Test track (ng/L)	<0.20	<0.20	<0.20	0.676	1.14	1.11	0.566	<0.10	5.48	45.6	27.4	57.2	22.3	75.5	62.2	223	79.7	602
118084/44	Snow, Test track (ng/L)	<0.20	<0.20	<0.20	<0.20	1.06	<0.10	0.492	<0.10	5.58	43.3	26.5	53.2	21.9	72.8	64.7	234	101	718
118084/45	Snow, Background (ng/L)	<0.20	<0.20	<0.20	<0.20	<0.10	<0.10	<0.10	<0.10	0.37	0.53	1.00	0.68	0.62	0.42	<0.05	<0.05	0.05	0.05

**sum PFOS

		PFBS	PFPeS	PFHxS	PFHpS	PFOS-99*	PFNS	PFDS	PFDoDS	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA
	Cas nr	375-73-5	2706-91-4	355-46-4	375-92-8	1763-23-1	474511-07-4	335-77-3	79780-39-5	2706-90-3	335-77-3	79780-39-5	2706-90-3	307-24-4	375-85-9	335-67-1	375-95-1	335-76-2	2058-94-8
Sample ID:	Sample type																		
118084/47	Air, outdoor (ng/m^3)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10
118084/48	Air, indoor (ng/m^3)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1.90	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10
118084/51	Air, indoor (ng/m^3)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10
118084/52	Air, indoor (ng/m^3)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	4.33	<0.05	2.65	3.31	1.71	<0.10	<0.10
118084/56	Air, outdoor (ng/m^3)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10
118084/59	Dust, wipe (ng/sample)	<0.05	<0.05	1.568	<0.05	3.71	<0.05	9.40	<0.05	1.03	2.03	0.619	1.63	1.50	0.847	0.703	0.490	0.365	<0.02
118084/60	Dust, wipe (ng/sample)	0.193	<0.05	<0.05	<0.05	0.25	<0.05	0.365	<0.05	0.079	0.534	0.057	0.114	0.108	0.093	0.036	0.032	<0.02	<0.02
118084/61	Dust, vacuum (ng/sample)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.126	<0.05	<0.05	0.181	<0.05	0.100	<0.05	0.042	<0.02	<0.02	<0.02	<0.02
118084/62	Dust, vacuum (ng/sample)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02
118084/63	Dust, vacuum (ng/sample)	<0.05	<0.05	<0.05	<0.05	0.143	<0.05	0.443	<0.05	<0.05	<0.05	<0.05	0.090	<0.05	0.029	<0.02	<0.02	<0.02	<0.02
118084/64	Arctic air (ng/m^3)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10
118084/65	Arctic air (ng/m^3)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10
118084/66	Arctic air (ng/m^3)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10

**sumPFOS

		PFHxDA	PFOcDA
	Cas nr	67905-19-5	16517-11-6
Sample ID:	Sample type		
118084/41	Snow, Test track (ng/L)	192	68.4
118084/42	Snow, Test track (ng/L)	212	148
118084/43	Snow, Test track (ng/L)	43.8	14.6
118084/44	Snow, Test track (ng/L)	123	115
118084/45	Snow, Background (ng/L)	<0.05	<0.05

Complete results new PFAS (compound nr. 19-34)

		144808-89-9	374-88-9	short F53 B	F53B	long F53B	6:2 FTS	8:2 FTS	10:2 FTS	377-73-1	863090-89-5	HEPO DA	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	ADONA	13252-14-7
	Cas nr	144808-89-9	374-88-9	737728-96-0	756426-58-1	763051-92-9	27619-97-2	39108-34-4	120226-60-0	377-73-1	863090-89-5	13252-13-6	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	958445-44-8	13252-14-7
Sample ID:	Sample type																		
118084/77	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/78	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/79	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/80	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.05	0.64	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/81	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.05	<0.08	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/82	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	8.60	1.33	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/83	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	8.18	0.67	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/84	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	2.21	0.42	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/85	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	2.26	0.50	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/86	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	1.58	<0.08	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/87	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	1.28	<0.08	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/88	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.05	<0.08	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/89	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.05	<0.08	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/90	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.05	<0.08	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/91	Water (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.05	<0.08	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/92	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/93	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0

		144808-89-9	374-88-9	short F53 B	F53B	long F53B	6:2 FTS	8:2 FTS	10:2 FTS	377-73-1	863090-89-5	HEPO DA	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	ADONA	13252-14-7
	Cas nr	144808-89-9	374-88-9	737728-96-0	756426-58-1	763051-92-9	27619-97-2	39108-34-4	120226-60-0	377-73-1	863090-89-5	13252-13-6	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	958445-44-8	13252-14-7
Sample ID:	Sample type																		
118084/94	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/95	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/96	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/97	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/98	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/99	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/100	Sediment (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/101	Soil (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/102	Soil (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/103	Soil (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/104	Soil (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/105	Fish (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/106	Fish (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/107	Fish (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/108	Fish (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/109	Fish (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0

		144808-89-9	374-88-9	short F53 B	F53B	long F53B	6:2 FTS	8:2 FTS	10:2 FTS	377-73-1	863090-89-5	HEPO DA	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	ADONA	13252-14-7
	Cas nr	144808-89-9	374-88-9	737728-96-0	756426-58-1	763051-92-9	27619-97-2	39108-34-4	120226-60-0	377-73-1	863090-89-5	13252-13-6	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	958445-44-8	13252-14-7
Sample ID:	Sample type																		
118084/110	Fish (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/111	Blue mussel homogenate (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/112	Blue mussel homogenate (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/113	Blue mussel homogenate (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/114	POCIS (ng/mL in extract)	<2.0	<2.0	<1.0	<1.0	<1.0	1.03	0.15	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/115	POCIS (ng/mL in extract)	<2.0	<2.0	<1.0	<1.0	<1.0	1.04	0.17	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/116	POCIS (ng/mL in extract)	<2.0	<2.0	<1.0	<1.0	<1.0	1.04	0.15	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/117	POCIS (ng/mL in extract)	<2.0	<2.0	<1.0	<1.0	<1.0	1.83	0.46	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/118	POCIS (ng/mL in extract)	<2.0	<2.0	<1.0	<1.0	<1.0	0.62	0.05	<0.5	<2.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/1	White-tailed eagle Liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	25.1	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/2	White-tailed eagle Liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	5.52	60.8	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/3	White-tailed eagle Liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	5.16	51.6	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/4	White-tailed eagle Liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	19.0	56.1	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0

		144808-89-9	374-88-9	short F53 B	F53B	long F53B	6:2 FTS	8:2 FTS	10:2 FTS	377-73-1	863090-89-5	HEPO DA	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	ADONA	13252-14-7
	Cas nr	144808-89-9	374-88-9	737728-96-0	756426-58-1	763051-92-9	27619-97-2	39108-34-4	120226-60-0	377-73-1	863090-89-5	13252-13-6	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	958445-44-8	13252-14-7
Sample ID:	Sample type																		
118084/5	White-tailed eagle Liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	12.6	77.5	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/6	Otter, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	11.2	38.3	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/7	Otter, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	12.8	43.7	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/8	Otter, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	27.4	75.4	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/9	Otter, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	27.8	76.8	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/10	Otter, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	15.3	38.6	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/11	Wolf, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/12	Wolf, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/13	Wolf, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/14	Wolf, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/15	Wolf, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/16	Moose, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/17	Moose, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/18	Moose, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/19	Moose, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/20	Moose, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/21	Glaucous gull, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0

		144808-89-9	374-88-9	short F53 B	F53B	long F53B	6:2 FTS	8:2 FTS	10:2 FTS	377-73-1	863090-89-5	HEPO DA	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	ADONA	13252-14-7
	Cas nr	144808-89-9	374-88-9	737728-96-0	756426-58-1	763051-92-9	27619-97-2	39108-34-4	120226-60-0	377-73-1	863090-89-5	13252-13-6	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	958445-44-8	13252-14-7
Sample ID:	Sample type																		
118084/22	Glaucous gull, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/23	Glaucous gull, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/24	Glaucous gull, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/25	Glaucous gull, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/26	Polar bear, blood plasma (ng/mL)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/27	Polar bear, blood plasma (ng/mL)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/28	Polar bear, blood plasma (ng/mL)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/29	Polar bear, blood plasma (ng/mL)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/30	Polar bear, blood plasma (ng/mL)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/31	Arctic fox, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	1.47	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/32	Arctic fox, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0

		144808-89-9	374-88-9	short F53 B	F53B	long F53B	6:2 FTS	8:2 FTS	10:2 FTS	377-73-1	863090-89-5	HEPO DA	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	ADONA	13252-14-7
	Cas nr	144808-89-9	374-88-9	737728-96-0	756426-58-1	763051-92-9	27619-97-2	39108-34-4	120226-60-0	377-73-1	863090-89-5	13252-13-6	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	958445-44-8	13252-14-7
Sample ID:	Sample type																		
118084/33	Arctic fox, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/34	Arctic fox, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/35	Arctic fox, liver (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	114	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/36	Waste water LYB (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/37	Waste water LYB (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/38	Waste water LYB (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	0.49	4.09	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/39	Waste water LYB (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	1.21	0.79	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/40	Waste water LYB (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	24.7	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/41	Snow, Test track (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	0.26	<0.20	<0.20	**2.98**	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/42	Snow, Test track (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	0.26	0.74	<0.20	**2.77**	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/43	Snow, Test track (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	0.25	0.73	<0.20	**2.05**	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/44	Snow, Test track (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	0.30	0.72	<0.20	**1.62**	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/45	Snow, Background (ng/L)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0

		144808-89-9	374-88-9	short F53 B	F53B	long F53B	6:2 FTS	8:2 FTS	10:2 FTS	377-73-1	863090-89-5	HEPO DA	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	ADONA	13252-14-7
	Cas nr	144808-89-9	374-88-9	737728-96-0	756426-58-1	763051-92-9	27619-97-2	39108-34-4	120226-60-0	377-73-1	863090-89-5	13252-13-6	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	958445-44-8	13252-14-7
Sample ID:	Sample type																		
118084/47	Air, outdoor (ng/m³)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/48	Air, indoor (ng/m³)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/51	Air, indoor (ng/m³)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/52	Air, indoor (ng/m³)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/56	Air, outdoor (ng/m³)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/59	Dust, wipe (ng/sample)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/60	Dust, wipe (ng/sample)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/61	Dust, vacuum (ng/sample)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/62	Dust, vacuum (ng/sample)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/63	Dust, vacuum (ng/sample)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/64	Arctic air (ng/m³)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/65	Arctic air (ng/m³)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/66	Arctic air (ng/m³)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0

		144808-89-9	374-88-9	short F53 B	F53B	long F53B	6:2 FTS	8:2 FTS	10:2 FTS	377-73-1	863090-89-5	HEPO DA	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	ADONA	13252-14-7
	Cas nr	144808-89-9	374-88-9	737728-96-0	756426-58-1	763051-92-9	27619-97-2	39108-34-4	120226-60-0	377-73-1	863090-89-5	13252-13-6	378-03-0	801212-59-9	96513-97-2	948014-44-6	151772-58-6	958445-44-8	13252-14-7
Sample ID:	Sample type																		
118084/119	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/120	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/121	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/122	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/123	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/124	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/125	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/126	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/127	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0
118084/128	Snowbunting, egg (ng/g)	<2.0	<2.0	<1.0	<1.0	<1.0	<0.20	<0.20	<0.20	<1.0	<1.0	<1.0	<2.0	<1.0	<2.0	<1.0	<1.0	<0.5	<1.0

Complete results new PFAS (compound nr. 35-47)

		151772-59-7	65294-16-8	1212077-14-9	65150-95-0	52481-85-3	65578-62-3	57678-05-4	57678-07-6	94200-54-1	94200-55-2	101896-22-4
	Cas nr	151772-59-7	65294-16-8	1212077-14-9	65150-95-0	52481-85-3	65578-62-3	10:2 mono PAP	12:2 mono PAP	14:2 mono PAP	16:2 mono PAP	101896-22-4
Sample ID:	Sample type											
118084/77	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/78	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/79	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/80	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/81	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/82	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/83	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/84	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/85	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/86	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/87	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/88	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/89	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/90	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/91	Water (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/92	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/93	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/94	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/95	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/96	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/97	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/98	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/99	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/100	Sediment (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/101	Soil (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/102	Soil (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/103	Soil (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/104	Soil (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/105	Fish (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/106	Fish (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/107	Fish (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/108	Fish (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.

		151772-59-7	65294-16-8	1212077-14-9	65150-95-0	52481-85-3	65578-62-3	57678-05-4	57678-07-6	94200-54-1	94200-55-2	101896-22-4
	Cas nr	151772-59-7	65294-16-8	1212077-14-9	65150-95-0	52481-85-3	65578-62-3	10:2 mono PAP	12:2 mono PAP	14:2 mono PAP	16:2 mono PAP	101896-22-4
118084/109	Fish (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/110	Fish (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/111	Blue mussel homogenate (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/112	Blue mussel homogenate (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/113	Blue mussel homogenate (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/114	POCIS (ng/mL in extract)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/115	POCIS (ng/mL in extract)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/116	POCIS (ng/mL in extract)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/117	POCIS (ng/mL in extract)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/118	POCIS (ng/mL in extract)	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	n.d.
118084/1	White-tailed eagle, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/2	White-tailed eagle, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/3	White-tailed eagle, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/4	White-tailed eagle, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/5	White-tailed eagle, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/6	Otter, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/7	Otter, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/8	Otter, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/9	Otter, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/10	Otter, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/11	Wolf, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/12	Wolf, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/13	Wolf, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/14	Wolf, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/15	Wolf, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/16	Moose, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/17	Moose, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/18	Moose, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/19	Moose, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/20	Moose, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/21	Glaucous gull, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/22	Glaucous gull, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/23	Glaucous gull, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/24	Glaucous gull, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/25	Glaucous gull, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.

		151772-59-7	65294-16-8	1212077-14-9	65150-95-0	52481-85-3	65578-62-3	57678-05-4	57678-07-6	94200-54-1	94200-55-2	101896-22-4
	Cas nr	151772-59-7	65294-16-8	1212077-14-9	65150-95-0	52481-85-3	65578-62-3	10:2 mono PAP	12:2 mono PAP	14:2 mono PAP	16:2 mono PAP	101896-22-4
118084/26	Polar bear, blood plasma (ng/mL)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/27	Polar bear, blood plasma (ng/mL)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/28	Polar bear, blood plasma (ng/mL)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/29	Polar bear, blood plasma (ng/mL)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/30	Polar bear, blood plasma (ng/mL)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/31	Arctic fox, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/32	Arctic fox, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/33	Arctic fox, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/34	Arctic fox, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/35	Arctic fox, liver (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/36	Waste water LYB (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	2.72	<2.0	<2.0	<2.0	<2.0	n.d.
118084/37	Waste water LYB (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	1.28	<2.0	<2.0	<2.0	<2.0	n.d.
118084/38	Waste water LYB (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	3.29	<2.0	<2.0	<2.0	<2.0	n.d.
118084/39	Waste water LYB (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	1.63	<2.0	<2.0	<2.0	<2.0	n.d.
118084/40	Waste water LYB (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	2.50	<2.0	<2.0	<2.0	<2.0	n.d.
118084/41	Snow, Test track (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/42	Snow, Test track (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/43	Snow, Test track (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/44	Snow, Test track (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/45	Snow, Background (ng/L)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.

		151772-59-7	65294-16-8	1212077-14-9	65150-95-0	52481-85-3	65578-62-3	57678-05-4	57678-07-6	94200-54-1	94200-55-2	101896-22-4
	Cas nr	151772-59-7	65294-16-8	1212077-14-9	65150-95-0	52481-85-3	65578-62-3	10:2 mono PAP	12:2 mono PAP	14:2 mono PAP	16:2 mono PAP	101896-22-4
Sample ID:	Sample type											
118084/47	Air, outdoor (ng/m^3)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/48	Air, indoor (ng/m^3)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/51	Air, indoor (ng/m^3)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/52	Air, indoor (ng/m^3)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/56	Air, outdoor (ng/m^3)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/59	Dust, wipe (ng/sample)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/60	Dust, wipe (ng/sample)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/61	Dust, vacuum (ng/sample)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/62	Dust, vacuum (ng/sample)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/63	Dust, vacuum (ng/sample)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/64	Arctic air (ng/m^3)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/65	Arctic air (ng/m^3)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/66	Arctic air (ng/m^3)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/119	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/120	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/121	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/122	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/123	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/124	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/125	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/126	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/127	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.
118084/128	Snowbunting, egg (ng/g)	<1.0	<1.0	<2.0	<1.0	<1.0	<0.5	<2.0	<2.0	<2.0	<2.0	n.d.

Complete results semi volatile and volatile PFAS (compound nr. 48-57)

		FBSA	N-Me FBSE	N-Et- FBSE	N-Me FHxSA	N-Me FHxSE	PFHxS amid	FOSA	N-Me-FOSA	N-Et-FOSA	N-Me-FOSE
	Cas nr	30334-69-1	34454-97-2	34449-89-3	68259-15-4	68555-75-9	38850-58-7	754-91-6	31506-32-8	4151-50-2	24448-09-7
Sample ID:	Sample type										
118084/77	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/78	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/79	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/80	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/81	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/82	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/83	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/84	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/85	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/86	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/87	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/88	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/89	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/90	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/91	Water (ng/L)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/92	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/93	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/94	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/95	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/96	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/97	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/98	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/99	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/100	Sediment (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/101	Soil (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/102	Soil (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/103	Soil (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/104	Soil (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/105	Fish (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/106	Fish (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/107	Fish (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/108	Fish (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2

		FBSA	N-Me FBSE	N-Et- FBSE	N-Me FHxSA	N-Me FHxSE	PFHxS amid	FOSA	N-Me-FOSA	N-Et-FOSA	N-Me-FOSE
	Cas nr	30334-69-1	34454-97-2	34449-89-3	68259-15-4	68555-75-9	38850-58-7	754-91-6	31506-32-8	4151-50-2	24448-09-7
Sample ID:	Sample type										
118084/109	Fish (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/110	Fish (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/111	Blue mussel homogenate (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/112	Blue mussel homogenate (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/113	Blue mussel homogenate (ng/g)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/114	POCIS (ng/mL in extract)	<0.5	<2	<2	<0.5	<2	n.d.	<0.5	<2	<2	<2
118084/115	POCIS (ng/mL in extract)	<0.8	<2	<2	<0.8	<2	n.d.	<0.8	<2	<2	<2
118084/116	POCIS (ng/mL in extract)	<0.6	<2	<2	<0.6	<2	n.d.	<0.6	<2	<2	<2
118084/117	POCIS (ng/mL in extract)	<0.7	<2	<2	<0.7	<2	n.d.	<0.7	<2	<2	<2
118084/118	POCIS (ng/mL in extract)	<0.9	<2	<2	<0.9	<2	n.d.	<0.9	<2	<2	<2
118084/1	White-tailed eagle, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	0.42	<1	<1	<1
118084/2	White-tailed eagle, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	9.19	<1	<1	<1
118084/3	White-tailed eagle, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	4.00	<1	<1	<1
118084/4	White-tailed eagle, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	2.24	<1	<1	<1
118084/5	White-tailed eagle, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	6.54	<1	<1	<1
118084/6	Otter, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	12.54	<1	<1	<1
118084/7	Otter, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	31.88	<1	<1	<1
118084/8	Otter, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	27.03	<1	<1	<1
118084/9	Otter, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	8.95	<1	<1	<1
118084/10	Otter, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	16.73	<1	<1	<1
118084/11	Wolf, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/12	Wolf, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/13	Wolf, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/14	Wolf, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/15	Wolf, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/16	Moose, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/17	Moose, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/18	Moose, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/19	Moose, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/20	Moose, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/21	Glaucous gull, egg (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/22	Glaucous gull, egg (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/23	Glaucous gull, egg (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/24	Glaucous gull, egg (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/25	Glaucous gull, egg (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1

		FBSA	N-Me FBSE	N-Et- FBSE	N-Me FHxSA	N-Me FHxSE	PFHxS amid	FOSA	N-Me-FOSA	N-Et-FOSA	N-Me-FOSE
	Cas nr	30334-69-1	34454-97-2	34449-89-3	68259-15-4	68555-75-9	38850-58-7	754-91-6	31506-32-8	4151-50-2	24448-09-7
Sample ID:	Sample type										
118084/26	Polar bear, blood plasma (ng/mL)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/27	Polar bear, blood plasma (ng/mL)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/28	Polar bear, blood plasma (ng/mL)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/29	Polar bear, blood plasma (ng/mL)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/30	Polar bear, blood plasma (ng/mL)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/31	Arctic fox, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	15.20	<1	<1	<1
118084/32	Arctic fox, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	0.34	<1	<1	<1
118084/33	Arctic fox, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	0.13	<1	<1	<1
118084/34	Arctic fox, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/35	Arctic fox, liver (ng/g)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	22.65	<1	<1	<1
118084/36	Waste water LYB (ng/L)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/37	Waste water LYB (ng/L)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/38	Waste water LYB (ng/L)	2.62	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/39	Waste water LYB (ng/L)	0.43	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/40	Waste water LYB (ng/L)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/41	Snow, Test track (ng/L)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/42	Snow, Test track (ng/L)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/43	Snow, Test track (ng/L)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/44	Snow, Test track (ng/L)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/45	Snow, Background (ng/L)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/47	Air, outdoor (ng/m^3)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/48	Air, indoor (ng/m^3)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/51	Air, indoor (ng/m^3)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/52	Air, indoor (ng/m^3)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/56	Air, outdoor (ng/m^3)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/59	Dust, wipe (ng/sample)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/60	Dust, wipe (ng/sample)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/61	Dust, vacuum (ng/sample)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/62	Dust, vacuum (ng/sample)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/63	Dust, vacuum (ng/sample)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/64	Arctic air (ng/m^3)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/65	Arctic air (ng/m^3)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1
118084/66	Arctic air (ng/m^3)	<0.4	<0.5	<0.5	<0.5	<0.5	n.d.	<0.10	<1	<1	<1

Complete results semi volatile and volatile PFAS (compound nr. 58-68)

		N-Et-FOSE	N-Me-FOSAA	N-Et-FOSAA	Me FBSAC	Et-FBSAC	Me FHxSAC	Et-FHxSAC				
	Cas nr	1691-99-2	2355-31-9	2991-50-6	67584-55-8	17329-79-2	67584-57-0	1893-52-3	67584-61-	67906-70-1	67584-59-2	67939-33-7
Sample ID:	Sample type											
118084/77	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/78	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/79	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/80	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/81	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/82	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/83	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/84	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/85	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/86	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/87	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/88	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/89	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/90	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/91	Water (ng/L)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/92	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/93	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/94	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/95	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/96	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/97	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/98	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/99	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/100	Sediment (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/101	Soil (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/102	Soil (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/103	Soil (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/104	Soil (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/105	Fish (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/106	Fish (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/107	Fish (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/108	Fish (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

n.a.: not analysed

		N-Et-FOSE	N-Me-FOSAA	N-Et-FOSAA	Me FBSAC	Et-FBSAC	Me FHxSAC	Et-FHxSAC				
	Cas nr	1691-99-2	2355-31-9	2991-50-6	67584-55-8	17329-79-2	67584-57-0	1893-52-3	67584-61-	67906-70-1	67584-59-2	67939-33-7
Sample ID:	Sample type											
118084/109	Fish (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/110	Fish (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/111	Blue mussel homogenate (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/112	Blue mussel homogenate (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/113	Blue mussel homogenate (ng/g)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/114	POCIS (ng/mL in extract)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/115	POCIS (ng/mL in extract)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/116	POCIS (ng/mL in extract)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/117	POCIS (ng/mL in extract)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/118	POCIS (ng/mL in extract)	<2	<0.5	<0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
118084/1	White-tailed eagle, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/2	White-tailed eagle, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/3	White-tailed eagle, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/4	White-tailed eagle, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/5	White-tailed eagle, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/6	Otter, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/7	Otter, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/8	Otter, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/9	Otter, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/10	Otter, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/11	Wolf, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/12	Wolf, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/13	Wolf, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/14	Wolf, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/15	Wolf, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/16	Moose, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/17	Moose, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/18	Moose, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/19	Moose, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/20	Moose, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/21	Glaucous gull, egg (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/22	Glaucous gull, egg (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/23	Glaucous gull, egg (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/24	Glaucous gull, egg (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/25	Glaucous gull, egg (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

n.d.: not detected

		N-Et-FOSE	N-Me-FOSAA	N-Et-FOSAA	Me FBSAC	Et-FBSAC	Me FHxSAC	Et-FHxSAC				
	Cas nr	1691-99-2	2355-31-9	2991-50-6	67584-55-8	17329-79-2	67584-57-0	1893-52-3	67584-61-	67906-70-1	67584-59-2	67939-33-7
Sample ID:	Sample type											
118084/26	Polar bear, blood plasma (ng/mL)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/27	Polar bear, blood plasma (ng/mL)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/28	Polar bear, blood plasma (ng/mL)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/29	Polar bear, blood plasma (ng/mL)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/30	Polar bear, blood plasma (ng/mL)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/31	Arctic fox, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/32	Arctic fox, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/33	Arctic fox, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/34	Arctic fox, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/35	Arctic fox, liver (ng/g)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/36	Waste water LYB (ng/L)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/37	Waste water LYB (ng/L)	<1	0.71	0.97	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/38	Waste water LYB (ng/L)	<1	<0.5	1.09	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/39	Waste water LYB (ng/L)	<1	0.78	0.95	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/40	Waste water LYB (ng/L)	<1	0.71	0.97	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/41	Snow, Test track (ng/L)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/42	Snow, Test track (ng/L)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/43	Snow, Test track (ng/L)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/44	Snow, Test track (ng/L)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/45	Snow, Background (ng/L)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/47	Air, outdoor (ng/m^3)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/48	Air, indoor (ng/m^3)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/51	Air, indoor (ng/m^3)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/52	Air, indoor (ng/m^3)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/56	Air, outdoor (ng/m^3)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/59	Dust, wipe (ng/sample)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/60	Dust, wipe (ng/sample)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/61	Dust, vacuum (ng/sample)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/62	Dust, vacuum (ng/sample)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/63	Dust, vacuum (ng/sample)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/64	Arctic air (ng/m^3)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/65	Arctic air (ng/m^3)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
118084/66	Arctic air (ng/m^3)	<1	<0.5	<0.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

n.d.: not detected

Complete results semi volatile and volatile PFAS (compound nr. 69-73)

		10:2 FTOH	12:2 FTOH	14:2 FTOH	16:2 FTOH	18:2 FTOH
	Cas nr	865-86-1	39239-77-5	60699-51-6	65104-67-8	65104-65-6
Sample ID:	Sample type					
118084/77	Water (ng/L)	<5	<5	<5	<5	<5
118084/78	Water (ng/L)	<5	<5	<5	<5	<5
118084/79	Water (ng/L)	<5	<5	<5	<5	<5
118084/80	Water (ng/L)	<5	<5	<5	<5	<5
118084/81	Water (ng/L)	<5	<5	<5	<5	<5
118084/82	Water (ng/L)	<5	<5	<5	<5	<5
118084/83	Water (ng/L)	<5	<5	<5	<5	<5
118084/84	Water (ng/L)	<5	<5	<5	<5	<5
118084/85	Water (ng/L)	<5	<5	<5	<5	<5
118084/86	Water (ng/L)	<5	<5	<5	<5	<5
118084/87	Water (ng/L)	<5	<5	<5	<5	<5
118084/88	Water (ng/L)	<5	<5	<5	<5	<5
118084/89	Water (ng/L)	<5	<5	<5	<5	<5
118084/90	Water (ng/L)	<5	<5	<5	<5	<5
118084/91	Water (ng/L)	<5	<5	<5	<5	<5
118084/92	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/93	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/94	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/95	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/96	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/97	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/98	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/99	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/100	Sediment (ng/g)	<5	<5	<5	<5	<5
118084/101	Soil (ng/g)	<5	<5	<5	<5	<5
118084/102	Soil (ng/g)	<5	<5	<5	<5	<5
118084/103	Soil (ng/g)	<5	<5	<5	<5	<5
118084/104	Soil (ng/g)	<5	<5	<5	<5	<5
118084/105	Fish (ng/g)	<5	<5	<5	<5	<5
118084/106	Fish (ng/g)	<5	<5	<5	<5	<5
118084/107	Fish (ng/g)	<5	<5	<5	<5	<5
118084/108	Fish (ng/g)	<5	<5	<5	<5	<5

		10:2 FTOH	12:2 FTOH	14:2 FTOH	16:2 FTOH	18:2 FTOH
	Cas nr	865-86-1	39239-77-5	60699-51-6	65104-67-8	65104-65-6
Sample ID:	Sample type					
118084/109	Fish (ng/g)	<5	<5	<5	<5	<5
118084/110	Fish (ng/g)	<5	<5	<5	<5	<5
118084/111	Blue mussel homogenate (ng/g)	<5	<5	<5	<5	<5
118084/112	Blue mussel homogenate (ng/g)	<5	<5	<5	<5	<5
118084/113	Blue mussel homogenate (ng/g)	<5	<5	<5	<5	<5
118084/114	POCIS (ng/mL in extract)	<5	<5	<5	<5	<5
118084/115	POCIS (ng/mL in extract)	<5	<5	<5	<5	<5
118084/116	POCIS (ng/mL in extract)	<5	<5	<5	<5	<5
118084/117	POCIS (ng/mL in extract)	<5	<5	<5	<5	<5
118084/118	POCIS (ng/mL in extract)	<5	<5	<5	<5	<5
118084/1	White-tailed eagle, liver (ng/g)	<2	<2	<2	<2	<2
118084/2	White-tailed eagle, liver (ng/g)	<2	<2	<2	<2	<2
118084/3	White-tailed eagle, liver (ng/g)	<2	<2	<2	<2	<2
118084/4	White-tailed eagle, liver (ng/g)	<2	<2	<2	<2	<2
118084/5	White-tailed eagle, liver (ng/g)	<2	<2	<2	<2	<2
118084/6	Otter, liver (ng/g)	<2	<2	<2	<2	<2
118084/7	Otter, liver (ng/g)	<2	<2	<2	<2	<2
118084/8	Otter, liver (ng/g)	<2	<2	<2	<2	<2
118084/9	Otter, liver (ng/g)	<2	<2	<2	<2	<2
118084/10	Otter, liver (ng/g)	<2	<2	<2	<2	<2
118084/11	Wolf, liver (ng/g)	<2	<2	<2	<2	<2
118084/12	Wolf, liver (ng/g)	<2	<2	<2	<2	<2
118084/13	Wolf, liver (ng/g)	<2	<2	<2	<2	<2
118084/14	Wolf, liver (ng/g)	<2	<2	<2	<2	<2
118084/15	Wolf, liver (ng/g)	<2	<2	<2	<2	<2
118084/16	Moose, liver (ng/g)	<2	<2	<2	<2	<2
118084/17	Moose, liver (ng/g)	<2	<2	<2	<2	<2
118084/18	Moose, liver (ng/g)	<2	<2	<2	<2	<2
118084/19	Moose, liver (ng/g)	<2	<2	<2	<2	<2
118084/20	Moose, liver (ng/g)	<2	<2	<2	<2	<2
118084/21	Glaucous gull, egg (ng/g)	<2	<2	<2	<2	<2
118084/22	Glaucous gull, egg (ng/g)	<2	<2	<2	<2	<2
118084/23	Glaucous gull, egg (ng/g)	<2	<2	<2	<2	<2
118084/24	Glaucous gull, egg (ng/g)	<2	<2	<2	<2	<2
118084/25	Glaucous gull, egg (ng/g)	<2	<2	<2	<2	<2

		10:2 FTOH	12:2 FTOH	14:2 FTOH	16:2 FTOH	18:2 FTOH
	Cas nr	865-86-1	39239-77-5	60699-51-6	65104-67-8	65104-65-6
Sample ID:	Sample type					
118084/26	Polar bear, blood plasma (ng/mL)	<2	<2	<2	<2	<2
118084/27	Polar bear, blood plasma (ng/mL)	<2	<2	<2	<2	<2
118084/28	Polar bear, blood plasma (ng/mL)	<2	<2	<2	<2	<2
118084/29	Polar bear, blood plasma (ng/mL)	<2	<2	<2	<2	<2
118084/30	Polar bear, blood plasma (ng/mL)	<2	<2	<2	<2	<2
118084/31	Arctic fox, liver (ng/g)	<2	<2	<2	<2	<2
118084/32	Arctic fox, liver (ng/g)	<2	<2	<2	<2	<2
118084/33	Arctic fox, liver (ng/g)	<2	<2	<2	<2	<2
118084/34	Arctic fox, liver (ng/g)	<2	<2	<2	<2	<2
118084/35	Arctic fox, liver (ng/g)	<2	<2	<2	<2	<2
118084/36	Waste water LYB (ng/L)	<2	<2	<2	<2	<2
118084/37	Waste water LYB (ng/L)	<2	<2	<2	<2	<2
118084/38	Waste water LYB (ng/L)	<2	<2	<2	<2	<2
118084/39	Waste water LYB (ng/L)	<2	<2	<2	<2	<2
118084/40	Waste water LYB (ng/L)	<2	<2	<2	<2	<2
118084/41	Snow, Test track (ng/L)	<2	<2	<2	<2	<2
118084/42	Snow, Test track (ng/L)	279	<2	<2	<2	<2
118084/43	Snow, Test track (ng/L)	<2	<2	<2	<2	<2
118084/44	Snow, Test track (ng/L)	<2	<2	<2	<2	<2
118084/45	Snow, Background (ng/L)	<2	<2	<2	<2	<2
118084/47	Air, outdoor (ng/m^3)	<2	<2	<2	<2	<2
118084/48	Air, indoor (ng/m^3)	<2	<2	<2	<2	<2
118084/51	Air, indoor (ng/m^3)	<2	<2	<2	<2	<2
118084/52	Air, indoor (ng/m^3)	27.3	<2	<2	<2	<2
118084/56	Air, outdoor (ng/m^3)	<2	<2	<2	<2	<2
118084/59	Dust, wipe (ng/sample)	<2	<2	<2	<2	<2
118084/60	Dust, wipe (ng/sample)	<2	<2	<2	<2	<2
118084/61	Dust, vacuum (ng/sample)	<2	<2	<2	<2	<2
118084/62	Dust, vacuum (ng/sample)	<2	<2	<2	<2	<2
118084/63	Dust, vacuum (ng/sample)	<2	<2	<2	<2	<2
118084/64	Arctic air (ng/m^3)	<2	<2	<2	<2	<2
118084/65	Arctic air (ng/m^3)	<2	<2	<2	<2	<2
118084/66	Arctic air (ng/m^3)	<2	<2	<2	<2	<2

Complete results very volatile PFASs (nr. 74-78).

	Cas nr	307-33-5	335-64-8	355-24-8	355-41-9	336-19-6
Sample ID:	Sample type					
118084/129	Arctic air (ng/m^3)	<0.3	n.a.	<0.3	<0.3	<0.3
118084/130	Arctic air (ng/m^3)	<0.3	n.a.	<0.3	<0.3	<0.3
118084/131	Arctic air (ng/m^3)	<0.3	n.a.	<0.3	<0.3	<0.3

Complete results ultra short chain PFASs and EOF (nr. 79-82).

		TFA	PFPrA	PFEtS	PFPrS	EOF
	Cas nr					
Sample ID:	Sample type					
118084/77	Water (ng/L)	<15.5	<48.5	<0.12	<0.12	2073
118084/78	Water (ng/L)	<92.9	<26.9	<0.15	<0.15	1422
118084/79	Water (ng/L)	<92.9	<26.9	<0.12	<0.12	202
118084/80	Water (ng/L)	<218.6	<0.6	<0.12	<0.12	1464
118084/81	Water (ng/L)	<85.7	<25.8	<0.13	<0.13	1420
118084/82	Water (ng/L)	<85.7	<25.8	<0.11	<0.11	1227
118084/83	Water (ng/L)	<85.7	<25.8	<0.13	<0.13	919
118084/84	Water (ng/L)	<85.7	<25.8	<0.12	<0.12	925
118084/85	Water (ng/L)	<85.7	<25.8	<0.19	<0.19	1257
118084/86	Water (ng/L)	<15.5	<48.5	<0.12	<0.12	4034
118084/87	Water (ng/L)	<92.9	<26.9	<0.14	<0.14	770
118084/88	Water (ng/L)	<218.6	<0.6	<0.14	<0.14	2071
118084/89	Water (ng/L)	<92.9	<26.9	<0.12	<0.12	807
118084/90	Water (ng/L)	<15.5	<48.5	<0.14	<0.14	1925
118084/91	Water (ng/L)	<15.5	<48.5	<0.12	<0.12	1216
118084/92	Sediment (ng/g)	<65.4	<0.1	<0.02	<0.02	37
118084/93	Sediment (ng/g)	<65.4	<0.1	<0.02	<0.02	131
118084/94	Sediment (ng/g)	<65.4	<0.1	<0.02	<0.02	36
118084/95	Sediment (ng/g)	<5.0	<1.0	<0.02	<0.02	<22
118084/96	Sediment (ng/g)	<5.0	<1.0	<0.02	<0.02	388
118084/97	Sediment (ng/g)	4.97	<1.0	<0.02	<0.02	<22
118084/98	Sediment (ng/g)	4.97	<1.0	<0.02	<0.02	44
118084/99	Sediment (ng/g)	4.97	<1.0	<0.02	<0.02	55
118084/100	Sediment (ng/g)	4.97	<1.0	<0.02	<0.02	23
118084/101	Soil (ng/g)	<5.0	<1.0	<0.02	<0.02	<22
118084/102	Soil (ng/g)	<5.0	<1.0	<0.02	<0.02	<22
118084/103	Soil (ng/g)	<5.0	<1.0	<0.02	<0.02	<22
118084/104	Soil (ng/g)	<5.0	<0.95	<0.02	<0.02	58
118084/105	Fish (ng/g)	<65.4	<1.9	<0.38	<0.38	369
118084/106	Fish (ng/g)	<65.4	<0.6	<0.13	<0.13	148
118084/107	Fish (ng/g)	<65.4	<0.8	<0.16	<0.16	<145
118084/108	Fish (ng/g)	<65.4	<0.5	<0.1	<0.1	<88
118084/109	Fish (ng/g)	<43.8	<0.1	<0.02	<0.02	35
118084/110	Fish (ng/g)	<43.8	<0.1	<0.02	<0.02	23
118084/111	Blue mussel homogenate (ng/g)	<43.8	<0.1	<0.02	<0.02	142
118084/112	Blue mussel homogenate (ng/g)	<43.8	<0.1	<0.02	<0.02	120
118084/113	Blue mussel homogenate (ng/g)	<43.8	<0.1	<0.02	<0.02	132
118084/114	POCIS (ng/mL in extract)	n.a.	n.a.	n.a.	n.a.	207
118084/115	POCIS (ng/mL in extract)	n.a.	n.a.	n.a.	n.a.	104
118084/116	POCIS (ng/mL in extract)	n.a.	n.a.	n.a.	n.a.	162
118084/117	POCIS (ng/mL in extract)	n.a.	n.a.	n.a.	n.a.	159
118084/118	POCIS (ng/mL in extract)	n.a.	n.a.	n.a.	n.a.	110
118084/1	White-tailed eagle, liver (ng/g)	34.04	<3.16	<0.05	<0.05	128
118084/2	White-tailed eagle, liver (ng/g)	51.19	<3.12	<0.05	<0.05	117
118084/3	White-tailed eagle, liver (ng/g)	33.60	<3.14	<0.05	<0.05	254
118084/4	White-tailed eagle, liver (ng/g)	25.96	<3.11	<0.05	<0.05	153
118084/5	White-tailed eagle, liver (ng/g)	28.74	<3.16	<0.05	<0.05	232
118084/6	Otter, liver (ng/g)	88.60	<3.12	<0.05	<0.05	173
118084/7	Otter, liver (ng/g)	69.19	<3.14	<0.05	<0.05	322
118084/8	Otter, liver (ng/g)	19.58	<3.16	<0.05	<0.05	386
118084/9	Otter, liver (ng/g)	82.99	<3.16	<0.05	<0.05	521
118084/10	Otter, liver (ng/g)	71.70	<3.16	<0.05	<0.05	<86
118084/11	Wolf, liver (ng/g)	40.39	<3.11	<0.05	<0.05	97
118084/12	Wolf, liver (ng/g)	44.95	<3.16	<0.05	<0.05	58
118084/13	Wolf, liver (ng/g)	26.57	<3.08	<0.05	<0.05	203
118084/14	Wolf, liver (ng/g)	65.26	<3.14	<0.05	<0.05	<86
118084/15	Wolf, liver (ng/g)	55.18	<3.22	<0.05	<0.05	312

n.a.: not analysed

		TFA	PFPrA	PFEtS	PFPrS	EOF
	Cas nr					
Sample ID:	Sample type					
118084/16	Moose, liver (ng/g)	43.12	<3.24	<0.05	<0.05	52
118084/17	Moose, liver (ng/g)	29.58	<3.20	<0.05	<0.05	380
118084/18	Moose, liver (ng/g)	30.25	<3.19	<0.05	<0.05	<86
118084/19	Moose, liver (ng/g)	59.95	<3.20	<0.05	<0.05	74
118084/20	Moose, liver (ng/g)	35.49	<3.19	<0.05	<0.05	148
118084/21	Glaucous gull, egg (ng/g)	29.34	<3.06	<0.05	0.14	207
118084/22	Glaucous gull, egg (ng/g)	14.19	<3.09	<0.05	0.20	332
118084/23	Glaucous gull, egg (ng/g)	10.94	<3.09	<0.05	0.11	189
118084/24	Glaucous gull, egg (ng/g)	16.94	<3.12	<0.05	0.19	244
118084/25	Glaucous gull, egg (ng/g)	30.59	<3.14	<0.05	<0.05	252
118084/26	Polar bear, blood plasma (ng/mL)	<63.0	<31.25	<0.47	<0.47	833
118084/27	Polar bear, blood plasma (ng/mL)	<63.0	<31.25	<0.47	<0.47	695
118084/28	Polar bear, blood plasma (ng/mL)	<63.0	<31.25	<0.47	<0.47	893
118084/29	Polar bear, blood plasma (ng/mL)	<63.0	<31.25	<0.47	<0.47	591
118084/30	Polar bear, blood plasma (ng/mL)	<63.0	<31.25	<0.47	<0.47	488
118084/31	Arctic fox, liver (ng/g)	222	0.76	<0.1	<0.1	395
118084/32	Arctic fox, liver (ng/g)	115	<0.3	<0.1	<0.1	226
118084/33	Arctic fox, liver (ng/g)	147	0.55	<0.1	<0.1	95
118084/34	Arctic fox, liver (ng/g)	47	0.99	<0.1	<0.1	152
118084/35	Arctic fox, liver (ng/g)	172	<0.3	<0.1	<0.1	252
118084/36	Waste water LYB (ng/mL)	<0.02	<0.1	<0.0002	<0.0002	1
118084/37	Waste water LYB (ng/mL)	<0.03	<0.1	<0.0002	<0.0002	<182
118084/38	Waste water LYB (ng/mL)	<0.02	<0.1	<0.0002	<0.0002	2
118084/39	Waste water LYB (ng/mL)	<0.03	<0.1	<0.0002	<0.0002	<182
118084/40	Waste water LYB (ng/mL)	<0.03	<0.1	<0.0002	<0.0002	1
118084/41	Snow, Test track (ng/mL)	0.56	0.21	<0.0012	<0.0012	11
118084/42	Snow, Test track (ng/mL)	0.25	0.10	<0.0009	<0.0009	13
118084/43	Snow, Test track (ng/mL)	0.19	0.10	<0.0011	<0.0011	14
118084/44	Snow, Test track (ng/mL)	0.30	0.07	<0.0008	<0.0008	10
118084/45	Snow, Background (ng/mL)	0.24	<0.06	<0.0009	<0.0009	<0.182
118084/47	Air, outdoor (ng/m^3)	14.03	8.12	<0.1	<0.1	114
118084/48	Air, indoor (ng/m^3)	10.10	5.76	<0.1	<0.1	60
118084/51	Air, indoor (ng/m^3)	9.37	2.32	<0.1	<0.1	95
118084/52	Air, indoor (ng/m^3)	9.73	4.17	<0.1	<0.1	294
118084/56	Air, outdoor (ng/m^3)	11.45	3.40	<0.1	<0.1	<45
118084/59	Dust, wipe (ng/sample)	40.41	8.86	<0.1	<0.1	387
118084/60	Dust, wipe (ng/sample)	33.11	2.53	<0.1	<0.1	480
118084/61	Dust, vacuum (ng/sample)	12.94	1.78	<0.1	<0.1	113
118084/62	Dust, vacuum (ng/sample)	<6.5	<0.3	<0.1	<0.1	<95
118084/63	Dust, vacuum (ng/sample)	10.20	3.03	<0.1	<0.1	<95
118084/64	Arctic air (ng/m^3)	<8.2	1.21	<0.1	<0.1	<95
118084/65	Arctic air (ng/m^3)	<6.5	<0.3	<0.1	<0.1	<95
118084/66	Arctic air (ng/m^3)	<7.4	0.81	<0.1	<0.1	<95

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