Environmental pollutants in the terrestrial and urban environment 2022

Eldbjørg S. Heimstad, Børge Moe, Anders R. Borgen, Ellen Katrin Enge, Unni M. Nordang, Kine Bæk, Maja Nipen, Mikael Harju, Linda Hanssen

NILU report 23/2023

NILU report 23/2023 M-2609|2023	ISBN: 978-82-425-3136-0 ISSN: 2464-3327	CLASSIFICATION A – Unclassified (open report)
DATE 12.10.2023	SIGNATURE OF RESPONSIBLE PERSON Aasmund F. Vik Deputy CEO and CTO (sign.)	NUMBER OF PAGES 133
TITLE Environmental pollutants in the terrestrial and urban environment 2022		PROJECT LEADER Linda Hanssen NILU PROJECT NO. O-121061
AUTHOR(S) Eldbjørg S. Heimstad (NILU), Børge Moe (NINA), Anders R. Borgen (NILU), Ellen Katrin Enge (NILU), Unni M. Nordang (NILU), Kine Bæk (NIVA), Maja Nipen (NILU), Mikael Harju (NILU), Linda Hanssen (NILU)		QUALITY CONTROLLER Pernilla Bohlin-Nizzetto
REPORT PREPARED FOR Norwegian Environment Agency		CONTRACT REF. 21087022, Gunn Lise Haugestøl

ABSTRACT

Samples of soil, earthworm, fieldfare egg, brown rat liver, spanish slug, house dust and cat liver from the urban terrestrial environment in the Oslo area were analysed for several different groups of environmental pollutants. Biota-soil accumulation was calculated from soil to earthworm from the same location, and biomagnification-potential was estimated based on detected data for relevant predator-prey pairs from the same location.

NORWEGIAN TITLE

Miljøgifter i terrestrisk og bynært miljø 2022

KEYWORDS

Urban terrestrial monitoring	POPs, PFAS, metals	Bioaccumulation

ABSTRACT (in Norwegian)

Prøver av jord, meitemark, egg fra gråtrost, lever fra brunrotte, brunskogsnegle, husstøv og lever fra en katt fra det urbane terrestriske miljøet i Oslo-området, ble analysert for mange ulike stoffgrupper av miljøgifter. Biota-jord akkumulering ble beregnet for jord til meitemark fra samme lokalitet, og biomagnifiseringspotensialet ble estimert basert på detekterbare data for relevante rov og byttedyr par fra samme lokalitet.

PUBLICATION TYPE: Digital document (pdf)	COVER PICTURE: Spanish slug: Marius Gudbrandsen

Citation: Heimstad, E. S., Moe, B., Borgen, A. R., Enge, E. K., Nordang, U. M., Bæk, K., Nipen, M., Hanssen, L. (2023). Environmental pollutants in the terrestrial and urban environment 2022 (Norwegian Environment Agency report,M-2609/2023) (NILU report 23/2023). Kjeller: NILU.

NILU's ISO Certifications: NS-EN ISO 9001 and NS-EN ISO 14001. NILU's Accreditation: NS-EN ISO/IEC 17025.

Contents

Summary

On behalf of the Norwegian Environment Agency, NILU in collaboration with the Norwegian Institute for Nature Research (NINA), and Norwegian Institute for Water Research (NIVA) have analysed house dust, soil and biological samples from the terrestrial and urban environment for metals and various organic environmental pollutants. IFE, Institute for Energy Technology, analysed the stable isotopes of nitrogen and carbon in the samples.

Key goals of the programme are to:

- Report concentrations of selected environmental pollutants at different trophic levels of a terrestrial food web in an urban area.
- Estimate bioaccumulation and biomagnification potential of the different pollutants in food chains.
- Contribute with information about potential sources to pollutants for terrestrial organisms.

A broad range of environmental pollutants, consisting of metals, polychlorinated biphenyls (PCB), brominated flame retardants (BFR), organic phenolic pollutants, ultraviolet (UV) stabilizing substances, per- and polyfluorinated alkylated substances (PFAS), siloxanes, chlorinated paraffins (CP), organic phosphorous flame retardants (OPFR), musk and dechloranes were measured in the following samples collected from various locations across Oslo, Norway:

- five pooled samples of soil
- five pooled samples of earthworm
- five pooled samples of fieldfare egg
- five pooled samples of brown rat liver
- five indoor house dust samples
- one cat liver sample
- four samples of Spanish slug (only analysed for PFAS)

In addition to the compound classes mentioned above, selected biocides were analysed in brown rat liver, cat liver and indoor house dust samples. Phthalates were added to the list of analytes in soil samples, and Spanish slug samples were only analysed for PFAS. A total oxidizable precursors (TOP) assay which can give information about possible PFAS precursors in addition to the target PFAS, was applied to some samples from Spanish slug, rat liver and fieldfare egg.

In general, measured concentrations of the compound classes were in agreement with results from previous years of this monitoring programme. Indoor house dust samples and one cat liver sample were sampled for the first time this year. The results revealed that indoor house dust samples contained approximately the same levels of metals, OPFR compounds and UV compounds. These compound classes were found in highest levels, followed by phenols and siloxanes. Indoor house dust samples also revealed a high detection frequency of BFR compounds and at relatively high concentrations. DBDPE had highest BFR concentration in dust with 909 ng/g. The highest Pb concentration in soil was detected at Alna with 132 ng/g dw. This site had six times higher concentration than the four other stations with comparable concentrations. The soil sample from Alna also had the highest TCPP concentration of 218 ng/g dw.

PFAS compounds were detected at relatively low concentrations in all samples, except in one rat sample from Binneveien in a central area of the western part of Oslo. PFOA and PFNA concentrations at this site was 510 and 202 ng/g ww, respectively. The highest PFOS concentrations were found in rat liver from Tvetenveien of 219 ng/g ww, a site in the Eastern part of Oslo, not far from the Alna site. The same sample had a PFDcS concentration of 71.7 ng/g ww.

OPFR and UV compounds were first and foremost detectable in soil samples and indoor house dust. Some phenols were detectable and at high concentrations in indoor house dust where Bis-A and Bis-F dominated. Alkylphenols were also detectable in house dust and some of the other samples. Cyclic siloxanes were detected in many samples this year at relatively low concentrations, except one rat liver sample with high concentrations of D5 and D6 of 148 and 184 ng/g ww, respectively. Linear siloxanes L3, L4 and L5 were not detected in any samples. MCCPs were detected in many samples with high concentrations in indoor house dust and rat liver. Dechloranes were detected in relatively low concentrations and the measured concentrations were in agreement with observations from previous years. Syn- and anti-DP were detected in indoor house dust where the maximum concentration was 104 ng/g dust. Of the different phthalates measured in soil, DEHP and DiNP were the dominating compounds.

TOP assay revealed increased concentrations of perfluorinated carboxylates (PFCA) in both egg and rat liver compared to target PFAS analysis, indicating a presence of oxidizable precursors not part of the targeted PFAS. For some slug samples, PFCAs were detected above the LOD after TOP assay, whereas the concentrations were below LOD for targeted PFAS by standard extraction.

Calculated biota-soil accumulation factors, BSAF or BAF, were above 1 for several PCB congeners, PFOS and some PFCA compounds for several of the earthworm/soil locations. Cyclic siloxanes revealed also BSAF >1 for all locations for earthworm and soil, and more uncertain data for a couple of OPFR compounds, α-HBCD, γ-HBCD and UV-328 due to BSAF values near 1 and low detection frequencies.
Biomagnification factor (BMF) confirmed earlier findings that several PCBs, PFOS and long chained PFCA compounds bioaccumulate and biomagnify with BMF>1 for some of the locations with earthworm as prey for fieldfare. BMF was also above 1 for D5 and D6 for the locations Alna and Alnaparken, and more uncertain for other compounds where BMF was near 1.

Sammendrag

På oppdrag fra Miljødirektoratet, har NILU, i samarbeid med Norsk institutt for naturforskning (NINA) og Norsk institutt for vannforskning (NIVA), analysert en lang rekke uorganiske og organiske miljøgifter i jord, husstøv og dyrearter fra bynært og terrestrisk miljø. IFE, Insitutt for energiteknikk analyserte stabile nitrogen og karbon isotoper i prøvene.

Prosjektet har følgende prioriterte mål:

- Rapportere konsentrasjon av utvalgte miljøgifter i flere trofiske nivåer i et urbant terrestrisk næringsnett.
- Estimere opptak og grad av opphoping av miljøgifter i utvalgte dyr og næringskjeder
- Bidra til å skaffe informasjon om kilder til eksponering i landlevende dyr for ulike typer miljøgifter

Et stort antall miljøgifter som metaller, polyklorterte bifenyler (PCB), bromerte flammehemmere (BFR), UV stabiliserende stoffer, per- og polyfluorerte stoffer (PFAS), siloksaner, klorerte parafiner (CP), organiske fosforflammehemmere (OPFR), fenoler, musk og dekloraner ble analysert i følgende prøver:

- fem samleprøver av jord
- fem samleprøver av meitemark
- fem samleprøver av gråtrostegg
- fem samleprøver av lever fra brunrotte
- fem samleprøver av husstøv
- en prøve av kattelever
- fire prøver av brunskogsnegle (kun analysert for PFAS)

I tillegg til stoffgruppene som er nevnt ovenfor, så ble utvalgte biocider analysert i leverprøver fra rotte, katt og støvprøver. Jordprøvene ble i tillegg analysert for ftalater, og brunskogsnegle ble kun analysert for PFAS. Total oxidizable precursors assay (TOPA) ble brukt til å bestemme tilstedeværelsen av mulige forløpere til PFAS forbindelser sammen med spesifikke PFAS forbindelser i noen prøver av snegle, rottelever og gråtrost egg.

Generelt var de målte konsentrasjoner av de ulike forbindelsene i samsvar med resultater fra tidligere år. Prøver fra husstøv og lever fra en katt ble samlet inn for første gang i 2022. Resultatene viste at husstøv inneholdt omtrent samme nivåer av metaller, OPFR-forbindelser og UV-forbindelser. Disse stoffgruppene dominerte, etterfulgt av fenoler og siloksaner. Husstøv hadde høy deteksjonsfrekvens av BFR-forbindelser og med relativt høye konsentrasjoner. DBDPE hadde høyeste BFR-konsentrasjon i støv med 909 ng/g. Høyeste Pb-konsentrasjon i jord ble funnet ved Alna med 132 ng/g dw. Denne lokaliteten hadde seks ganger høyere enn de fire andre lokalitetene som hadde sammenlignbare konsentrasjoner. Den samme jordprøven hadde den høyeste TCPP-konsentrasjonen på 218 ng/g dw.

PFAS-forbindelser hadde relativt lave konsentrasjoner i prøvene, bortsett fra en rotteprøve fra Binneveien i et sentralt område i vestlig del av Oslo. PFOA- og PFNA-konsentrasjoner på denne lokaliteten var hhv 510 og 202 ng/g vv. De høyeste PFOS-konsentrasjonene ble funnet i rottelever fra

Tvetenveien på 219 ng/g vv. Den samme prøven hadde en PFDcS-konsentrasjon på 71.7 ng/g vv. OPFR- og UV-forbindelser var først og fremst påvist i jordprøver og husstøv. Noen fenoler var påvisbare og i høye konsentrasjoner i husstøv der Bis-A og Bis-F dominerte. Alkylfenoler var også detektert i støv og noen av de andre prøvene. Sykliske siloksaner ble påvist i mange prøver i år ved relativt lave konsentrasjoner, bortsett fra én rotteleverprøve med høye konsentrasjoner av D5 og D6 på henholdsvis 148 og 184 ng/g vv. Lineære siloksaner ble ikke detektert i noen av prøvetypene. MCCP ble påvist i mange prøver med høye konsentrasjoner i husstøv og rottelever. Dekloraner ble funnet relativt lave konsentrasjoner og i samsvar med tidligere år. Syn- og anti-DP ble påvist i husstøv hvor maksimumskonsentrasjon var 104 ng/g støv. Av ftalater i jord var DEHP og DiNP de dominerende forbindelsene.

TOP assay viste at konsentrasjonen av perfluorerte karboksylater (PFCA) i egg og rottelever økte etter at de var sammenlignet med standard ekstraksjons metode som indikerer tilstedeværelse av oksiderte forløpere som ikke ble påvist ved vanlig analyse. I noen snegleprøver ble PFCA forbindelser detektert over LOD med TOP assay, men under LOD med den vanlige ekstraksjons- og analysemetoden.

Beregnet biota-jord akkumuleringsfaktorer, BSAF el BAF, var over 1 for flere PCB kongenere, PFOS og en del PFCA forbindelser for flere av meitemark/jord lokalitetene. Sykliske siloksaner viste også BSAF >1 for alle lokalitetene for jord og meitemark, og mer usikre data for et par OPFR forbindelser, α-HBCD, γ-HBCD og UV-328 pga BSAF verdier nær 1 og lav deteksjonsfrekvens. Biomagnifiseringsfaktor (BMF) bekreftet tidligere funn at PCB kongenere, PFOS og langkjedete PFCA bioakkumulerer og biomagnifiserer med BMF>1 for enkelte av lokalitetene med meitemark som byttedyr for gråtrost. BMF var også over 1 for D5 og D6 for lokalitetene Alna og Alnaparken, og mer usikre for andre forbindelser der BMF verdien var nær 1.

Abbreviations

BAF	bioaccumulation factor
BFR	brominated flame retardants
BR	Brown rat
BMF	biomagnification factor
BSAF	biota soil accumulation factor
CI	confidence interval
CP	chlorinated paraffins
cVMS	cyclic volatile methyl siloxanes
dw	dry weight
EI	electron impact ionization
ESI	electrospray ionization
EW	Earthworm
FF	Fieldfare
fv	Fettvekt
GC-MS	gas chromatography – mass spectrometry
GC-HRMS	gas chromatography – high resolution mass spectrometry
GPC	gel permeation chromatography
ICP MS	inductive coupled plasma – mass spectrometry
LC-MS	liquid chromatography – mass spectrometry
LOD	limit of detection
LOEL	lowest observed effect level
MEC	measured environmental concentration
lw	lipid weight
MCCPs	medium-chain chlorinated paraffins
M-W U	Mann–Whitney *U* test
N	detected/measured samples
n.a.	not analysed
NCI	negative chemical ionization
NOEC	no observed effect concentration
NOAEL	no observed adverse effect level
NOEL	no observed effect level
n-PFAS	neutral polyfluorinated compounds
newPFAS	new polyfluorinated compounds
NP-detector	nitrogen-phosphorous detector
OPFR	organophosphorus compounds
PBDE	polybrominated diphenyl ethers
PCA	principal component analysis
PCB	polychlorinated biphenyls
PCI	positive chemical ionization
PEC	predicted environmental concentration
PFAS	per- and polyfluorinated alkylated substances
PFCA	perfluorinated carboxylic acids
PFSA	perfluorinated sulfonates
PNEC	predicted no effect concentration
PSA	primary/secondary amine phase
SCCPs	short-chain chlorinated paraffins
SSD	species sensitivity distribution
SIR	selective ion reaction
SPE	solid phase extraction
TL	trophic level
TMF	trophic magnification factor
TOP	total oxidizable precursor

UHPLC	ultra high pressure liquid chromatography
vv	Våtvekt
ww	wet weight

1 Background

The terrestrial ecosystem covers food chains of organisms that live and grow on land. The main objective of this monitoring programme; *Environmental pollutants in organisms from an urban environment (MILBY)*, is to report and assess the presence, levels and bioaccumulation potential of selected environmental pollutants in a terrestrial urban ecosystem. The monitoring is conducted in Oslo, the capital of Norway and Norway's largest city. The programme is led by NILU in cooperation with The Norwegian Institute for Nature Research (NINA), The Norwegian Institute for Water Research (NIVA) and IFE, Institute for Energy Technology. Together with the monitoring programme "Environmental pollutants in an urban fjord" which monitors environmental pollutants in the inner Oslofjord, MILBY seeks to assess the presence and environmental uptake of environmental pollutants from sources in an urban environment.

A description of the environmental pollutants included in the study, the sampling and how the samples were handled and prepared, is provided in the Material and Methods, Appendix 1. Appendix 1 also describes the chemical analysis and the quality assurance measures taken.

Due to the different physicochemical properties of the pollutants of interest, several different sample preparations methods were applied. Lipophilic compounds such as PCB, BFR and CP were analysed together. PFAS, metals, phenols, siloxanes, UV compounds, phthalates, musk, and biocides each required a dedicated sample preparation method.

GPS coordinates of the different locations where samples were collected are given in Appendix 2. Concentrations of pollutants and isotope values in the samples are given in Appendix 3.

2 Plan for sampling and analysis in 2022

An overview over the analysed species and samples is given in Table 1, and locations are given in Figure 1 and Table 2. In brief, and as further described in Appendix 1 all samples were sampled and handled according to the guidelines given in CEMP (OSPAR)[1]. Analytical endpoints for the various samples are shown in Table 3.

The sampling sites at Alnabru and Alnaparken are located in an area with industrial activity and is close to one of Oslo's main highways. Ammerud is a residential area around 6 km north west of Alnabru and close to Badedammen and Steinbruvann which are fresh water lakes surrounded by forest that lies in a recreational area. Hølaløkka on the other hand is a green corridor in a semi-urban and partly industrialized area at Grorud north of Alnabru. The sampling sites at Alnabru, Alnaparken, Hølaløkka, Ammerud, Badedammen/ Steinbruvann and Tveitenveien are all located in the Grorud Valley in the Northeastern part of Oslo. The sampling site in Svartdalsparken is at a former landfill which has been converted and restored to a recreational area not far in the eastern part of central Oslo. All these sites are in close vicinity of the Alna River which is Oslo's longest river and that has been included in national river monitoring programme due to concerns of pollution. The Alna River runs through the Eastern Parts of Oslo, from Alnsjøen near Ammerud to the Oslo Fjord at Bjørvika. The Alna river also drains Breisjøen, Steinbruvann Tokerudbekken, and Østensjøvannet.

In 2022 some additional samples were included in the sampling program. The aim was to compare contaminant levels in species living in the outdoor environment with species living mostly in indoor environment. It was expected that exposure and contaminant levels would be different for some of the environmental pollutants. This was done by collecting indoor dust samples in residential areas in family houses having dog pets. Only one cat could be delivered for analysis from veterinary centres. These samples are not shown in the table and map.

2.1 Sampling plan in 2022

Table 1: Type of samples, sampling strategy showing whether and how samples where pooled before analysis, number of samples analysed and locations (coordinates can be found in the Appendix 2). Locations corresponds to locations shown in Fig. 1.

Sample type	Sampling strategy	No. of samples	Locations	Year
Soil	Pooled samples at each location consisting of 3 soil samples	5	Alna, Alnaparken, Ammerud, Hølaløkka, Svartdalsparken	2022
Earthworms (EW) *Lumbricidae*	Pooled samples at each location, each sample consisted of 20 individuals	5	Alna, Alnaparken , Ammerud, Hølaløkka, Svartdalsparken	2022
Fieldfare (FF) egg *Turdus pilaris*	Each sample consisted of 2 eggs from one nest/location	5	Alnabru, Alnaparken, Ammerud, Hølaløkka, Svartdalsparken	2022
Brown rat (BR) liver *Rattus norvegicus*	1- 2 individual livers for one sample	5	Trondheimsvegen, Binneveien Tvetenveien, Grønland T-bane, Fredensborgveien	2022
Spanish slug *Arion vulgaris*	1-3 individuals per sample	4	Badedammen and Steinbruvann, Hølaløkka, Svartdalsparken, Alna (Bredtvedt)	2022

[1] https://www.ospar.org/work-areas/cross-cutting-issues/cemp

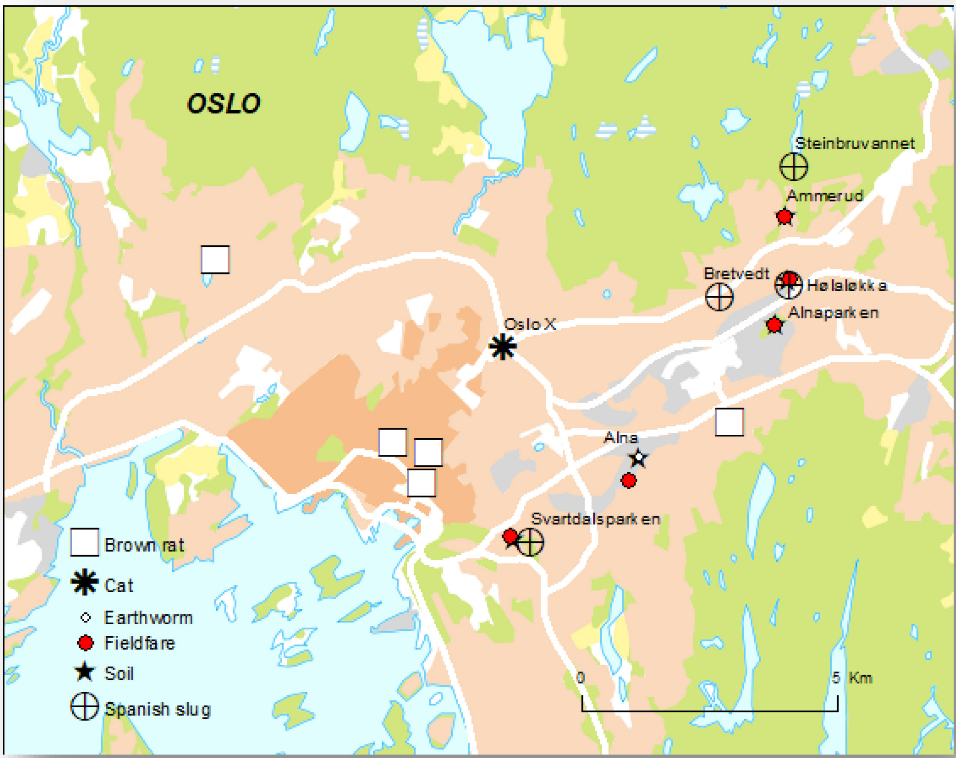


Figure 1: Locations of samples collected and analysed in 2022. See below for corresponding table of sample types and locations, and Appendix 2 for coordinates of the sites.

Table 2: Locations of all samples collected and analysed in 2022. Locations are shown in the map in Figure 1.

Municipality	Sampling-sites	Soil	Earthworm	Fieldfare egg	Spanish slug 2022	Brown rat
Oslo	**Alnaparken**	X	X	X		
Oslo	**Alna**	X	X			
Oslo	**Alnabru**			X		
Oslo	**Bredtvedt (Alna)**				X	
Oslo	**Svartdalsparken**	X	X	X	X	
Oslo	**Ammerud**	X	X	X		
Oslo	**Hølaløkka**	X	X	X	X	
Oslo	**Steinbruvann**				X	
Oslo	Trondheimsveien 5					X
Oslo	Binneveien 10-4 (Holmenkollen)					X
Oslo	Tvetenveien 217 (Trosterud Metro)					X
Oslo	Grønland Metro					X
Oslo	Fredensborgveien 37					X

2.2 Pollutants and other analytical endpoints in 2022 matrices

The various contaminant classes and other analytical endpoints are given in Table 3. Phthalates were only analysed in soil samples. Biocides were only analysed in brown rat liver samples. Lipid content was analysed in earthworm, fieldfare eggs and brown rat liver. Stable isotopes were analysed in soil, earthworm, fieldfare egg and rat liver.

Table 3: Type of matrices and analytical endpoints in samples collected in 2022 and in additional samples from 2021

Type of sample	Contaminant classes analysed in the samples
Soil n=5	Metals, PCB, PFCA, PFSA, nPFAS, new PFAS, Other BFR, Dechloranes, Siloxanes, CP, OPFR, UV-compounds, Phenols, Musk, Phthalates, stable isotopes $\delta^{15}N$ and $\delta^{13}C$, TOC and pH
Earthworm (EW) n=5	Metals, PCB, PFCA, PFSA, nPFAS, new PFAS, Other BFR, Dechloranes, Siloxanes, CP, OPFR, UV-compounds, Phenols, Musk, stable isotopes $\delta^{15}N$ and $\delta^{13}C$, lipid content
Brown rat (BR) liver n=5	Metals, PCB, PFCA, PFSA, nPFAS, new PFAS, Other BFR, Dechloranes, Siloxanes, CP, OPFR, UV-compounds, Phenols, Musk, Biocides, stable isotopes $\delta^{15}N$ and $\delta^{13}C$, lipid content
Fieldfare (FF) egg n=5	Metals, PCB, PFCA, PFSA, nPFAS, new PFAS, Other BFR, Dechloranes, Siloxanes, CP, OPFR, UV-compounds, Phenols, Musk, stable isotopes $\delta^{15}N$ and $\delta^{13}C$, lipid content
In house dust samples n=5	Metals, PCB, PFCA, PFSA, nPFAS, new PFAS, Other BFR, Dechloranes, Siloxanes, CP, OPFR, UV-compounds, Phenols, Musk, biocides
Cat liver n=1	Metals, PCB, PFCA, PFSA, nPFAS, new PFAS, Other BFR, Dechloranes, Siloxanes, CP, OPFR, UV-compounds, Phenols, Musk, biocides
Spanish slug n=4	PFAS and Total oxidizable precursors assay (TOPA)
Additional samples from 2021	
Spanish slug (n=1)	Total oxidizable precursors assay (TOPA)
Fieldfare egg n=1)	Total oxidizable precursors assay (TOPA)
Rat liver (n=1)	Total oxidizable precursors assay (TOPA)

3 Key findings

A list of the selected environmental pollutants with abbreviations and CAS no. can be found in Appendix 1, Table 12. In addition, Appendix 1 gives background information on sampling strategies, compound classes, analytical and statistical methods.

In total, 166 selected environmental pollutants, belonging to 14 larger compound classes were analysed. PFAS is one large compound class consisting of the sub groups PFSA, PFCA, nPFAS and newPFAS. In addition, other important parameters were analysed such as isotopes $\delta^{13}C$ and $\delta^{15}N$, lipid content in biological samples, dry matter, pH and TOC in soil, see Appendix 3.

Table 4 shows the percentage detection of the components in the different sample types. For environmental pollutants not analysed in the samples, these are denoted n.a. in the table. For example, the Spanish slug samples were only analysed for PFAS compounds. As can be seen, metals were detected in almost all samples which is also the case with PCBs. Perfluorinated carboxylates (PFCA) and sulfonates (PFSA) had highest detection frequencies in earthworm, fieldfare egg and brown rat liver. High detection frequencies were found for cyclic siloxanes in all samples, and for BFR, CP, OPFR and UV in indoor house dust samples. Indoor house dust was the sample type with highest detection frequencies across all compound classes.

Biocides were only analysed in indoor house dust and livers from rat and cat. Phthalates were only analysed in soil, as described in Table 3.

In the following chapter, key findings of the results for 2022 are given. Tables for all component classes and some figures are given in the Appendix, Results. Key findings focus on newer compound classes, and also new matrices with interesting findings in 2022. LOD/2 values are included in the boxplots with at least one detected concentration in the samples. For compounds in matrices with no detected concentrations, these are omitted from the figures.

The Appendix 2 contains a result chapter including tables with average, minimum and maximum concentrations for each component of the various compound classes. Concentrations and isotope data for the individual samples are available in Appendix 3.

Table 4: Percentage detection of components in various sample types. n.a.: not analysed. White cell without text is zero detection. The colour scale is from navy blue (100 % detection) through lighter blue to white (zero detection)

Chemical group name	Components	Soil	Earthworm	Fieldfare egg	Rat liver	Cat liver	Indoor dust	Spanish slug
	Cr	100	100	100	100	100	100	n.a.
	Ni	100	100	100	100	100	100	n.a.
	Cu	100	100	100	100	100	100	n.a.
	Zn	100	100	100	100	100	100	n.a.
	As	100	100	100	100	100	100	n.a.
Metals	Ag	100	100	50	100	100	100	n.a.
	Cd	100	100	100	100	100	100	n.a.
	Pb	100	100	100	100	100	100	n.a.
	Hg	100	100	100	100	100	100	n.a.
	Gd	100	100	100	100	100	100	n.a.
	Sb	100	100		100	100	100	n.a.
	Sn	100	75	100	80	100	100	n.a.
	PCB28	20	100	60	80		67	n.a.
	PCB52	40	100	100	40			n.a.
	PCB101	100	100	100	100			n.a.
PCB	PCB118	100	100	100	100	100	67	n.a.
	PCB138	100	100	100	100	100	33	n.a.
	PCB153	100	100	100	100	100	33	n.a.
	PCB180	100	100	100	100	100	100	n.a.
	ATE (TBP-AE)							n.a.
	α-TBECH						20	n.a.
	β-TBECH						60	n.a.
	γ/δ-TBECH		20					n.a.
	BATE							n.a.
	PBT						80	n.a.
	PBEB							n.a.
	PBBZ							n.a.
BFR	HBB		20				60	n.a.
	DPTE						80	n.a.
	EHTBB						100	n.a.
	BTBPE						80	n.a.
	TBPH (BEH/TBP)				20		100	n.a.
	DBDPE				20		100	n.a.
	TBBPA						100	n.a.
	α-HBCD	40	20	60	60	n.a.	100	n.a.
	β-HBCD					n.a.	80	n.a.
	γ-HBCD	40	20			n.a.	100	n.a.
	TFA							
	PFPrA							
	PFBA							
	PFPA	20	80		80			25
	PFHxA		60		20		60	
	PFHpA	80	80		20			
PFCA	PFOA	80	100	100	80	100		100
	PFNA		100	100	100	100	100	
	PFDcA		100	100	100		40	75
	PFUnDA	20	100	100	100			
	PFDoDA		80	100	100		40	
	PFTriDA		100	100	100			
	PFTeDA		100	100	100			
	PFHxDA		100	100	100			
	PFOcDA							
	PFEtS							
	PFPrS							
	PFBS	20	80	20			20	
	PFPS							
	PFHxS		80	100				
	PFHpS		80	100				20
	PFOS	100	100	100		100		100
PFSA	SUM PFOS	100	100	100		100		100
	PFNS							
	PFDcS		40	100				
	PFUnS							
	PFDoS							
	PFTrS							
	PFTS							
	PFOSA						40	
	N-MeFBSA							
	N-EtFBSA							
	PFBSA							
nPFAS	meFOSA							
	etFOSA							
	meFOSEA							
	PFOSA						100	
	meFOSE							
	etFOSE							
	FOSAA							
	Me-FOSAA							
	Et-FOSAA							
	6:2 FTS					100		
	8:2 FTS						60	
newPFAS	10:2 FTS							
	12:2 FTS							
	4:2 FTS							
	PFECHS							

Table 4 cont.: Percentage detection of components in various sample types. n.a.: not analysed. White cell without text is zero detection. The colour scale is from navy blue (100 % detection) through lighter blue to white (zero detection).

Chemical group name	Components	Soil	Earthworm	Fieldfare egg	Rat liver	Cat liver	Indoor dust	Spanish slug
CP	SCCP		20	20	40		100	n.a.
	MCCP		20	100	80		100	n.a.
	D4	100	100	20	100	100	100	n.a.
Cyclic siloxanes	D5	100	100	100	100	100	100	n.a.
	D6	80	100	100	100	100	100	n.a.
	M3T(Ph)							n.a.
Linear siloxanes	L3							n.a.
	L4							n.a.
	L5							n.a.
	TEP	20			20	n.a.	n.a.	n.a.
	TCEP	60	20	40			100	n.a.
	TPrP							n.a.
	TCPP	100	40	40		100	100	n.a.
	TDCPP				60		100	n.a.
	TPHP	100		60			100	n.a.
	BdPhP							n.a.
OPFR	DBPhP						20	n.a.
	TIBP/TNBP	40	80	60			100	n.a.
	TBOEP	80		20	60		100	n.a.
	TCP	60		20			100	n.a.
	EHDP	60		40	20		100	n.a.
	TXP	40		20			100	n.a.
	TIPPP	80		20			80	n.a.
	TTBPP				20		100	n.a.
	TEHP	100		40				n.a.
	DBA							n.a.
	Dec-602	20	20	100				n.a.
	Dec-603			80	20			n.a.
Dechloranes	Dec-604							n.a.
	Dec-601							n.a.
	syn-DP	40		40	60		80	n.a.
	anti-DP	100	20	40	60		100	n.a.
	OC	40	20		20		100	n.a.
	BP3	40				100	100	n.a.
	EHMC-Z		60	67	20		100	n.a.
UV stabilizing comp.	EHMC-E	40	20	25	20		100	n.a.
	UV-327						100	n.a.
	UV-328	60	20		20		100	n.a.
	UV-329					100	100	n.a.
	Homosalate	20					100	n.a.
	OTNE							n.a.
	GALAXOLIDE						100	n.a.
Musk compounds	Tonalide						100	n.a.
	Traseolide							n.a.
	Phantolide							n.a.
	Celestolide							n.a.
	Bromadiolon	n.a.	n.a.	n.a.	100	100		n.a.
	Brodifacoum	n.a.	n.a.	n.a.	20			n.a.
Rodenticides (biocides)	Flocumafen	n.a.	n.a.	n.a.				n.a.
	Difenacoum	n.a.	n.a.	n.a.				n.a.
	Difethialone	n.a.	n.a.	n.a.				n.a.
	Permethrin	n.a.	n.a.	n.a.	40	100	100	n.a.
	TBPPA							n.a.
	4.4 Bisphenol A	40			40		100	n.a.
	2.4- Bisphenol A						60	n.a.
	2.4 Bisphenol S				20		100	n.a.
	4.4 Bisphenol F	60	80		20		100	n.a.
	2.4 Bisphenol F	40	100		20		80	n.a.
Bisphenols and alkylphenols	Bisphenol G							n.a.
	Bisphenol FL							n.a.
	Bisphenol AP							n.a.
	Bisphenol Z							n.a.
	Bisphenol E							n.a.
	Bisphenol B							n.a.
	Bisphenol M							n.a.
	4-Dodecylphenol							n.a.
	4-n-Nonylphenol		40	20	40	100	60	n.a.
	4-n-Octylphenol		40	20	60	100	80	n.a.
	4-t-Octylphenol		60			100	80	n.a.
	DEHP	100	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DPHP+DiDP	80	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DiNP	80	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DiBP		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DnBP	40	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Phthalates	DEP		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	BBP	40	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DCHP	40	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DHxP		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DOP	40	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DNP	60	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DiUnP		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

3.1.1 PFAS compounds

For the PFSA compounds, high concentrations of PFOS were detected in brown rat liver and fieldfare egg. PNECoral of 37 ng/g ww and QSbiota of 33 ng/g ww for secondary poisoning of predators (Ankley et al., 2021), were exceeded at two locations (Alnaparken and Alnabru) for fieldfare egg and two locations (Tvetenveien and Binnevegen) for brown rat liver. Only PFHpS and PFOS were detected in the four slug samples, and PFOS was not detected in indoor dust samples.

For the PFCA compounds, PFOA in four of the earthworm samples, one fieldfare egg and one brown rat liver exceeded QSbiota of 0.9 ng/g for secondary poisoning of predators set by Valsecchi et al., 2017 (Ankley et al., 2021). A relatively high PFOA concentration of 20 ng/g ww in earthworm was detected at Svartdalsparken, ten times higher than the second highest concentration at Hølaløkka of 2.1 ng/g ww. Overall, highest PFAS concentrations in earthworm was detected at Svartdalsparken, but this was not reflected in fieldfare eggs from the same location. Among the fieldfare eggs, the fieldfare egg from Alnaparken had the highest PFCA concentrations where PFDoDA dominated with 11.7 ng/g ww. Brown rat liver sample from Binneveien in Oslo had very high concentration of PFOA and PFNA of 510 and 202 ng/g ww, respectively. In indoor dust, PFHxA, PFOA and other PFCA compounds were in agreement or lower than previously detected in household dust from Oslo (Bohlin-Nizzetto et al., 2015).

For other PFAS compounds (nPFAS and newPFAS), PFOSA could be detected in the five dust samples. 6:2 FTS was only detected in the one sample of cat liver at 0.53 ng/g ww, and 8:2 FTS was only detected in three out of five house dust samples.

Figure 2 : Box plot of PFCA compounds in in environmental samples, soil , earthworm (EW), fieldfare (FF) egg, brown rat (BR) liver, Cat liver, indoor house dust (Dust) and spanish slug (Slug). Concentrations are given in ng/g ww, except ng/g dw in soil and ng/g dust in indoor dust samples. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers. LOD/2 included for compound with at least one detection. Compounds that are not detected in any of the samples are not shown.

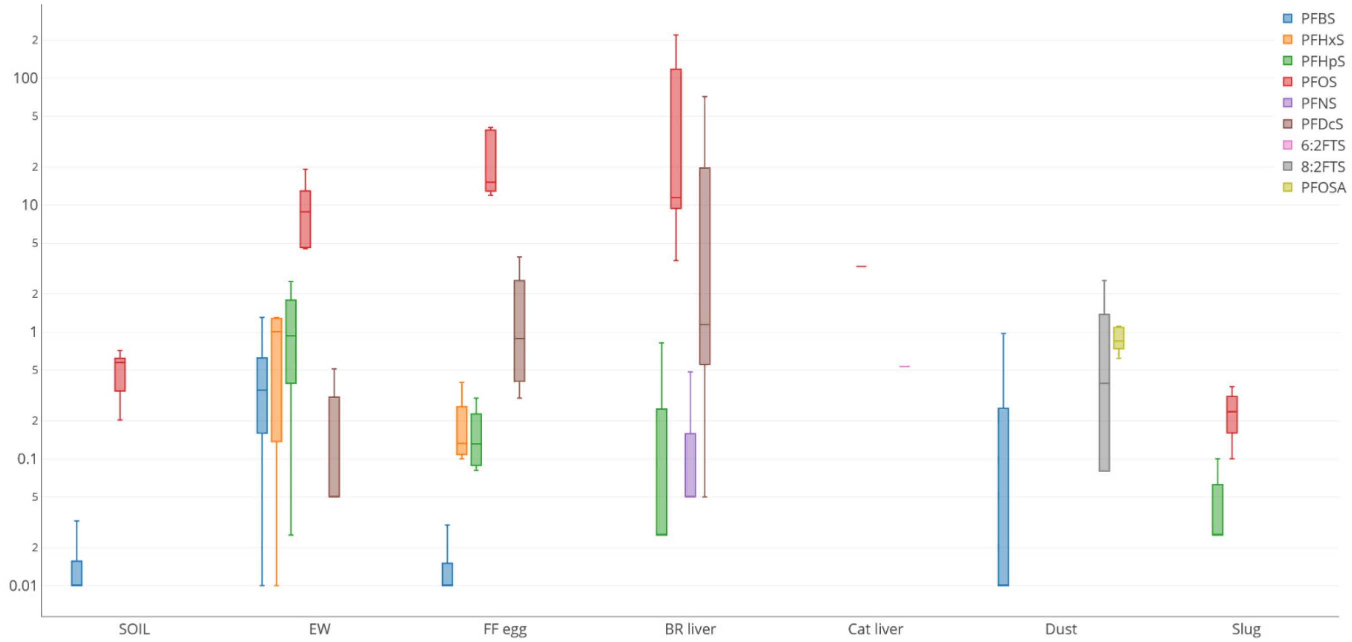


Figure 3: Box plot of PFSA, PFOSA, 6:2 FTS and 8:2 FTS compounds in environmental samples. Concentrations are given in ng/g ww, except ng/g dw in soil and ng/g dust in indoor house dust samples. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers. LOD/2 included for compound with at least one detection. Compounds that are not detected in any of the samples are not shown.

Brown rat liver samples have revealed quite high variations in PFAS concentrations within one year, between locations and between years, as seen in the figure below for PFOS, where annually average concentrations in each year are connected by a blue line. This likely reflects that brown rat, is an opportunistic predator species that will consume almost anything in the urban areas, especially human food waste.

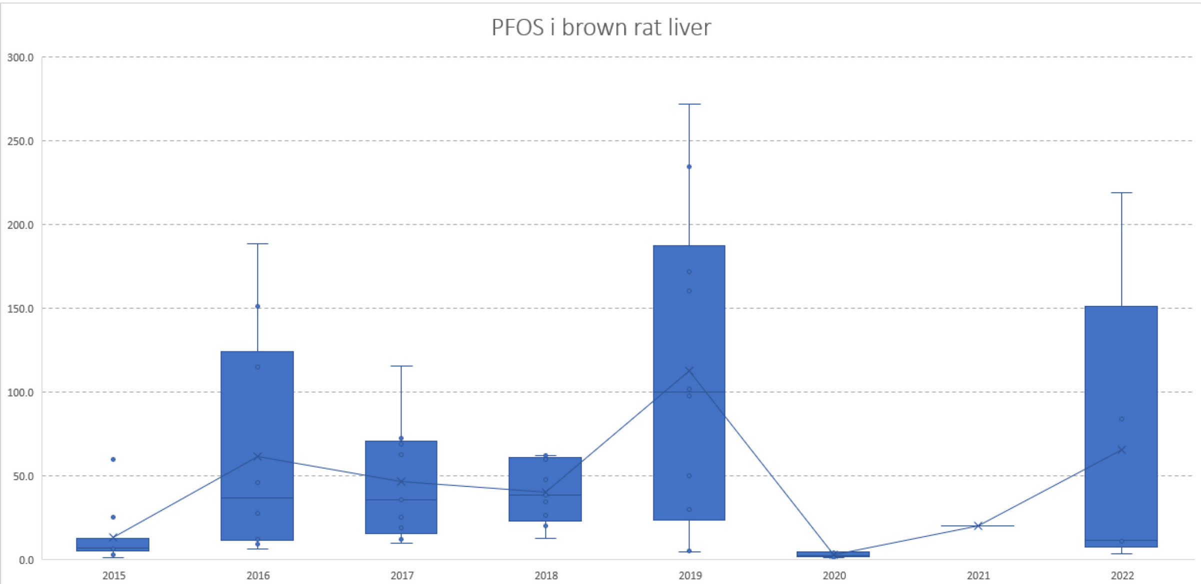


Figure 4: PFOS concentration in brown rat liver from year 2015 to 2022, expressed as box plots where average conecntrations are connected with line.

TOP assay was applied on some fieldfare egg, rat liver, and Spanish slug samples. The concentration of targeted PFAS after the samples have been processed through TOP assay had increased for both

PFCA and PFSA. This is an indication that there could be PFAS present in the samples that are not part of the analysed PFAS. For two rat liver samples, two fluorotelomer sulfonates were detected. They are defined as precursors and usually oxidized with TOP assay. Due to the high concentration of some PFAS in one of the samples it is possible that the oxidation has not been complete. The difference in concentration of PFCA before and after TOP assay is presented in Figure 5.

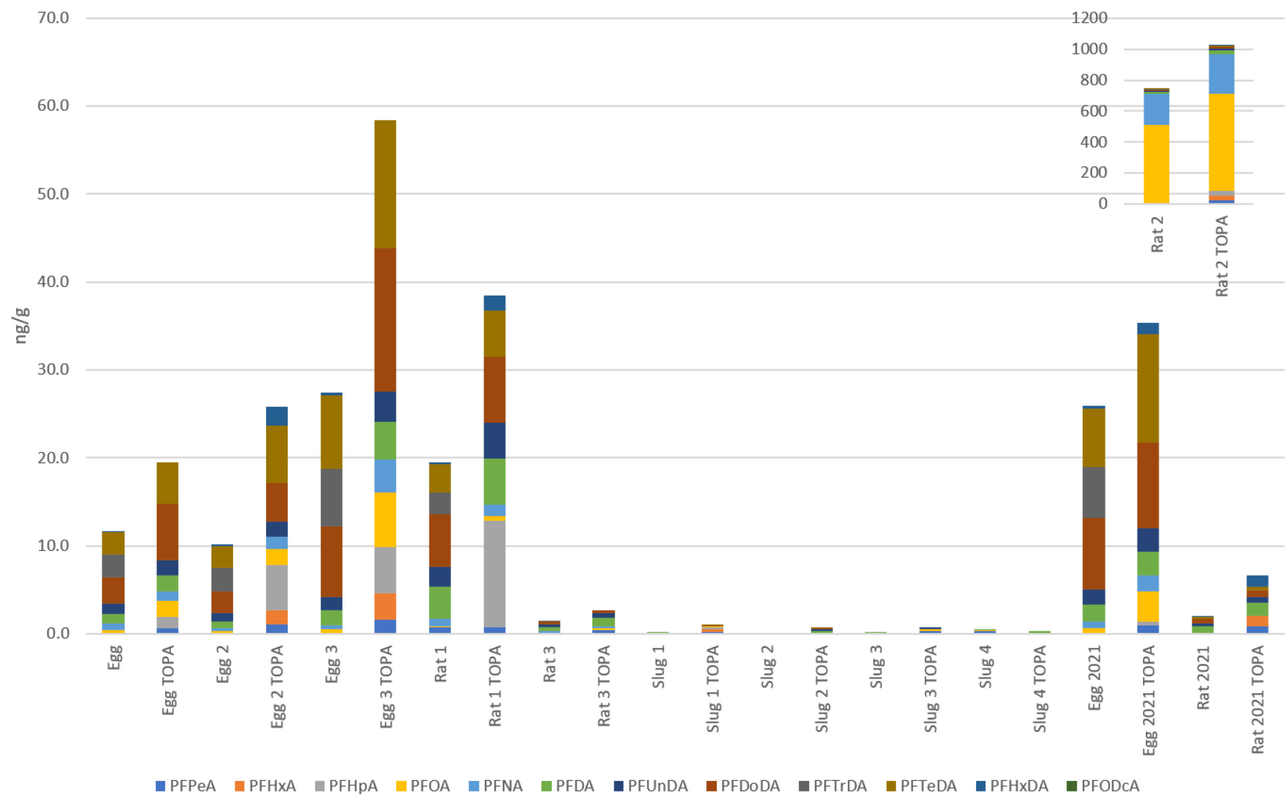


Figure 5: PFCA concentrations (ng/g ww) in egg from fieldfare, rat liver and Spanish slug before and after TOP assay (TOPA). The higher concentrations for rat liver sample nr 2 (Rat 2 and Rat2 TOPA) are shown separately at the upper right.

3.1.2 BFR compounds

Very few BFR compounds were detected, and at low concentrations in soil, earthworm and fieldfare egg. Some more and with higher concentrations were detected in rat liver, and even more compounds were detected in indoor house dust samples and at high concentrations. The BFR detected in highest concentrations was DBDPE which was found at a concentration of at 909 ng/g in house dust. Comparison of data on the content of organic or lipid weight were not possible due to lack of organic content in house dust samples. As can be seen from the box plot below, there are some similarities in brown rat (BR) liver and house dust samples for the pattern of TBPH, DBDPE and α-HBCD.

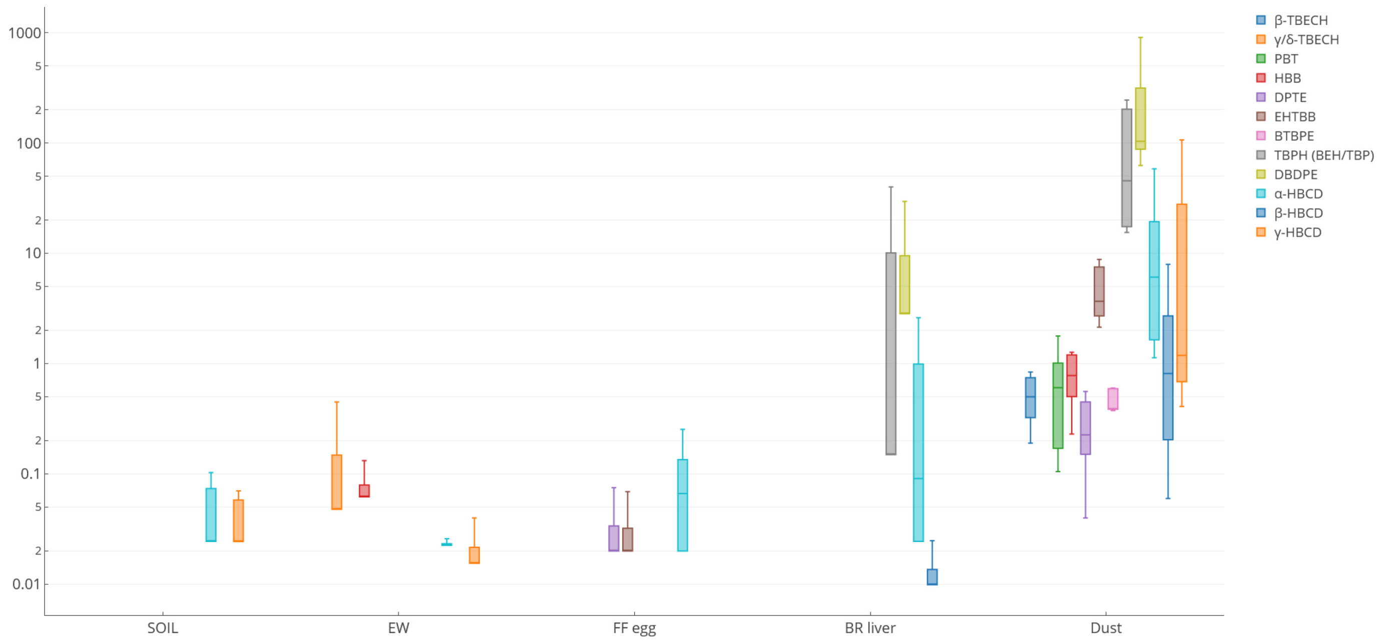


Figure 6: Box plot of BFR compounds in environmental samples. Concentrations are given in ng/g ww, except ng/g dw in soil and ng/g dust in indoor house dust samples. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers. LOD/2 included for compound with at least one detection. Compounds that are not detected in any of the five samples are not shown.

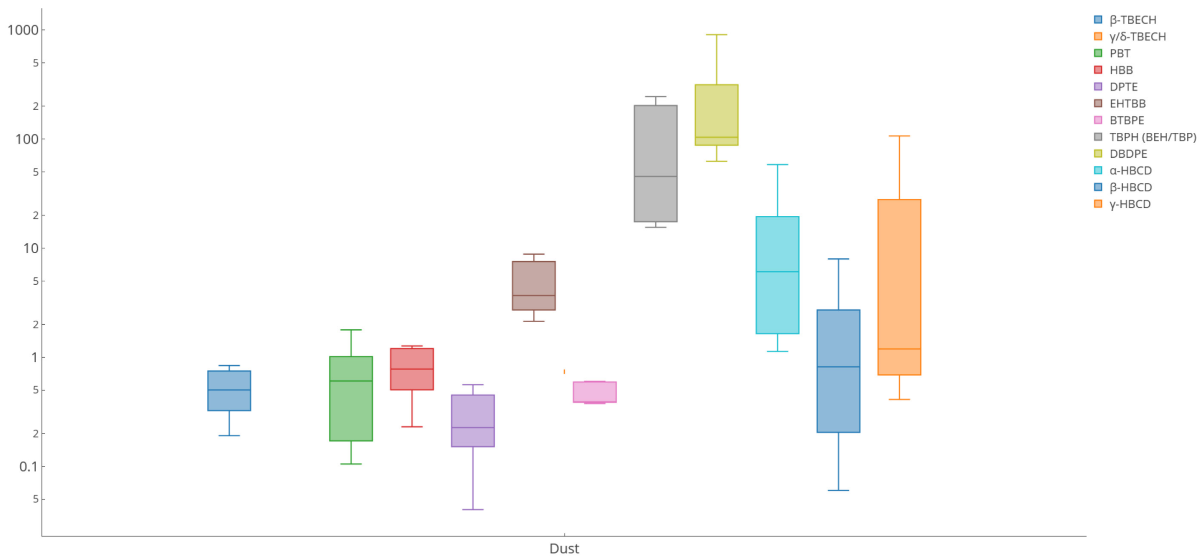


Figure 7: Box plot of BFR compounds in indoor house dust samples. Concentrations are given in ng/g dust. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers. LOD/2 included for compound with at least one detection. Compounds that are not detected in any of the five samples are not shown.

3.1.3 Chlorinated paraffins (CP)

MCCPs was the dominating CP in all samples. Both SCCPs and MCCPs were below limit of detection in soil and the single cat liver. In earthworm and fieldfare egg, SCCPs were only detected in one sample. The highest concentrations of SCCPs and MCCPs in biological samples were detected in rat liver, both on wet and lipid weight basis across species. Maximum concentration of SCCP was 43 ng/g ww and 2193 ng/g ww for MCCP in rat liver. None of the samples exceeded the PNECoral values of 5500 ng/g food and 10 000 ng/g food (wet weight) for SCCPs and MCCPs, respectively.

House dust samples in general had high concentrations of CP, which indicate a potential source for exposure in indoor environment. SCCPs varied from 870 to 1693 ng/g dust and MCCPs from 1658 to 5271 ng/g dust, and were comparable or lower than concentrations detected in a recent Norwegian study (Yuan et al., 2021).

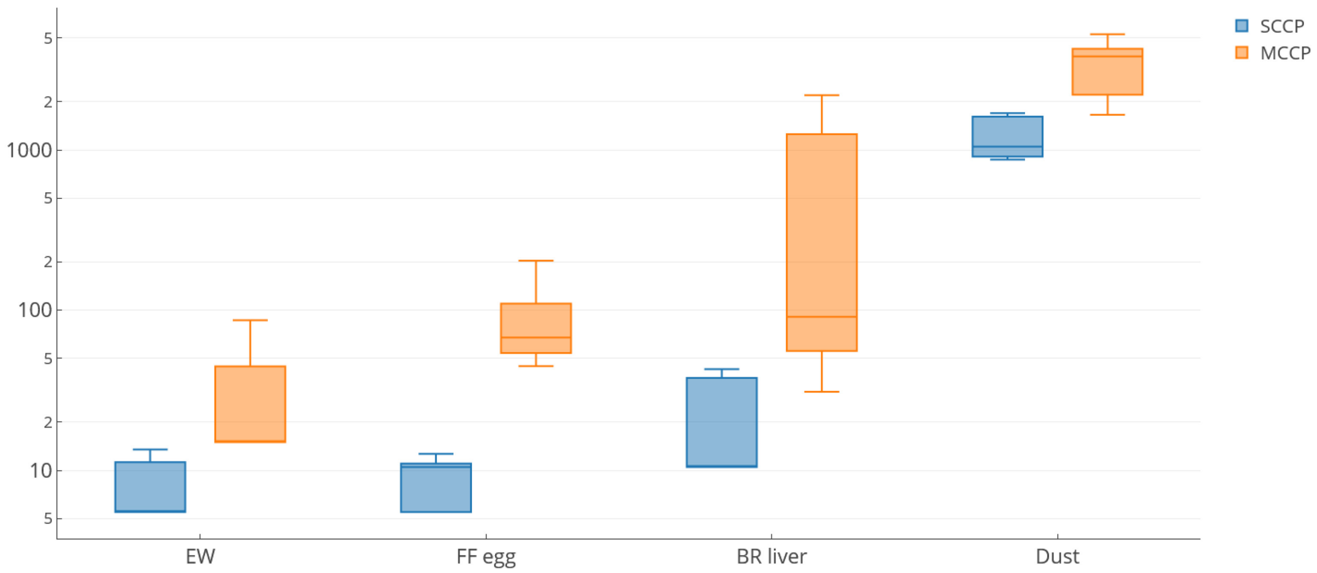


Figure 8: Box plot of SCCPs and MCCPs in analysed samples. Concentrations are given in ng/g ww (biota) and ng/g dust. LOD/2 included for compound with at least one detection. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers.

3.1.4 Cyclic siloxanes

Cyclic siloxanes were detectable in all the various samples with detection rate of 80-100%, except for D4 in fieldfare egg which was only detected in one out of five samples. Highest concentrations in soil and earthworm were detected at Hølaløkka location, but this was not reflected with highest concentrations in fieldfare egg, which was detected at Alna and Alnaparken.

Very high concentrations of D5 (148 ng/g ww) and D6 (184 ng/g ww) were detected in brown rat liver from Binneveien. Highest concentration of D4 (10.0 ng/g ww) in rat liver was detected in the same sample from Binneveien. Highest concentrations of D4, D5 and D6 in the indoor house dust samples were detected in the same residential bedroom with concentrations 26.7, 75.7 and 51.9 ng/g dust, respectively.

None of the biological samples exceeded the available PNEC values for secondary poisoning, available at the ECHA chemical information web site[2] (see also Appendix 1).

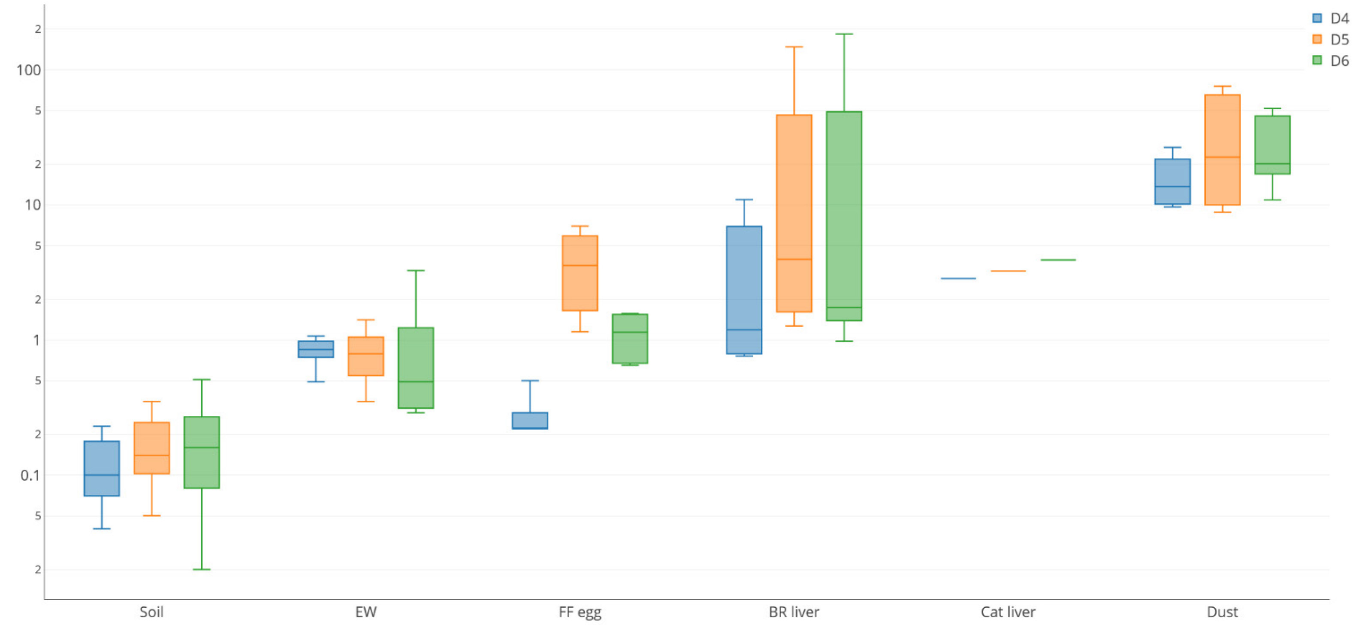


Figure 9: Box plot of siloxanes in analysed samples. Concentrations are given in ng/g ww (biota), ng/g dw (soil) and ng/g dust. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers.

3.1.5 Linear siloxanes

Linear siloxanes, L3, L4 and L5 were not detected above LOQ in any sample.

[2] https://echa.europa.eu/da/search-for-chemicals

3.1.6 OPFR compounds

OPFR compounds had highest detection frequencies in indoor house dust samples, followed by soil samples. Among the different OPFRs analyzed, TCPP was the OPFR found in highest concentrations in most of the samples, Figure 10. In indoor dust, TBOEP (Tris(2-butoxyethyl) phosphate) dominated with a maximum concentration of 33 190 ng/g dust (Figure 11) and has been shown to be a dominating OPFR compound in house dust from other studies (Cequier et al, 2014; Marklund et al., 2003). For comparison, the PNECsoil value of TBOEP (TBEP) is set to 165.8 ng/g dw (ECHA Chemical information[3]).

Highest TCPP concentration (6027 ng/g) and maximum concentrations of TiBP (TnBP) and TXP in indoor dust samples were detected in the same house and room as the highest TBOEP concentration. Only TCPP was detected in the one sample of cat liver of 3.64 ng/g ww.

The difference in levels between samples from outdoor samples to indoor house dust, reveal exposure sources of OPFRs in the indoor environment. OPFR compounds are known to be used as flame retardants or plasticizers in residential households and consumer products such as electronics, textiles, polishes etc (Lu et al., 2023). TBOEP is known to be used as an additive in floor polishes and sponge-rubber mattresses (Kim et al., 2019).

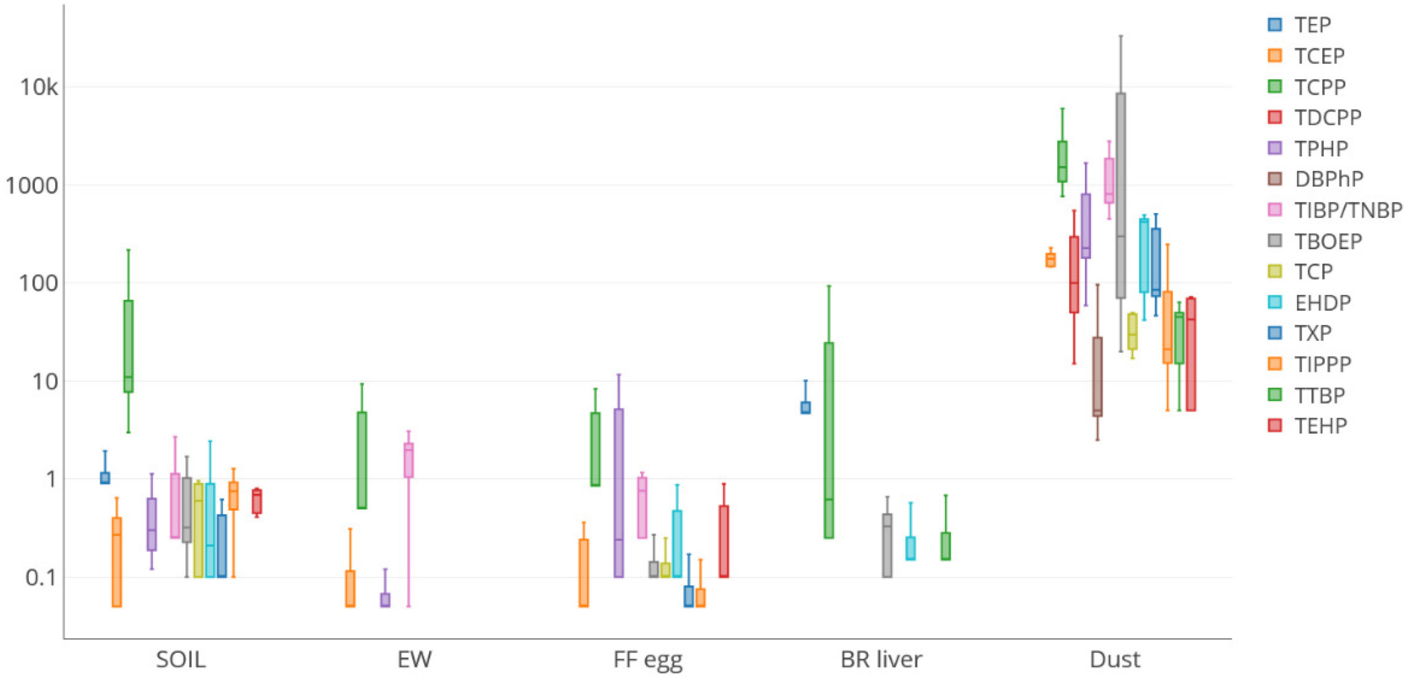


Figure 10: Box plot of OPFR in analysed samples. Concentrations are given in ng/g ww (biota), ng/g dw (soil) and ng/g dust. TCPP in catliver is not included in the plot. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers.

[3] https://echa.europa.eu/da/brief-profile/-/briefprofile/100.001.021

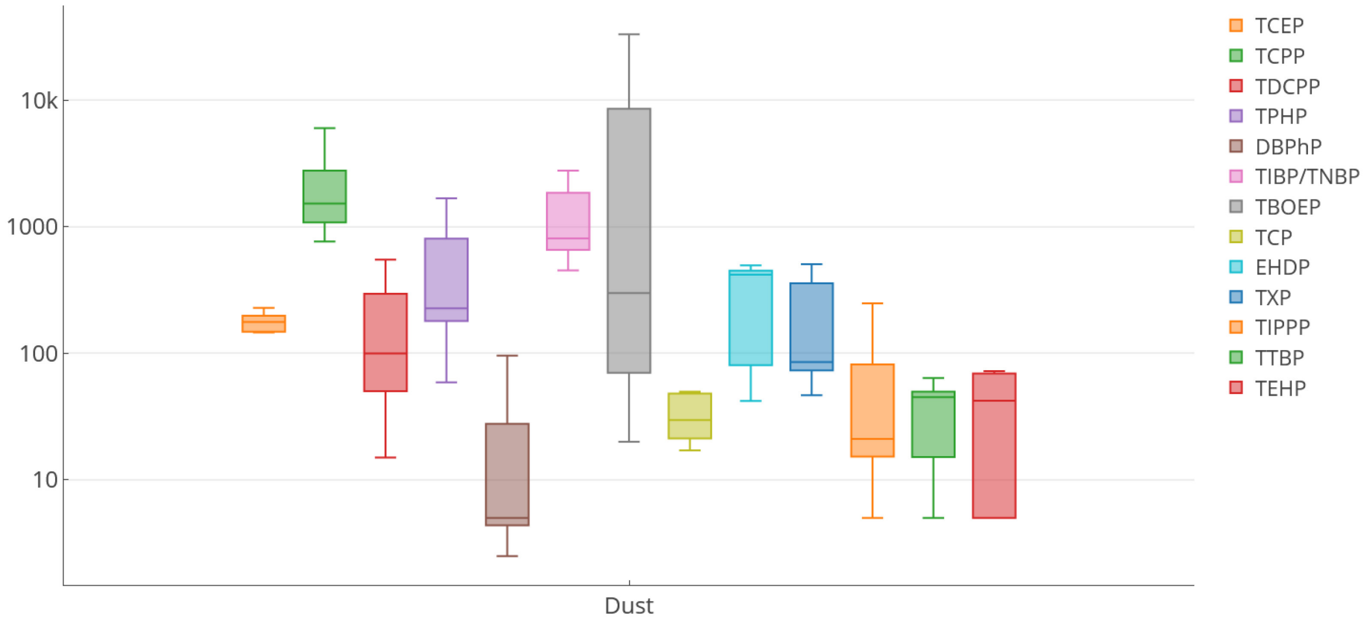


Figure 11: Box plot of OPFR in indoor dust. Concentrations are given ng/g dust. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers.

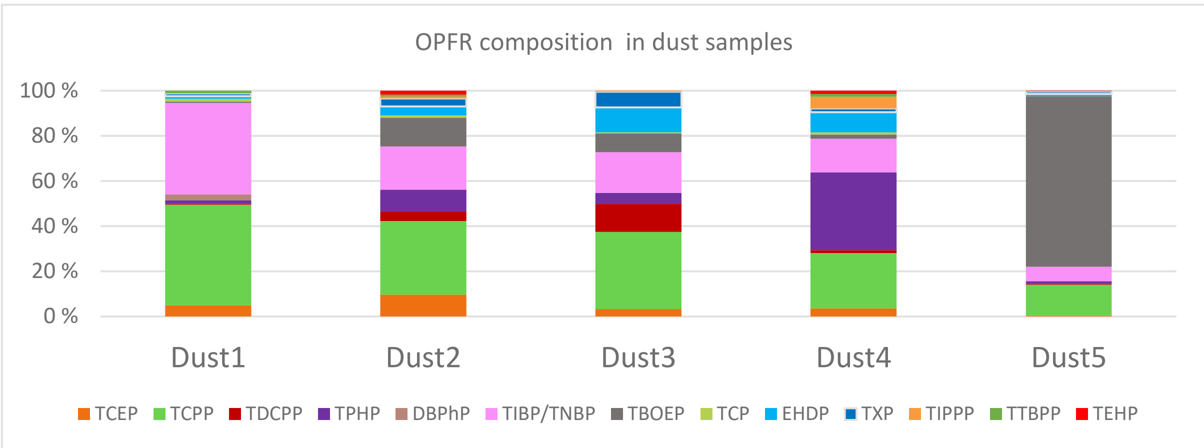


Figure 12: Percentage distribution of OPFR compounds in the five dust samples.

3.1.7 UV compounds

Some UV absorbing compounds could be detected in the various sample types, and many were below LOD, except in house dust where all UV compounds could be detected. Highest number of UV compounds were detected in the house dust and soil samples. OC and Homosalate dominated the indoor dust samples.

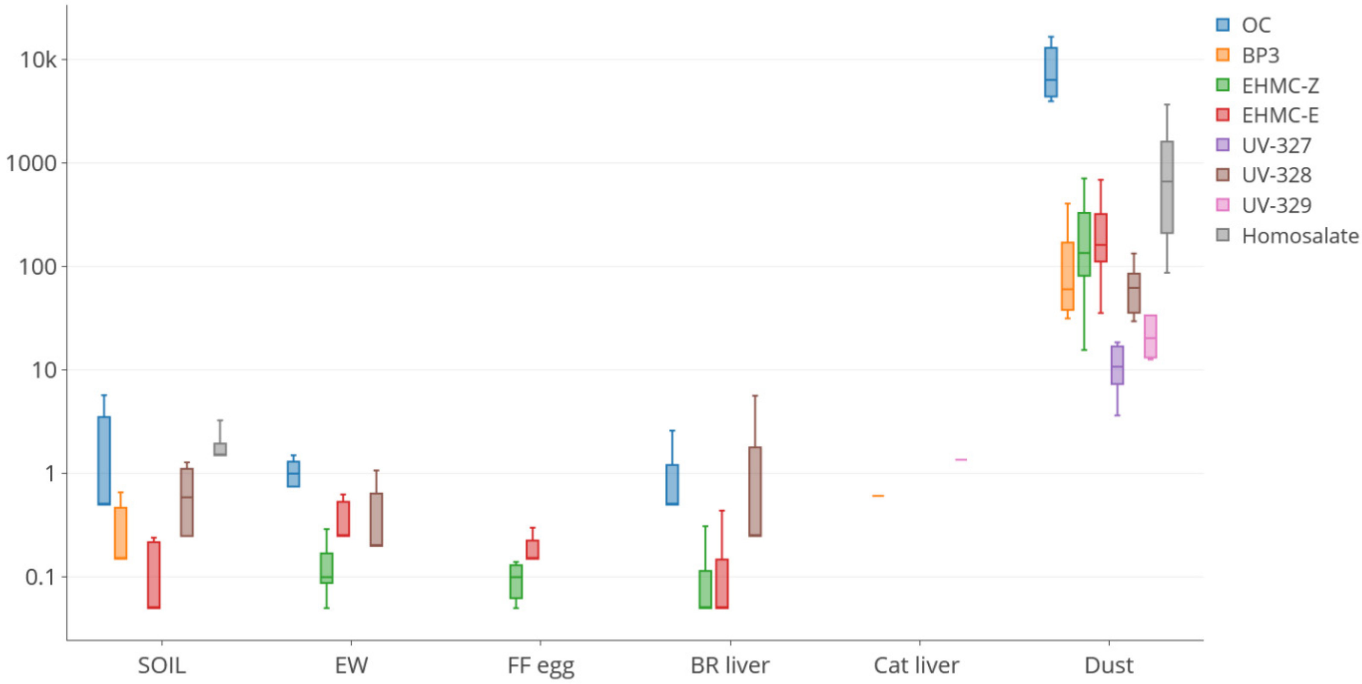


Figure 13: Box plot of UV compounds in analysed samples. Concentrations are given in ng/g ww (biota), ng/g dw (soil) and ng/g dust. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers.

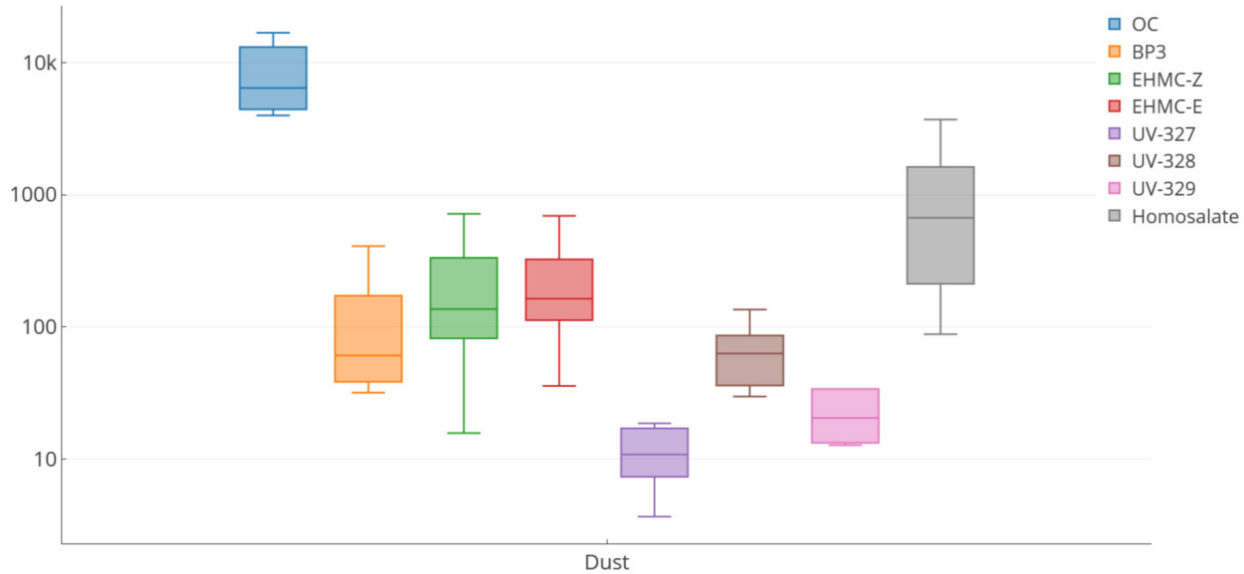


Figure 14: Box plot of UV compounds in indoor dust. Concentrations are given ng/g dust. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers.

3.1.8 Bisphenols and phenols

Of phenols, 4-n-nonylphenol could be detected in all samples, except soil. 4,4-Bis A was only detected in soil, brown rat liver and house dust samples. In cat liver, only the octyl and nonyl phenols were detected. As with OPFR, UV- and CP compounds, indoor dust samples had highest detection frequencies and high concentrations.

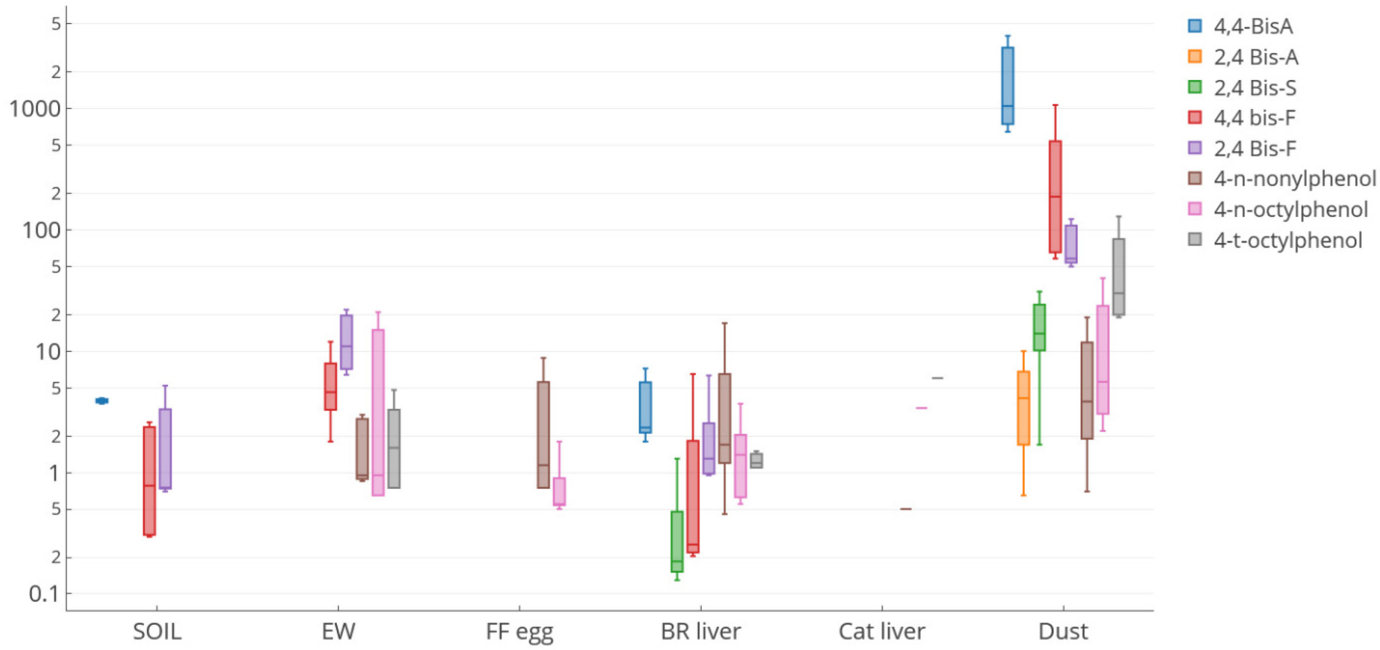


Figure 15: Box plot of bisphenols and phenols in the samples. Concentrations are given in ng/g ww (biota), ng/g dw (soil) and ng/g dust. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers.

3.1.9 Dominating pollutant groups in the species

Dominating pollutant groups with respect to average detection frequencies in each pollutant group:

Soil	Metals>PCB>cVMS*> phthalates>OPFR
Earthworm	PCB>Metals> cVMS>PFCA>PFSA
Fieldfare egg	PCB> Metals>CP>cVMS~PFCA
Brown rat liver	Metals>PCB>cVMS>CP=PFCA
Cat liver	Metals>cVMS>PCB>Biocides>UV
Indoor house dust	Metals=CP=UV comp>cVMS~ OPFR> BFR> Phenols

*cVMS: cyclic siloxanes

Dominating pollutant groups in the different matrixes were found to be as follows when sum concentrations was calculated on a wet weight basis for biota and dry weight for soil and indoor dust**:

Soil:	Metals>> Phthalates> OPFR >Phenols~UV
Earthworm:	Metals>> CP>Phenols~PFCA>PFSA
Fieldfare egg:	CP>PCB>PFSA> PFCA
Brown rat liver:	Metals> CP> Biocides>PFCA
Cat liver:	Metals> Phenols~Siloxanes>Biocides
Indoor dust:	Metals>OPFR~UV>CP >Phenols

** Concentrations below LOD were not included in the sum concentrations. Average sum concentration was calculated based on the five samples for each matrix. Metals consist of Hg, Cd, Pb and As.Phthalates were only analysed in soil

When concentrations of hydrophobic pollutants in soil samples were normalised to TOC and all biota samples to lipid content, the dominating hydrophobic organic pollutants in these samples were found to be as follows*:

Soil:	Phthalates>OPFR> Phenols>UV
Earthworm:	CP> Phenols>OPFR>Siloxanes
Fieldfare egg:	CP>Phenols>PCB~OPFR
Brown rat liver:	CP>Biocides>Siloxanes>OPFR
Cat liver:	Siloxanes~Phenols>Biocides>OPFR

* Phthalates were only analysed in soil, and selected biocides only in rat liver, cat liver and dust.

In principle, hydrophobic pollutants should be normalised with respect to lipid or organic content weight in order to be compared within and across species (with preferentially the same organs). In this study, concentrations were normalised to TOC for soil and lipid content for organisms for all compound groups except PFAS (PFSA, PFCA, new and nPFAS). Although some bisphenols might be slightly hydrophilic we normalised all to organic and lipid content. Bisphenol F was detected in soil, rat and indoor house dust, with a LogKow above 3. Bisphenol A with a LogKow around 4 was dominating in indoor house dust samples. Alkylphenols were detected in several samples and these phenols are hydrophobic. Among OPFR compounds some compounds might be water soluble (Bika et al 2022), but we chose to normalise these to the content of organic content in soil and lipids in biota. TCPP, the dominating OPFR compound in most samples, has a relatively low $LogK_{ow}$ (2.6) and high water solubility (1200 mg/l). Organic content in dust samples were not known.

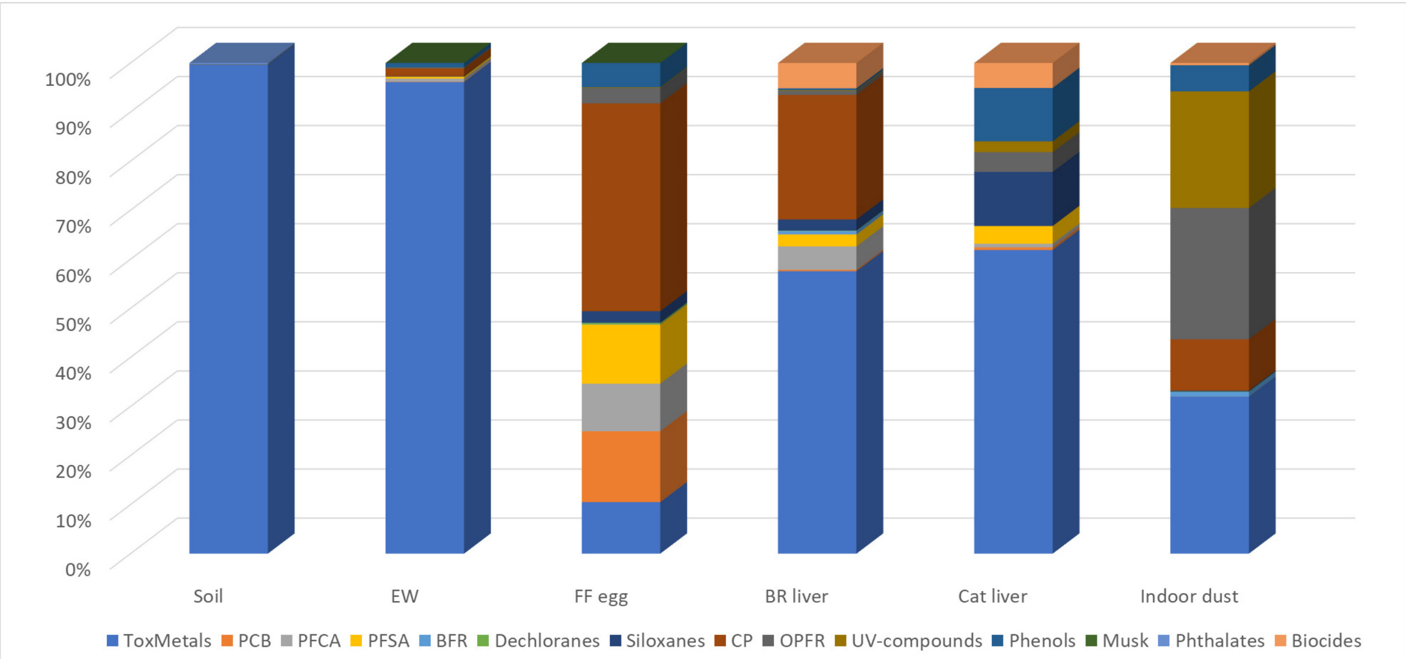


Figure 16: Percentage distribution of average sum concentrations of compound classes in matrices: Soil, earthworm (EW), fieldfare egg (FF egg), brown rat liver (BR liver), fieldfare egg (FF egg), Cat liver and Indoor Dust. Biota in ng/g ww, soil in ng/g dw and indoor dust as ng/g sample. Phthalates were only analysed in soil, biocides in BR liver, Cat liver and dust samples. Tox Metals are Pb, Cd, Hg and As.

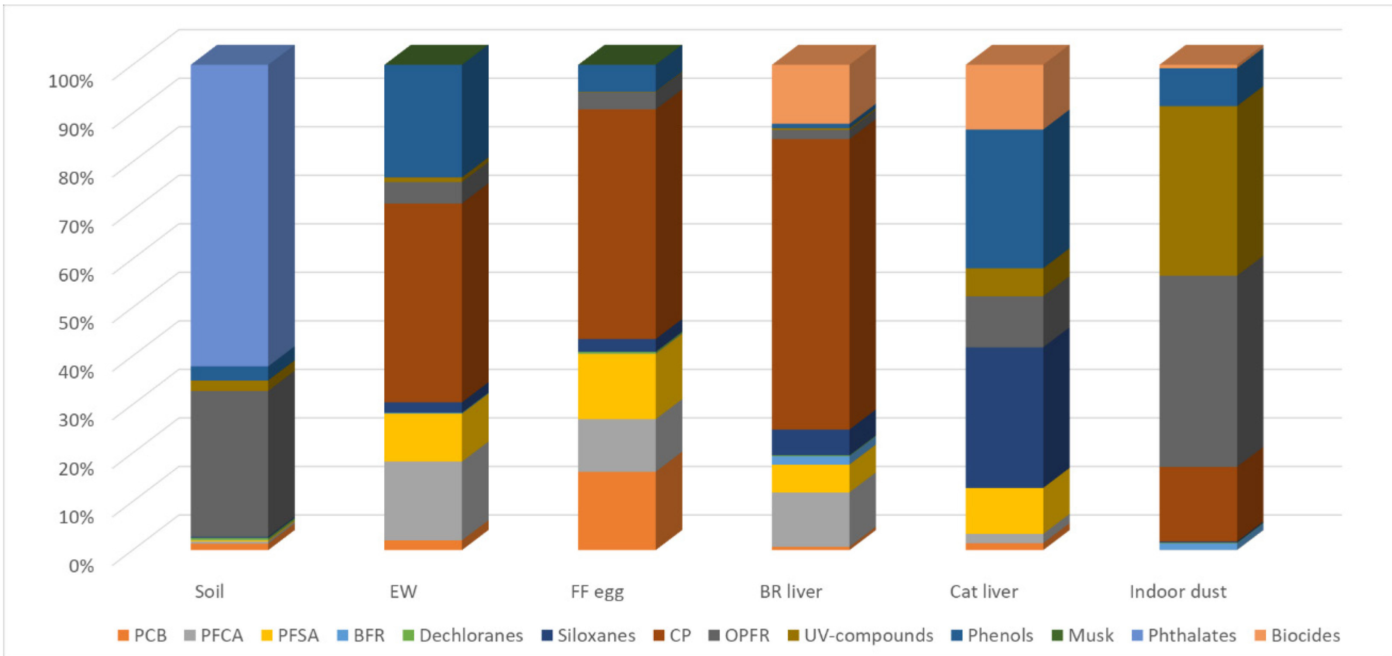


Figure 17: Percentage distribution of sum concentrations of organic pollutant classes in matrices: Soil, earthworm (EW), fieldfare egg (FF egg), brown rat liver (BR liver), fieldfare egg (FF egg), Cat liver and Indoor Dust. Biota in ng/g ww, soil in ng/g dw and indoor dust as ng/g sample. Phtalates were only analysed in soil, biocides in BR liver, Cat liver and dust samples.

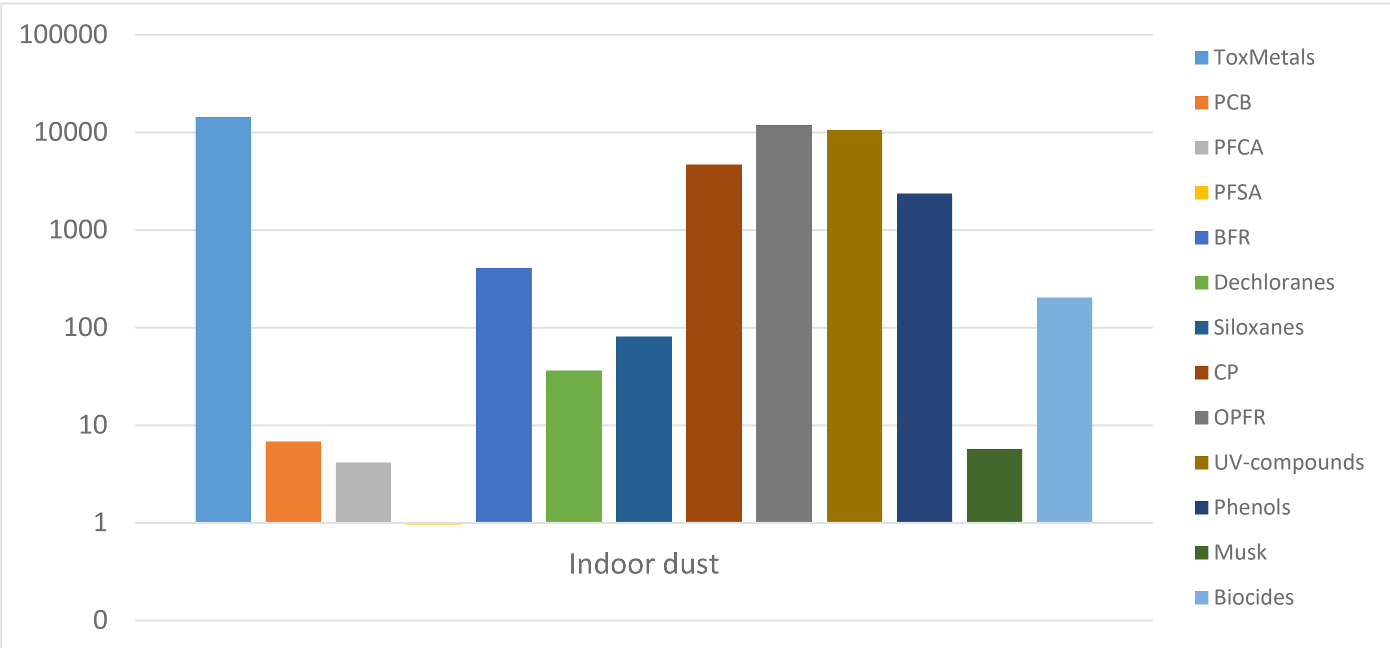


Figure 18: Average sum concentrations (ng/g dust) of all compound groups in indoor house dust.

3.1.10 Bioaccumulation and biomagnification factors

Simple biota soil accumulation factor (BSAF) and biomagnification factor (BMF), excluding trophic levels in the equations of prey and predator, were calculated for some compounds with detected data at specific locations in Oslo, see tables below and chapter 5.1.15 in Appendix 2 for more details. Median BSAF, BAF and BMF values are given together when detection rate was below n=4.

Table 5: **BSAF (C_{EWlw}/ $C_{SoilTOC}$)** for cyclic siloxanes, OPFR-, UV compunds and HBCD isomers at the various locations. <LOD is marked where either one or both soil and earthworm conc. were below LOD.

Compounds	BSAF Alna	BSAF Alnaparken	BSAF Ammerud	BSAF Hølaløkka	BSAF Svartdalsp.	Median BSAF
D4	5.91	21.8	31.1	19.9	11.2	19.9
D5	4.49	12.9	20.8	17.0	4.69	12.9
D6	2.78	8.57	<LOD	27.0	3.64	6.1
TCPP*	<LOD	<LOD	1.50	<LOD	1.04	1.3 (n=2)
TIBP/TNBP*	<LOD	<LOD	<LOD	<LOD	1.19	1.2 (n=1)
α-HBCD	<LOD	<LOD	<LOD	<LOD	0.26	0.3 (n=1)
γ-HBCD	1.06	<LOD	<LOD	<LOD	<LOD	1.1 (n=1)
UV-328	1.56	<LOD	<LOD	<LOD	<LOD	1.6 (n=1)

* TCPP has a logKow below 3, and BSAF on a wet weight basis was 1.34 and 1.20 for Ammerud and Svartdalsparken, respectively. BSAF for TIBP/TNBP (LogKow ~4) for Svartdalsparken was 1.37 on a wet weight basis.

Table 6: **BAF (C_{EW} /C_{Soil})$_{ww}$** values for PFAS compounds with detected concentrations on a wet weight basis for the various locations.<LOD is marked where either one or both soil and earthworm conc. were below LOD.

Compounds	**BAF Alna**	**BAF Alnaparken**	**BAF Ammerud**	**BAF Hølaløkka**	**BAF Svartdalsparken**	Median BSAF
PFPA	<LOD	<LOD	<LOD	<LOD	29.5	29.5 (n=1)
PFHpA	<LOD	9.83	6.81	2.27	<LOD	6.8 (n=3)
PFOA	5.03	6.36	7.27	2.36	75.2	6.4
PFNA	2.75	5.96	11.5	7.85	41.3	7.9
PFUnDA	<LOD	<LOD	<LOD	1.90	<LOD	1.9 (n=1)
PFBS	<LOD	52.1	<LOD	<LOD	<LOD	52.1 (n=1)
PFOS (sum)	9.60	69.3	27.7	8.00	40.1	27.7

Table 7: **BMF (C_{FF}/C_{EW})$_{lw}$** for cyclic siloxanes, OPFR, CP and UV compounds on a lipid weight basis. <LOD is marked where either one or both of earthworm and fieldfare egg conc. were below LOD.

Compounds	BMF Alna	BMF Alnaparken	BMF Ammerud	BMF Hølaløkka	BMF Svartdalsp.	Median BMF
D4	0.99	<LOD	<LOD	<LOD	<LOD	0.99 (n=1)
D5	15.5	4.09	0.72	0.72	1.69	1.7
D6	5.28	1.72	0.69	0.11	0.92	0.9
MCCP	<LOD	<LOD	1.18	<LOD	<LOD	1.2 (n=1)
TCPP*	<LOD	<LOD	1.27	<LOD	<LOD	1.3 (n=1)
TIBP/TNBP	<LOD	<LOD	0.28	0.32	0.14	0.3 (n=3)
EHMC-Z	0.48	<LOD	<LOD	<LOD	<LOD	0.5 (n=1)

*BMF of TCPP on a wet weight basis was 0.55 for Ammerud

Table 8: **BMF (C_{FF}/C_{EW})$_{ww}$** values for PFAS compounds with detected concentrations on a wet weight basis. <LOD is marked where either one or both soil and earthworm conc. were below LOD.

Compounds	BMF Alna	BMF Alnaparken	BMF Ammerud	BMF Hølaløkka	BMF Svartdalsparken	**Median BMF**
PFOA	1.33	1.14	0.31	0.15	0.02	0.3
PFNA	0.34	1.83	0.63	0.47	0.12	0.5
PFDcA	0.32	7.72	1.99	1.50	0.41	1.5
PFUnA	0.31	5.24	1.88	3.70	0.73	1.9
PFDoA	0.84	8.12	2.71	<LOD	1.08	1.9
PFTriA	1.05	4.39	1.66	2.32	0.71	1.7
PFTeA	2.98	2.54	0.99	2.10	0.50	2.1
PFHxDA	0.40	0.55	0.62	1.01	0.21	0.6
PFHxS	0.13	0.52	0.28	0.09	<LOD	0.2
PFHpS	0.09	0.30	<LOD	0.09	0.04	0.1
PFOS (sum)	0.8	2.8	3.8	1.4	8.5	2.8
PFDcS	1.74	<LOD	<LOD	1.87	<LOD	1.8 (n=2)

3.2 Recommendations for future development of the monitoring programme

The third period (2021-2025) of the urban terrestrial monitoring programme included several new species, new pollutants in some of the contaminant classes, and some new contaminant groups. Fieldfare eggs from Grønmo have shown stable and relatively high PFOS concentration (250 ng/g ww) the last 3-4 years of the previous program period. In order to elucidate if these levels in fieldfare eggs could be due to local sources, we recommend future sampling of fieldfare egg, earthworm and soil at Grønmo location.

- We recommend analysing other components in the four slug samples from 2022, which had the same locations as soil, earthworm and fieldfare egg.
- Indoor house dust samples revealed high detection rates and high concentrations for OPFR, CP, UV and should be followed up with additional sampling and analysis in the coming years.
- The determination of TOC in dust samples could be of interest in order to investigate associations of contaminant load to organic content.
- In order to use TMF calculations it is recommended to have similar number of samples at lower and higher trophic levels, at least three trophic levels, rather muscle than liver samples, and organisms related by diet through the food web.

3.3 Acknowledgements

We are grateful for all help from many participants in the project and a special thanks goes to:

NINA:
Augusta Hlin Aspar Sundbø (NINA), Kristine Roaldsnes Ulvund (NINA) and Magdalene Langset (NINA), prepared the egg and liver samples before analysis. Lisa Åsgård, Carl Christian Holm, Gjøran Stenberg, Anders Endrestøl (NINA), Sveinn Are Hanssen (NINA), Nina Eide (NINA), Neri Horntvedt Thorsen (NINA).

Anticimex for collecting brown rat samples.

IFE:
Ingar Johansen, responsible for stable isotope analysis.

NIVA:
Laura Röhler and Jan Tomas Rundberget, for chemical analysis of biocides and UV compounds.

NILU, sample preparation and chemical analyses;
Oda Siebke Løge, Silje Winnem, Vladimir Nikiforov, Nahla Ibrahim Zainalabdeen, Silje Thomassen, Kirsten Davanger, Inger Christin Steen, Sheryl Rodrigo, Stine M. Bjørneby, Mebrat Ghebremeskel, Heidi Eikenes, Hans Gundersen, Hilde T. Uggerud, Marit Vadset, Morten Bjørklund, and Gabriele Piattoli.

Marius Gudbrandsen and Birk Barøy for collecting Spanish slug samples.

4 Appendix 1: Material & Methods

4.1 Sampling and matrices

Soil and earthworms

Soil and earthworm samples were collected at the same five locations (Table 9). The upper layer of 0-20 cm of soil was sampled and at three locations at each site, combining the three subsamples to one pooled sample per location. In cases where the site was connected to a transition between forest and open field, samples were taken in the forest, in the field and between. For earthworms, pooled samples at each site consisted of 15-20 individuals. To purge their guts, earthworms were kept in aluminium covered plastic containers, and lined with moist paper sheets for three days before being frozen at -20°C.

Table 9: Locations for soil and earthworm sampling.

Location for soil and earthworms	Date	Soil depth	Site description
Alna (Alnabru) 59.920027, 10.834633	August 17	14 cm	The samples were collected near the river Alna, hiking track and industry area. Soil sampled at three places among trees. Large earthworms.
Alnaparken 59.944753, 10.879040	August 17	20 cm	Samples along hiking and railway track, near residential area. Small earthworms, soil samples from forest clearing.
Ammerud 59.963805, 10.880665	August 17	12 cm	Soil samples near hiking track and creek, some plastic carbage.
Svartdalsparken 59.904378, 10.792512	August 17	18 cm	Park area for recreation and playground. Samples taken in birch forest near park.
Hølaløkka 59.952528, 10.882258	August 17	15 cm	Samples near water pond, industry and residential area, few earthworms, soil sampled in between trees

Fieldfare eggs

Two fieldfare eggs were collected 14th of May 2022 from each of five nest locations at Alnabru, Alnaparken, Hølaløkka, Svartdalsparken and Ammerud, 10 eggs in total, under permission from the Norwegian Environment Agency. The laying order of the eggs was not taken into account when collecting the eggs to avoid disturbing the nest more than necessary. The eggs were kept individually in polyethylene bags in a refrigerator (+4°C), before being shipped by express mail to NINA for measurements and emptying. When emptying, the whole content of the eggs was removed from the shell, homogenized and stored in a clean glass before storage at – 20°C. The weight of the eggs varied from 4.0 to 8.0 grams. Lowest weight (4.0 and 5.0 grams) of the two eggs were collected at Ammerud, where part of the eggs were broken. Both these two eggs had well developed embryos.

Table 10: Locations for fieldfare egg samples

Location for bird nest	Date	Weight two eggs (g)	Site description
Alnabru 59.915536 10.831243	May 14	8.0 and 7.8	Initial embryo development
Alnaparken 59.944608 10.878696	May 14	6.5 and 6.6.	Initial embryo development
Ammerud 59.963517 10.880198	May 14	4.0 and 5.0	Well developed embryo, one egg broken
Svartdalsparken 59.904519 10.791528	May 14	7.4 and 7.9	No embryo
Hølaløkka 59.952512 10.882977	May 14	6.0 and 6.9	No embryo in one, initial development in the other egg

Brown rat

Individual brown rats were caught during winter and spring time (March to May 2022) using clap-traps (avoiding rat poison) inside and outside in the city centre of Oslo. The rats were placed in the freezer as fast as possible on the day of collection and stored at -20°C before being shipped by express mail to NINA for measurements and dissection. Four of the five rat livers where from individual rats and liver from two female rats from the same location and address were combined to make one 15 g weight liver sample. The bodyweight of the two rats making the one pooled sample was 85.1 and 180 g. The weight of the other four rats varied between 249 and 396 grams where the one with highest weight was a male rat and the female rats.

Additional four rat liver samples from more or less the same locations and addresses were used for the analysis of biocides due to lack of sample material.

All the rat livers were sent frozen packed in aluminium foil in zip locked bags by express mail to NILU for analyses.

House dust samples

The house dust samples were collected in five households in the Oslo area, Norway, during Fall 2022. In each household, two separate rooms were sampled, giving 10 indoor dust samples. Due to the lack of samples of cat liver and the connection indoor dust samples, households with dogs were selected.

House	Sampling location
1	Living room with dog bed
	Living room, TV bench
2	Guest room, bed
	Living room, armchair (for dog)
3	Basement, hallway
	Home office
4	Bedroom
	Dining room
5	Bedroom 1
	Bedroom 2

The participants were asked to clean normally until one week before sampling and then not to vacuum clean or wet clean the floors and the horizontal surfaces in the rooms during the last week before sampling so that all samples would reflect an accumulation time of about one week.

The dust samples were collected on a cellulose filter using an industrial vacuum cleaner (Nilfisk GM 80P) equipped with a special forensic nozzle with a one-way filter housing (KTM AB, Bålsta, Sweden) placed in the front of the vacuum cleaner tube (Bohlin-Nizzetto et al., 2015). After sampling a lid was put on the filter housing, and the whole sampling compartment was wrapped in double layers of alumina foil, placed in two sealed plastic bags and stored at -20°C until sample preparation.

Cat liver

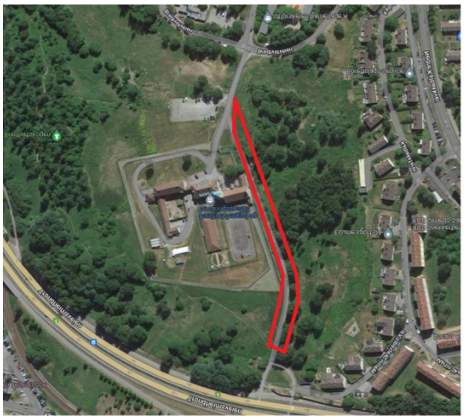
Several veterinary clinics in Oslo were contacted, and one came back with a positive response. Even though the sampling period was extended, only one cat was donated for research.

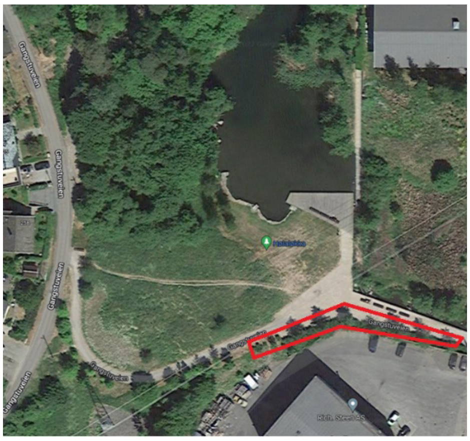
The cat was placed a freezer as fast as possible on the day of collection and stored at -20°C before being shipped by express mail to NINA for dissection.

Spanish slug

Spanish slug samples (10-11 individuals) were collected in 2022 from four different locations; Steinbruvann (included Badedammen), Hølaløkka, Svartdalsparken and Alna (Bredtvedt prison). These samples were only analysed for PFAS and with the TOPA assay.

Table 11: Locations for Spanish slug samples.

Location for Spanish slug	Date	No. of individuals	Site description (area for sampling outlined in red frame)
Steinbruvannet 59.9724516 10.882589	28.06.22	10 -11	
Alna 59.949005 10.859197	June-July 2022	10 -11	
Svartdalsparken 59.903946 10.798328	03.07.22	10 -11	

Hølaløkka 59.951843 10.883246	June-July 2022	10 -11	

4.2 Investigated environmental pollutants

In this study a total of 166environmental pollutants were investigated. These included metals, seven PCB, PFAS, other BFR, dechloranes, cyclic and linear siloxanes, chlorinated paraffins (SCCP and MCCP), organic phosphorous compounds (OPFR), UV compounds, phenols, musks, phthalates (soil), biocides (rat samples). In addition, the stable isotopes $\delta^{15}N$ and$\delta^{13}C$ were monitored. An overview over the analysed compounds is given in *Table 12*.

Table 12: Overview over analysed compounds.

Compounds	Abbreviation	CAS
Metals		
Chromium	Cr	7440-47-3
Nickel	Ni	7440-02-0
Copper	Cu	7440-50-8
Zink	Zn	7440-66-6
Arsenic	As	7440-38-2
Silver	Ag	7440-22-4
Cadmium	Cd	7440-43-9
Lead	Pb	7439-92-1
Mercury	Hg	7439-97-6
Gadolinium	Gd	7440-54-2
Antimony	Sb	7440-36-0
Tin	Sn	7440-31-5
Polychlorinated biphenyls (PCB)		
2,4,4'-Trichlorobiphenyl	PCB-28	7012-37-5
2,2',5,5'-Tetrachlorobiphenyl	PCB-52	35693-99-3
2,2',4,5,5'-Pentachlorobiphenyl	PCB-101	37680-73-2
2,3',4,4',5-Pentachlorobiphenyl	PCB-118	31508-00-6
2,2',3,4,4',5'-Hexachlorobiphenyl	PCB-138	35065-28-2
2,2',4,4',5,5'-Hexachlorobiphenyl	PCB-153	35065-27-1
2,2',3,4,4',5,5'-Heptachlorobiphenyl	PCB-180	35065-29-3
Per- and polyfluorinated alkyl substances (PFAS)		
PFCA (perfluorinated carboxylate acids)		
Trifluoro acetic acid	TFA	76-05-1
Perfluoro propanoic acid	PFPrA	422-64-0
Perfluorinated butanoic acid	PFBA	375-22-4
Perfluorinated pentanoic acid	PFPA	2706-90-3
Perfluorinated hexanoic acid	PFHxA	307-24-4
Perfluorinated heptanoic acid	PFHpA	335-67-1
Perfluorinated octanoic acid	PFOA	375-95-1
Perfluorinated nonanoic acid	PFNA	335-76-2
Perfluorinated decanoic acid	PFDA	2058-94-8
Perfluorinated undecanoic acid	PFUnDA	307-55-1
Perfluorinated dodecanoic acid	PFDoDA	72629-94-8
Perfluorinated tridecanoic acid	PFTrDA	376-06-7
Perfluorinated tetradecanoic acid	PFTeDA	67905-19-5
Perfluorinated hexadecanoic acid	PFHxDA	16517-11-6

Compounds	Abbreviation	CAS
Perfluorinated octadecanoic acid	PFOcDA	16517-11-6
PFSA (Perfluorinated sulfonates)		
Perfluoro ethane sulfonate	PFEtS	354-88-1
Perfluoro propane sulfonate	PFPrS	423-41-6
Perfluorinated butane sulfonate	PFBS	375-73-5
Perfluorinated pentane sulfonate	PFPS	2706-91-4
Perfluorinated hexane sulfonate	PFHxS	355-46-4
Perfluorinated heptane sulfonate	PFHpS	375-92-8
Perfluorinated octane sulfonate (linear)	PFOS	2795-39-3
Perfluorinated octane sulfonate (branched)	brPFOS	1763-23-1
Perfluorinated nonane sulfonate	PFNS	17202-41-4
Perfluorinated decane sulfonate	PFDcS	67906-42-7
Perfluoroundecane sulfonate	PFUnS	441296-91-9
Perfluorododecane sulfonate	PFDoS	79780-39-5
Perfluorotridecane sulfonate	PFTrS	749786-16-1
Perfluorotetradecane sulfonate	PFTS	n/a
nPFAS (polyfluorinated neutral compounds)		
Perfluorooctane sulfonamide	PFOSA	754-91-6
N-(methyl)nonafluorobutanesulfonamide	N-MeFBSA	68298-12-4
N-ethyl-perfluorobutane-1-sulfonamide	N-EtFBSA	40630-67-9
Perfluorobutylsulphonamide	PFBSA	30334-69-1
N-Methyl perfluorooctane sulphonamide	MeFOSA	31506-32-8
N-Ethyl perfluorooctane sulfonamide	EtFOSA	4151-50-2
N-Methylperfluorooctanesulfonamidoethyl acrylate	MeFOSEA	25268-77-3
N-Methyl perfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
N-Ethyl perfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2
Perfluorooctane sulfonamidoacetic acid	FOSAA	2806-24-8
N-Methylperfluoro-1-octanesulfonamidoacetic Acid	Me-FOSAA	2355-31-9
N-Ethyl perfluorooctanesulfonamidoacetic acid	Et-FOSAA	2991-50-6
newPFAS		
6:2 Fluorotelomersulfonate	6:2 FTS	27619-97-2
8:2 Fluorotelomersulfonate	8:2 FTS	481071-78-7
10:2 Fluorotelomersulfonate	10:2 FTS	120226-60-0
12:2 Fluorotelomersulfonate	12:2 FTS	149246-64-0
4:2 Fluorotelomersulfonate	4:2 FTS	757124-72-4
Cyclohexanesulfonic acid, decafluoro(pentafluoroethyl)	PFECHS	67584-42-3
BFR		
Decabromodiphenyl ethane	DBDPE	84852-53-9
2,4,6-tribromophenyl ether)	ATE (TBP-AE)	3278-89-5
α-1,2-Dibromo-4-(1,2-di-bromo-ethyl)cyclohexane	α-TBECH	3322-93-8
β-1,2-Dibromo-4-(1,2-di-bromo-ethyl)cyclohexane	β-TBECH	3322-93-8
γ/δ- 1,2-Dibromo-4-(1,2-di-bromo-ethyl)cyclohexane	γ/δ-TBECH	3322-93-8
2-bromoallyl 2,4,6-tribromophenyl ether	BATE	99717-56-3
1,2,3,4,5 Pentabromobenzene	PBBZ	608-90-2
Pentabromotoluene	PBT	87-83-2

Compounds	Abbreviation	CAS
Pentabromoethylbenzene	PBEB	85-22-3
Hexabromobenzene	HBB	87-82-1
2,3-dibromopropyl 2,4,6-tribromophenyl ether	DPTE	35109-60-5
2-Ethylhexyl 2,3,4,5-tetrabromobenzoate	EHTBB	183658-27-7
1,2-Bis(2,4,6-tribromophenoxy)ethane	BTBPE	37853-59-1
Bis(2-ethylhexyl) tetrabromophthalate	TBPH (BEH/TBP)	26040-51-7
α-Hexabromocyclododecane	α-HBCD	134237-50-6
β-Hexabromocyclododecane	β-HBCD	134237-51-7
γ-Hexabromocyclododecane	γ-HBCD	134237-52-8
Dechloranes and dibromoaldrin		
Dechlorane plus syn	syn-DP	135821-03-3
Dechlorane plus anti	anti-DP	135821-74-8
Dechlorane 601	Dec-601	3560-90-2
Dechlorane 602	Dec-602	31107-44-5
Dechlorane 603	Dec-603	13560-92-4
Dechlorane 604	Dec-604	34571-16-9
Dibromoaldrin	DBA	20389-65-5
Cyclic volatile methyl siloxanes		
D4 - octamethylcyclotetrasiloxane	D4	556-67-2
D5 - decamethylcyclopentasiloxane	D5	541-02-6
D6 - dodecamethylcyclohexasiloxane	D6	540-97-6
Tris(trimethylsiloxy)phenylsilane	M3T (Ph)	2116-84-9
Linear siloxanes		
L3- octamethyltrisiloxane	L3	107-51-7
L4- decamethyltetrasiloxane	L4	141-62-8
L5- dodecamethylpentasiloxane	L5	141-63-9
Chlorinated paraffins (CP)		
Short-chain chlorinated paraffins (C10-C13)	SCCP	85535-84-8
Medium-chain chlorinated paraffins (C14-C17)	MCCP	85535-85-9
Organic phosphorous flame retardants (OPFR)		
Tri(2-chloroethyl)phosphate	TCEP	115-96-8
Tris(2-chloroisopropyl) phosphate	TCPP/TCIPP	13674-84-5
Tris(1,3-dichloro-2-propyl)phosphate	TDCPP/TDCIPP	13674-87-8
Tris(2-butoxyethyl) phosphate	TBEP/TBOEP	78-51-3
2-etylhexyldiphenyl phosphate	EHDP/EHDPP	1241-94-7
Tricresyl phosphate	TCP	1330-78-5
Tri-n-butylphosphate	TBP/ TnBP	126-73-8
Tri-iso-butylphosphate	TBP/TiBP	126-71-6
Triethyl phosphate	TEP	78-40-0
Tripropyl phosphate	TPrP/TPP	513-08-6
Triisobutyl phosphate	TiBP	126-71-6
Butyl diphenyl phosphate	BdPhP	2752-95-6
Triphenyl phosphate	TPP/TPhP	115-86-6
Dibutylphenyl phosphate	DBPhP	2528-36-1

Compounds	Abbreviation	CAS
Trixylylphosphate	TXP	25155-23-1
Tris(4-isopropylphenyl)phosphate	TIPPP/T4IPP	26967-76-0
Tris(4-Tert-butylphenyl)phosphate	TTBPP	78-33-1
Tris(2-ethylhexyl)phosphate	TEHP	78-42-2
UV compounds		
Octocrylene	OC	6197-30-4
Benzophenone-3	BP3	131-57-7
Ethylhexylmethoxycinnamate	EHMC	5466-77-3
2-(5-Chloro-2H-benzotriazol-2-yl)-4,6-di-tert-butylphenol	UV-327	3864-99-1
2-(2H-Benzotriazol-2-yl)-4,6-di-tert-pentylphenol	UV-328	25973-55-1
Octrizole	UV-329	3147-75-9
Homomenthyl salicylate	Homosalate	118-56-9
Musk compounds		
OTNE	OTNE	54464-57-2
Galaxolide	Galaxolide	1222-05-5
Tonalide (AHMT)	Tonalide	1506-02-1
Traseolide (musk methyl ketone)	Traseolide	68140-48-7
Phantolide	Phantolide	15323-35-0
Celestolide	Celestolide	13171-00-1
Phenols		
Tetrabromobisphenol A	TBBPA	79-94-7
4,4 Bisphenol A	4,4 Bis-A	80-05-7
2,4- Bisphenol A	2,4 Bis-A	837-08-1
2,4 Bisphenol S	2,4 Bis-S	5397-34-2
4,4 Bisphenol F	4,4 Bis-F	620-92-8
2,4 Bisphenol F	2,4 Bis-F	2467-03-0
Bisphenol G	Bis- G	127-54-8
Bisphenol FL	Bis-FL	3236-71-3
Bisphenol AP	Bis-AP	1571-75-1
Bisphenol Z	Bis-Z	843-55-0
Bisphenol E	Bis-E	2081-08-5
Bisphenol B	Bis-B	77-40-7
Bisphenol M	Bis-M	13595-25-0
AO-MB1	AO-MB1	118-82-1
4-Dodecylphenol	4-Dodecylphenol	104-43-8
4-n-Nonylphenol	4-n-Nonylphenol	104-40-5
4-n-Octylphenol	4-n-Octylphenol	1806-26-4
4-t-Octylphenol	4-t-Octylphenol	140-66-9
Biocides (rodenticides)		
Bromadiolon		28772-56-7
Brodifacoum		56073-10-0
Flocumafen		90035-08-8
Difenacoum		56073-07-5
Difethialone		104653-34-1

Compounds	Abbreviation	CAS
Permethrin		52645-53-1
Phthalates		
Di (2-ethylhexyl)phthalate	DEHP	117-81-7
Di(2-propylheptyl) + Di-isodecyl phthalate	DPHP+DiDP	53306-54-0 +68515-49-1
Di-isononyl phthalate	DiNP	28553-12-0
Di-isobutyl phthalate	DiBP	84-69-5
Di-n-butyl phthalate	DnBP	84-74-2
Diethyl phthalate	DEP	84-66-2
Benzyl butyl phthalate	BBP	85-68-7
Dicyclohexyl phthalate	DCHP	84-61-7
Dihexyl phthalate	DHxP	84-75-3
Dioctyl phthalate	DOP	117-84-0
Dinonyl phthalate	DNP	84-76-4
Diundecyl phthalate, branched and linear	DiUnP	85507-79-5

4.3 PNEC values

Table 13: PNEC values for **Soil ecosystem** with references. Most data adopted from Andersen et al 2012[4], EU risk assessment reports (EU RAR), Environment Agency risk evaluation reports (EA ERAR) and European Chemicals Agency, http://echa.europe.eu. Entries with font coloured in grey are second priority due to assumed less reliability.

Compound	$PNEC_{Soil}$	Unit in soil	Reference	Safety factor	Endpoint
BPA (4,4 Bis-A)	3.2	mg/kg dw	EU RAR BPA	10	Calculated from PNECaquatic –D. magna
TBBPA	0.012	mg/kg dw	EU draft RAR TBBPA	10	Earthworm reproduction
PentaBDE	0.38	mg/kg dw	TA-2625	50	
OctaBDE	20.9	mg/kg ww	EU RAR 2003	50	Phytotoxicity
DecaBDE	98	mg/kg ww	EU RAR 2002	50	
HexBDE	1.2	mg/kg ww	EU RAR 2003	50	Phytotoxicity
TriBDE	20.9	mg/kg ww	Using Octa BDE value	50	Phytotoxicity
TetraBDE	20.9	mg/kg ww	Using Octa BDE value*	50	Phytotoxicity
HeptaBDE	20.9	mg/kg ww	Using Octa BDE value	50	Phytotoxicity
NonaBDE	20.9	mg/kg ww	Using Octa BDE value	50	Phytotoxicity
Cyclic siloxane (D4)	0.16	mg/kg ww	EA ERA 2009 Octamethylcyclotetra-siloxane		PNEC for water, equilibrium partitioning method
Cyclic siloxane (D4)	0.15	mg/kg dw	European Chemicals Agency,		partition coefficient
Cyclic siloxane (D5)	4.8	mg/kg ww	EA ERA 2009 Decamethylcyclo-pentasiloxane		PNEC for water, equilibrium partitioning method
Cyclic siloxane (D5)	3.77	mg/kg dw	European Chemicals Agency	100	
Nonylphenols	0.3	mg/kg dw	European Chemicals Bureau, 2002	10	Earthworm reproduction

[4] Andersen, S., Gudbrandsen, M., Haugstad, K., Hartnik, T. (2012) Some environmentally harmful substances in sewage sludge - occurrence and environmental risk. Oslo, Norwegian Climateand Pollution Agency (TA-3005/2012). (In Norwegian).

Compound	$PNEC_{Soil}$	Unit in soil	Reference	Safety factor	Endpoint
Octylphenols	0.0067	mg/kg dw	Environmental Agency (UK) 2005	10	Calculated from PNECaquatic-mysid M. bahia
4-tert-octylphenol	0.0059	*mg/kg ww*	EA RER 2005 4-tert-octylphenol	Large uncertainty	PNEC surface water and equilibrium partitioning
4-tert-octylphenol	2.3	mg/kg dw	European Chemicals Agency,	10	
MCCP	11.9	mg/kg dw	European Chemicals Agency,	10	
SCCP	5.95	mg/kg dw	European Chemicals Agency,	20	
MCCP	10.6	mg/kg ww	EU RAR addendum 2007	**10**	Earthworm reproduction
SCCP	1.76	mg/kg ww	EU RAR addendum 2008	**0**	LogKow estimation- no safety factor
TFA	4.7	**ng/g dw**	ECHA Chemical information (Scientific Properties)		Secondary poisoning: No potential for bioaccumulation (1)
PFOA	0.16	mg/kg dw	TA-2444/2008	100	Worm reproductivity
PFOS	0.373	mg/kg dw	pfos.uk.risk.eval.report.2004	1000	Worm toxicity
$SumPCB_7$	0.01	mg/kg dw	Aquateam rapport nr 06-039	50	Calculated from aquatic data
TCEP	0.386	mg/kg dw	EURAS, 2009	50	Folsomia candida 28 d exposure
TCPP	1.7	mg/kg dw	EU RAR TCPP	10	Spiring Lactuca sativa
TCPP	1.33-1.7	mg/kg dw	Echa Chemical Information		
TDCP/TDCPP	0.33	mg/kg dw	EU RAR 2008	10	57d NOEC reproduction toxicity E.foetida
TBEP	0.81	mg/kg dw	TA-2784	EqP	Calculated
EHDPP	0.302	mg/kg ww	Environmental Agency (UK), 2009	10	Estimated from aquatic data
TCP	0.0027	mg/kg dw	EU-RER	10	Spiring Lactuca sativa
TBP/TnBP	5.3	mg/kg dw	TA-2784	EqP	Based on LogKow
TBP/TnBP	0.64	mg/kg dw	ECHA-Registration dossier		
TIBP	0.64	mg/kg dw	TA-2784	EqP	Based on LogKow
DEHP	13	mg/kg dw	ECHA Chemical information (Scientific Properties)		
DiNP	30	mg/kg dw	ECHA Chemical information (Scientific Properties)		No potential for bioaccumulation
DPHP	26.5	mg/kg dw	ECHA Chemical information (Scientific Properties)		No potential for bioaccumulation
DnBP	50	**ng/g dw**	ECHA Chemical information (Scientific Properties)		
DiBP	23.1	**ng/g dw**	ECHA Chemical information (Scientific Properties)		No potential for bioaccumulation
UV-328 (25973-55-1)	90	mg/kg dw	ECHA Chemical information (Scientific Properties		

Compound	$PNEC_{Soil}$	Unit in soil	Reference	Safety factor	Endpoint
UV-329 (3147-75-9)	10	mg/kg dw	ECHA Chemical information (Scientific Properties		No potential to cause toxic effects if accumulated (in higher organisms) via the food chain
OC (6197-30-4)	1.25	mg/kg dw	ECHA Chemical information (Scientific Properties		No potential to cause toxic effects if accumulated (in higher organisms) via the food chain
Homosalate	54.11	mg/kg dw	ECHA Chemical information (Scientific Properties		No potential to cause toxic effects if accumulated (in higher organisms) via the food chain
BP3 (131-57-7)	13	**ng/g dw**	ECHA Chemical information (Scientific Properties		Additional info: No potential for bioaccumulation
Cd	1.15	mg/kg dw	European chemicals Bureau, 2007	2	*SSD: species sensitivity distribution*
Cd	0.9	mg/kg dw	European Chemicals Agency,		
Cr	62	mg/kg dw	European chemicals Bureau, 2005	3	Estimated from aquatic data
Cu	89.6	mg/kg dw	European chemicals Bureau, 2008	2	SSD
Cu	65	mg/kg dw	European Chemicals Agency		
Hg	0.3	mg/kg dw	Euro-chlor, Voluntary risk assessment, Mercury, 2004	1000	Background value Soil
Hg	0.022	mg/kg dw	European Chemicals Agency,		
Ni	50	mg/kg dw	VKM report 2009	2	SSD
Pb	166	mg/kg dw	EURAS, 2008	2	SSD
Pb	147-212	mg/kg dw	European Chemicals Agency,		
Zn	26	mg/kg dw	VROM, 2008	2	SSD
Zn	35.6	mg/kg dw	European Chemicals Agency,		
As	0.7	mg/kg dw	Reimann et al. (2017)[5]		

[5] Reimann et al. (2017). GEMAS: Establishing geochemical background and threshold for 53 chemical elements in European agricultural soil. Applied Geochemistry

Table 14: **$PNEC_{oral}$ values (mg/kg in food)** for secondary poisoning with references. Most data adopted from Andersen et al 2012, EU risk assessment reports (EU RAR), Environment Agency risk evaluation reports (EA ERAR) and European Chemicals Agency, http://echa.europe.eu. Entries with font coloured in grey have second priority.

Compound	$PNEC_{oral}$ mg/kg food	Reference	Safety factor	Endpoint
PCBs	0.001	INERIS: Annex VII PNEC values and hazard information for candidate substances, 2009. *Uncertainty to the value since not based on EU Risk Assessment report*		based on TDI of 0.02 µg/kg bw/day for total PCBs via diet (WHO, 2003 & ATSDR, 2000) and TDI of 0.01 µg/kgbw/day for total PCBs, via diet (RIVM, 2001)
PCB153	0.67	TemaNord 2011: 506. ISBN 978-92.893-2194-5 Using Sludge on Arable Land (Table 7)	20	RIVM (1995) Risk assessment of bioaccumulation in the food webs of two marine AMOEBE species: common tern and harbor seal. RIVM Report 719102040.
BPA	2.67	EU RAR BPA add	30	Three generation feeding study of rats
TBBPA	667	(mammalian) EU RAR TBBPA	30	2-generation rat reproduction study
PentaBDE	1	EU Risk assessment-Diphenyl Ether, Pentabromo derivative Final Report, August 2000	10	30 day oral rat study-liver effects
OctaBDE	6.7	EU Risk assessment-Diphenyl Ether, Octabromo derivative Final Report, August 2003	10	Rabbit phetotoxicity
DecaBDE	833	DecaBDE, EA-ENvRA-2009	30	Rat, two years carcinogenicity study
PFOS	0.067	Brooke et al. 2004 http://www.environment-agency.gov.uk/	30	Rat liver effects, chronic study NOEC 2mg/kg
PFOS	0.017	Brooke et al. 2004	30	Rat liver effects, chronic study Lowest no effect 0.5 ppm
PFOS	0.037	RIVM 2010 http://www.rivm.nl/dsresource?objectid=rivmp:15878&type=org&disposition=inline&ns_nc=1	90	NOAEL of 0.1 mg/kgbw/d for maternal weight gain from a teratogenicity study
PFOS	0.033	European Commission. 2011. Perfluorooctane sulfonate. PFOS Environmental Quality Standard (EQS) dossier. Brussels, Belgium.		QSbiota (secondary poisoning: predators)
PFOS	0.33	Newsted et al 2007, in Appendix 3, RIVM 2010	30	21 weeks, bodyweight, reproduction, NOEC, northern bobwhite quail
PFOA	0.9E-03	Valsecchia et al 2016 doi:10.1016/j.jhazmat.2016.04.055	90	Developmental abnormalities in mice
HCB	0.0167	Science Dossier http://www.eurochlor.org/media/90477/sd16-hcbaquaticra-final.pdf	30	NOEC mink 0.5 mg/kg
DEHP	3.3	ECHA Chemical Information		

Compound	$PNEC_{oral}$ mg/kg food	Reference	Safety factor	Endpoint
DnBP	1.33	ECHA Chemical Information		https://echa.europa.eu/brief-profile/-/briefprofile/100.001.416
Cyclic Siloxane (D4)	1.7	EA ERAR 2009 Octamethylcyclotetra-siloxane	300	Rat liver effects
Cyclic Siloxane (D4)	41	Source: European Chemicals Agency, http://echa.europa.eu/	90	
Cyclic Siloxane (D5)	13	EA ERAR 2009 Decamethylcyclopenta-Siloxane,	30	Repeated exposure, liver effects
Cyclic Siloxane (D5)	16	Source: European Chemicals Agency, http://echa.europa.eu/	90	
Cyclic Siloxane (D6)	66.7	Source: European Chemicals Agency, http://echa.europa.eu/	300	
Cyclic Siloxane (D6)	50-100	EA ERAR 2009	300	Reproduction NOAEL rat
Nonylphenols	10	EU RAR nonylphenol	10	Rat multi-generation study, reproduction effect
Octylphenols	10	Environmental Agency (UK) 2005	30	Rat, two-generation study, systemic and postnatal toxicity
4-tert-octylphenol	10	EA RER 2005 4-tert-octylphenol	30	
4-tert-octylphenol	2.36	Source: European Chemicals Agency, http://echa.europa.eu/	30	
MCCP	10	EU RAR addendum 2007	30	Rat, 90 days study, kidney effects
SCCP	5.5	EU RAR addendum 2008	30	Reproduction effects on wild duck
TDCP	3.3	EU RAR 2008	30	Two-years carcinogenicity rat study
EHDPP	1.1	Environmental Agency (UK) 2009	90	Rat 90 d oral exposure
TCP	1.7	EA RER 2009 (1330-78-5)	30	Two-years reproduction mouse study
TCPP	11.6	EU RAR TCPP 2008	90	Rat, 13 weeks study, liver effects
DEHP	3.3	ECHA chemical information (scientific information)		
UV-328	13.2	ECHA chemical information (scientific information)		
Cd	0.16	EU RAR	10	Based on 4 studies with birds and 5 studies with mammals
Hg and inorganic compounds	0.02	INERIS: Annex VII PNEC values and hazard information for candidate substances, 2009.	10	CIRCA data sheet, Dir. 2008/105/EC NOEC: 0.22 mg/kg_food Rhesus monkey, 1 year, growth
Hg	0.4	2009, Munoz et al.	10	NOEC 4 mg/kg food for Coturnis c. Japonica.
Ni	8.5	EU RAR Ni 2008	10	Wild duck, tremor effects observed in chickens at day 28

Compound	$PNEC_{oral}$ mg/kg food	Reference	Safety factor	Endpoint
Pb	3.6	Lead Water Framework Directive EQS dossier 2011	15	SSD
Bromadiolone	0.00019-0.00044	Directive 98/8/EC concerning the placing of biocidal products on the market 2010, Bromadiolone	90	NOAEL (mammals)
Permethrin	0.22	INERIS: Annex VII PNEC values and hazard information for candidate substances, 2009.	90	

EU RAR: EU Risk Assessment report

EA RER: Environmental Agency Risk Evaluation Report

4.4 Biomagnification

Field derived trophic magnification factor (TMF) can be useful to evaluate bioaccumulation when diet is the major route of exposure. TMF is a measure for biomagnification of a chemical within food web, and represents the average diet-to-consumer transfer of a chemical through food webs. TMF differs from biomagnification factors, which apply to individual species and can be highly variable between predator-prey combinations. The TMF is calculated from the slope of a regression between the chemical concentration and trophic level (TL) of organisms in the food web. The trophic level can be determined from stable N isotope ratios, $\delta^{15}N$ (Borgå et al. 2012). The general scientific consensus is that chemicals are considered bioaccumulative if they exhibit a TMF > 1.

The recommended TL equation for determining trophic magnification factor for application under the European Union Water Framework Directive (Kidd et al., 2019), and has been used for a terrestrial food chain (Huang et al. 2022):

$$TL\ (consumer) = 2 + (\delta^{15}N_{consumer} - \delta^{15}N_{baseline})/3.4$$

where TL(consumer) is the TL of the organism/consumer, and $\delta^{15}N_{consumer}$ and $\delta^{15}N_{baseline}$ are the $\delta^{15}N$ data for an organism and the baseline species, respectively, 2.0 is the assumed TL of the baseline species.

3.4 is a recommended isotopic (trophic) enrichment factor which in principle may vary from limnic to terrestrial food webs. A value of 3.4‰ per TL step has been recommended for constructing food webs without a priori knowledge of Δ15N or the ecology of the system (Kidd et al., 2019).

Kidd et al., 2019 recommended that the TMF study ideally includes species and individual organisms that range over at least 3 TLs to achieve the objective of quantifying biomagnification potential of a chemical.

Trophic magnification factors (TMFs) are calculated as the power of 10 of the slope (b) of the linear regression between log concentration and the samples TL.

$$\text{Log [compound]} = a + b\text{TL}$$

$$TMF = 10^{b}$$

Bioaccumulation and biomagnification factors, BSAF and BAF

Field based bioaccumulation factor (BAF) or biota-soil accumulation factor (BSAF) can be used to evaluate potential bioaccumulation from soil to soil living species such as earthworm.

For hydrophobic compounds such as PCBs, BFRs, siloxanes, UV compounds, the BSAF is normally calculated with concentrations normalized with respect to total organic content (TOC) in soil and lipid normalized concentrations in biota.

BSAF= C_{EW} (ng/g lw) / C_{soil} (ng/g TOC)

For PFAS, BSAF (or BAF) has in some cases been calculated with wet or dry weight concentration for earthworm divided by soil concentration normalized to TOC or dry weight (Rich et al. 2015; Conder et al. 2020).

BMF for hydrophobic compounds are calculated as lipid normalized concentration in consumer (predator) divided by lipid normalized concentration in diet (prey). This is normally done for whole body concentrations or muscle concentrations. For PFAS, wet weight concentrations or protein normalised concentrations are most relevant to use for BMF calculations (Savoca and Pace, 2021).

BMF= $C_{predator}$ (ng/g lw) / C_{prey} (ng/g lw)   for hydrophobic compounds

4.5 Analytical procedures

4.5.1 Sample preparation and quality assurance

In order to get sufficient material for analysis of the various chemical classes in each sample type, samples were pooled together for earthworms, fieldfare eggs and brown rat liver samples. Pooled earthworm samples per site consisted of as many individuals as possible, in general 15-20 individuals. Samples of fieldfare eggs consisted of two eggs from the same nest in order to get sufficient material for all the analysis. One pooled sample were used for the brown rat liver consisting of two individual liver samples of the same gender from the same location. For bees and spiders many individuals made up the pooled samples.

All of the work with sample homogenisation were done in clean cabinet or clean room. In addition, a clean cabinet/clean room was used for sample extraction and clean-up for several compound classes such as: siloxanes, phthalate, musk and OPFR.

A short description of sample preparation, extraction and analytical method are given in the QA/QC tables, and more detailed description can be found in report from the previous program period (Heimstad et al., 2021).

4.6 QA/QC

In Table 15 there is a short method description, including LOQ and an assessment and categorization of the uncertainty for every individual compound analysed. The uncertainty is divided in three groups from 1 to 3.

Group 1 includes the compounds with the highest certainty. For the compounds in this group the method is well established, both at NILU and NIVA, and internationally. This means that the quality of the analysis has been proven with intercalibration studies, and quality parameters are good. Most of these analyses is accredited according to ISO 17025.

Group 2 includes the compounds with medium certainty. The internal control parameters in the lab are good, the method is fit for purpose, but the quality cannot, or have not been proven within intercalibration studies. These groups also include parameters that have been tested in intercalibration studies, but the results within the studies show that the uncertainty of this analysis still is high (typically more than 50%).

Group 3 includes the compounds with the highest uncertainty. This could be due to not satisfying recovery data, method not fit for purpose, high variability in blanks, or others. There will be comments on all these parameters.

Table 15: Quality of analytical procedures for the various parameter groups and single parameters, including LOD or LOQ and uncertainty category.

Parameter group	Name of parameter	Cas nr	Blank	LOD range mg/kg	LOQ range mg/kg	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Metals	Hg	7440-02-0	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0.0001-0.0002	0.0002-0.0004	In-house accredited method. Microwave assisted decomposition with HNO3. Digestate split and one aliquot stabilized with HCl for subsequent determination of total-Hg. Analysis by ICP-MS (Agilent 7700x). CRM digested and analysed in every run	1	
	Cr	7440-47-3		0.0002-0.0003	0.0007-0.001		1	
	Ni	7440-02-0		0.0002-0.0003	0.0007-0.001		1	
	Cu	7440-50-8		0.003-0.005	0.01-0.02		1	
	Zn	7440-66-6		0.5-0.8	2-3		1	
	As	7440-38-2		0.0001-0.0002	0.0004-0.0006		1	
	Ag	7440-22-4		0.0005-0.0008	0.002-0.003		1	
	Cd	7440-43-9		0.00002-0.00004	0.0008-0.0001		1	
	Sb	440-36-0		0.0007-0.0001	0.0002-0.0004		1	
	Sn	7440-31-5		0.0005-0.0009	0.002-0.003		2	Not accredited
	Gd	7440-54-2		0.000006-0.00001	0.00002-0.00003		2	Not accredited
	Pb	7439-92-1		0.0005-0.0008	0.002-0.003		1	

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	LOQ range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
PCB	PCB 28	7012-37-5	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0.001-0.03	0.003-0.1	In-house, accredited method. Internal standard addition, extraction, GPC and/or H_2SO_4 cleanup followed by adsorption chromatography. Analysis was performed on a GC/HRMS (autspec)	1	Y
	PCB 52	35693-99-3		0.002-0.07	0.004-0.2		1	Y
	PCB 101	37680-73-2		0.001-0.1	0.003-0.3		1	Y
	PCB 118	31508-00-6		0.001-0.1	0.003-0.4		1	Y
	PCB 138	35065-28-2		0.001-0.5	0.004-1.4		1	Y
	PCB 153	35065-27-1		0.002-0.7	0.006-2		1	Y
	PCB 180	35065-29-3		0.001-0.2	0.004-0.5		1	Y

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
PFAS, soil	TFA	76-05-1	One blank pr batch. LOD calculated from average blanks + 3 x stdevs. If no peak present noise in the chromatogram was used as a proxy.		The weighed soil sample was added 1 ml of MilliQ water and 13C internal standard. Precisely 1 ml of 200 mM NaOH in methanol is added. Let stand and soak for 30 min. Add exactly 100 µl 2M HCl in methanol plus 9 ml methanol. The sample was vortex-mixed before treated three times for 10 min in ultrasonic bath with vortex in between, followed bu centrifugation. The supernatant is up-concentrated and cleaned up with suspensive EnviCarb treatment under acidic conditions. After addition of the RSTD, samples are ready for LC/MS measurements. With each sample batch a blank and a reference material sample must be run (for more than 20 samples one each 20th samples).	2	N
	PFPrA	422-64-0				2	N
	PFBA	375-22-4		0.50-1.0		2	Y
	PFPA	422-64-0		0.15-1.0		2	Y
	PFHxA	307-24-4		0.05-0.15		1	Y
	PFHpA	335-67-1		0.05-0.15		1	Y
	PFOA	375-95-1		0.05-0.15		1	Y
	PFNA	335-76-2		0.05-0.15		1	Y
	PFDA	2058-94-8		0.05-0.15		1	Y
	PFUnDA	307-55-1		0.05-0.15		1	Y
	PFDoDA	72629-94-8		0.05-0.15		1	Y
	PFTrDA	376-06-7		0.15-0.50		1	N
	PFTeDA	67905-19-5		0.05-0.15		1	Y
	PFHxDA	16517-11-6		0.15-0.50		1	N
	PFOcDA	16517-11-6		0.15-0.50		2	N
	PFEtS	354-88-1				2	N
	PFPrS	423-41-6				2	N
	PFBS	375-73-5		0.02-0.10		1	Y
	PFPS	2706-91-4		0.02-0.10		2	N
	PFHxS	355-46-4		0.02-0.10		1	Y
	PFHpS	375-92-8		0.02-0.10		1	N
	PFOS	1763-23-1		0.02-0.10		1	Y
	brPFOS	-		0.02-0.10		1	N
	PFNS	17202-41-4		0.05-0.15		2	N
	PFDcS	67906-42-7		0.05-0.15		2	N
	PFUnS	441296-91-9		0.05-0.15		2	N
	PFDoS	79780-39-5		0.05-0.15		2	N
	PFTrS	749786-16-1		0.05-0.15		2	N
	PFTS*	n/a		0.50-1.0		3	N
	PFOSA	754-91-6		0.05-0.15		2	Y
	N-MeFBSA	68298-12-4		0.05-0.15		2	N
	N-EtFBSA	40630-67-9		0.15-0.5		2	N
	PFBSA	30334-69-1		0.05-0.15		2	N
	MeFOSA	31506-32-8		0.05-0.15		2	N

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
	EtFOSA	4151-50-2		0.05-0.15		2	N
	MeFOSEA*	25268-77-3		0.50-1.0		3	N
	MeFOSE	24448-09-7		0.05-0.15		2	N
	EtFOSE	1691-99-2		0.05-0.15		2	N
	FOSAA	2806-24-8		0.05-0.15		2	N
	Me-FOSAA	2355-31-9		0.05-0.15		2	N
	Et-FOSAA	2991-50-6		0.05-0.15		2	N
	4:2 FTS	757124-72-4		0.10-0.50		2	N
	6:2 FTS	27619-97-2		0.10-0.50		2	Y
	8:2 FTS	481071-78-7		0.10-0.50		2	N
	10:2 FTS	120226-60-0		0.10-0.50		2	Y
	12:2 FTS *	149246-64-0		0.50-1.0		3	N
	PFECHS	67584-42-3		0.10-0.50		2	N

*	PFTS	No single standard available for these compounds. Retention time and MS settings based on similar isomers and literature references
	MeFOSEA	
	12:2 FTS	

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
PFAS, biota/vegetation	TFA	76-05-1	One blank pr batch. LOD calculated from average blanks + 3 x stdevs. If no peak present noice in the chromatogram was used as a proxy.		1-2 g of biota was homogenized and added internal standard before extraction with methanol followed by vortexing and sonication for 30min. After centrifugation the supernatant was up-concentrated and cleaned up with	2	Y
	PFPrA	422-64-0				2	Y
	PFBA	375-22-4		0.50-1.0		2	Y
	PFPA	422-64-0		0.15-1.0		2	Y
	PFHxA	307-24-4		0.05-0.15		1	Y
	PFHpA	335-67-1		0.05-0.15		1	Y
	PFOA	375-95-1		0.05-0.15		1	Y
	PFNA	335-76-2		0.05-0.15		1	Y
	PFDA	2058-94-8		0.05-0.15		1	Y
	PFUnDA	307-55-1		0.05-0.15		1	Y

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
	PFDoDA	72629-94-8		0.05-0.15	suspensive EnviCarb treatment under acidic conditions. After addition of the RSTD, samples are ready for LC/MS measurements. With each sample batch a blank and a reference material sample must be run (for more than 20 samples one each 20th samples).	1	Y
	PFTrDA	376-06-7		0.15-0.50		1	N
	PFTeDA	67905-19-5		0.05-0.15		1	Y
	PFHxDA	16517-11-6		0.15-0.50		1	N
	PFOcDA	16517-11-6		0.15-0.50		2	N
	PFEtS	354-88-1				2	N
	PFPrS	423-41-6				2	N
	PFBS	375-73-5		0.02-0.10		1	Y
	PFPS	2706-91-4		0.02-0.10		2	N
	PFHxS	355-46-4		0.02-0.10		1	Y
	PFHpS	375-92-8		0.02-0.10		1	N
	PFOS	1763-23-1		0.02-0.10		1	Y
	brPFOS	-		0.02-0.10		1	N
	PFNS	17202-41-4		0.05-0.15		2	N
	PFDcS	67906-42-7		0.05-0.15		2	N
	PFUnS	441296-91-9		0.05-0.15		2	N
	PFDoS	79780-39-5		0.05-0.15		2	N
	PFTrS	749786-16-1		0.05-0.15		2	N
	PFTS *	n/a		0.50-1.0		3	N
	PFOSA	754-91-6		0.05-0.15		2	Y
	N-MeFBSA	68298-12-4		0.05-0.15		2	N
	N-EtFBSA	40630-67-9		0.15-0.5		2	N
	PFBSA	30334-69-1		0.05-0.15		2	N
	MeFOSA	31506-32-8		0.05-0.15		2	N
	EtFOSA	4151-50-2		0.05-0.15		2	N
	MeFOSEA*	25268-77-3		0.50-1.0		3	N
	MeFOSE	24448-09-7		0.05-0.15		2	N
	EtFOSE	1691-99-2		0.05-0.15		2	N
	FOSAA	2806-24-8		0.05-0.15		2	N
	Me-FOSAA	2355-31-9		0.05-0.15		2	N
	Et-FOSAA	2991-50-6		0.05-0.15		2	N
	4:2 FTS	757124-72-4		0.10-0.50		2	N
	6:2 FTS	27619-97-2		0.10-0.50		2	Y
	8:2 FTS	481071-78-7		0.10-0.50		2	N

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
	10:2 FTS	120226-60-0		0.10-0.50		2	Y
	12:2 FTS *	149246-64-0		0.50-1.0		3	N
	PFECHS	67584-42-3		0.10-0.50		2	N

*	PFTS	No single standard available for these compounds. Retention time and MS settings based on similar isomers and literature references
	MeFOSEA	
	12:2 FTS	

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	LOQ range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
BFR	ATE (TBP-AE)	3278-89-5	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0.003-0.03	0.01-0.07	In-house method. Internal standard addition, extraction, GPC and/or H_2SO_4 cleanup followed by adsorption chromatography. GC/HRMS (autspec)	2	N
	α-TBECH	3322-93-8		0.02-0.2	0.05-0.5		2	N
	β-TBECH	3322-93-8		0.05-0.2	0.04-0.4		2	N
	γ/δ-TBECH	3322-93-8		0.008-0.09	0.01-0.09		2	N
	BATE	99717-56-3		0.003-0.03	0.01-0.8		2	N
	PBT	87-83-2		0.006-0.06	0.01-0.2		2	N
	PBEB	85-22-3		0.003-0.03	0.008-0.09		2	N
	PBBZ	608-90- 2		0.05-0.5	0.2-2		2	Y
	HBB	87-82-1		0.02-0.2	0.04-0.4		2	Y
	DPTE	35109-60-5		0.004-0.03	0.01-0.07		2	N
	EHTBB	183658-27-7		0.04-0.06	0.1-0.2		2	Y
	BTBPE	37853-59-1		0.008-0.06	0.03-0.2		2	Y
	TBPH (BEH /TBP)	26040-51-7		0.06-0.1	0.2-0.4		2	N
	DBDPE	84852-53-9		2.6-28	7.76		2	Y

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	LOQ range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Dechlorane	Dibromoaldrin	20389-65-5	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0.1-0.2	0.07-0.4	In-house method. Internal standard addition, extraction, GPC and/or H_2SO_4 cleanup followed by adsorption chromatography. GCGC-qToF 7200 in ECNI	2	N
	Dechlorane 602	31107-44-5		0.003-0.3	0.007-0.07		2	Y
	Dechlorane 603	13560-92-4		0.004-0.04	0.01-0.1		2	N
	Dechlorane 604	34571-16-9		0.07-0.7	0.2-1.6		2	N
	Dechlorane 601	13560-90-2		0.006-0.07	0.02-0.2		2	N
	Dechlorane plus syn	135821-03-3		0.02-0.2	0.04-0.4		2	Y
	Dechlorane plus anti	135821-74-8		0.01-0.1	0.03-0.3		2	N

Parameter gruppe	Name parameter	Cas nr	Blank subtraction and determination of LOQ	LOQ range, µg/kg	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Cyclic siloxanes, biota/soil	D4	556-67-2	Three blanks pr batch. Blank substraction for each batch based on the blank average. LOQ calculated from 10 x stdev. from blanks	0.4-2.0	Internal standard added to 1-2 g of sample, followed by addition of acetonitrile and hexane. Ultrasonic bath and shaking before centrifugation. No further cleanup. Recovery standard added to a sub sample before analysis on GC/MSD. A detailed description can be found in previous MILBY reports.	2	Y
	D5	541-02-6		0.5-2.0		2	Y
	D6	540-97-6		0.8-1.8		2	Y
	M3T(Ph)	2116-84-9		0.1-1.0		2	N
Linear siloxanes	L3	107-51-7	Three blanks pr batch. Blank substraction for each batch based on the blank average. LOQ calculated from 10 x stdev. from blanks	0.9-1.6	Internal standard added to 1-2 g of sample, followed by addition of acetonitrile and hexane. Ultrasonic bath and shaking before centrifugation. No further cleanup. Recovery standard added to a sub sample before analysis on GC/MSD. A detailed description can be found in previous MILBY reports	3	N
	L4	141-62-8		1.8-4.9		3	N
	L5	141-63-9		1.9-8.5		3	N

Parameter group	Name of parameter	Cas nr	Blank	LOD range ng/g	LOQ range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
CP	SCCP	85535-84-8	Method blanks following sample series. SCCP og MCCP results are corrected for blanks. Blanks are subtracted on congener group level prior to deconvolution. LOD/LOQ based on calculation of 3 and 10 stddev respectively	4-16	13-51	In-house method. Internal standard addition, extraction, GPC and/or H_2SO_4 cleanup followed by adsorption chromatography. GC-qToF 7200 in ECNI	3	13C-hexachloro-decane
	MCCP	85535-85-9		13-51	43-168		3	

Parameter group	Name of parameter	Cas nr	Blank subtraction and determination of LOQ	LOQ range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
OPFR, soil	TCEP	115-96-8	Three blanks pr batch. Blank subtraction for each batch based on the blank average. LOD and LOQ calculated from 3 x stdev and 10 x stdev. from blanks	5-10	3-5 g of soil was dried overnight and 1 g of dry material and deuterated internal standard was added and was taken for extraction with acetone/Hexane 1/1 using vortex and sonication for 10 min done three times. Samples was evaporated and diluted with water and cleaned up on HLB column. The extract was evaporated and transferred to analytical glass. Recovery standard added and analysis on LC-MSMS.	2	Y
	TCPP	13674-84-5		2-3		2	Y
	TDCPP	13674-87-8		1-2		2	Y
	TBOEP/TBEP	78-51-3		2-3		2	N
	EHDP	1241-94-7		1-2		2	N
	TCP	1330-78-5		1-2		2	N
	TnBP	126-73-8		2-3		2	Y
	TiBP	126-71-6		1-2		2	N
	TEP	78-40-0		1-2		2	Y
	TPP	115-86-6		1-2		2	Y
	BdPhP	2752-95-6		1-2		2	N
	TPP	115-86-6		1-2		2	N
	DBPhP	2528-36-1		1-2		2	Y
	TXP	25155-23-1		1-2		2	N
	TIPPP	64532-95-2		1-2		2	N
	TEHP	78-42-2		1-2		2	Y
	TTBPP	78-33-1		1-2		2	Y

Comment:	TEP is generally lost during evaporation

Parameter group	Name of parameter	Cas nr	Blank subtraction and determination of LOQ	LOQ range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
OPFR, biota	TCEP	115-96-8	Three blanks pr batch. Blank subtraction for each batch based on the blank average. LOD and LOQ calculated from 3 x stdev and 10 x stdev. from blanks	5-10	1-2 g of biota was homogenized and mixed with dry Na2SO4, added deuterated internal standard and later extracted with acetone/hexane (1/1) three times with vortex and sonication for 10 min. Extract was evaporated and cleaned up using multilayer SPE, eluting with ACN which was evaporated and transferred to analytical glass. Recovery standard added and analysis on LC-MSMS.	2	Y
	TCPP	13674-84-5		2-3		2	Y
	TDCPP	13674-87-8		1-2		2	Y
	TBOEP/TBEP	78-51-3		2-3		2	N
	EHDP	1241-94-7		1-2		2	N
	TCP	1330-78-5		1-2		2	N
	TnBP	126-73-8		2-3		2	Y
	TiBP	126-71-6		1-2		2	N
	TEP	78-40-0		1-2		2	Y
	TPP	115-86-6		1-2		2	Y
	BdPhP	2752-95-6		1-2		2	N
	TPP	115-86-6		1-2		2	N
	DBPhP	2528-36-1		1-2		2	Y
	TXP	25155-23-1		1-2		2	N
	TIPPP	64532-95-2		1-2		2	N
	TEHP	78-42-2		1-2		2	Y
	TTBPP	78-33-1		1-2		2	Y

Comment:	TEP is generally lost during evaporation

Parameter group	Name of parameter	Cas nr	Blank subtraction and determination of LOQ	LOQ range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Musk	OTNE	54464-57-2	Three blanks pr batch. LOD and LOQ calculated from 3 x stdev and 10 x stdev. from blanks		1-2 g of biota was homogenized and added deuterated internal standard before extraction, up-concentration and clean up. TCN added as recovery standard before analysis on GC/MSD.	3	N
	GALAXOLIDE	1222-05-5				3	N
	Tonalide	1506-02-1				2	Y
	Traseolide	68140-48-7				3	N
	Phantolide	15323-35-0				3	N
	Celestolide	13171-00-1				3	N

Parameter group	Name parameter	CAS Number	Blank subtraction and determination of LOQ	LOQ range ng/g or ng/L	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
UV compounds	Benzophenone-3	131-57-7	Three blanks per batch. Blank-subtraction and LOQ based on average signal of blanks + 3*std. Octocylene usually has the highest levels in blanks.	0.16-3.4	Internal Standard (IS) added. Samples then extracted twice, followed by clean-up via GPC and/or PSA. GC-MS/MS detection	2	
	Ethylhexylmethoxycinnamate (EHMZ-Z)	5466-77-3		0.2-0.7		2	
	Ethylhexylmethoxycinnamate (EHMZ-E)	5466-77-3		0.9-2.8		2	
	Octocrylene	6197-30-4		3.0-11		2	
	UV-327	3864-99-1		0.1-1.4		2	
	UV-328	25973-55-1		0.4-1.3		2	
	UV-329	3147-75-9		0.6-2.1		3	
	Homosalate	118-56-9		0.7-2.2		3	
	3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxy-benzenepropanoic acid	84268-36-0	One blank pr batch. LOQ based on 10 x signal-to-noise as measured in each sample	0.5	IS added. Solid samples then extracted twice, and water samples pre-concentrated on SPE. LC-MS/MS detection	2	

Comment:	
UV-329	Tests of the extraction and analysis recovery of UV-329 based on spiking experiments give results outside the range of 60-140%. The measured results of the analysis of complex samples (such as liver) could be overestimates consequently. An alternative and more appropriate internal standard will be considered to improve accuracy in future analyses.
Homosalate	There was no spiked sample with homosalate for the batch reported. However, there are spiked results for samples from the project “Urban fjord”, analysed in the same period with expectable recoveries.

Compound group	Compound name	Cas no	Blank	Method	LOD range ng/g	LOQ range ng/g	Uncertainty category	stable isotope labelled (SIL) analogue
Bisphenols Biota and soil	4,4-bisphenol A	80-05-7	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stdev respectively (or instrument detection limit if this is higher)	In-house method. Internal standard addition, extraction, clean-up using molecularly imprinted polymer SPE. LC/HRMS (orbitrap)	3.4-5.8	8.7-19.2	3	Y
	2,4-bisphenol A	837-08-1			1.2-1.9	3.4-5.6	3	N
	Bisphenol E	2081-08-5			0.4-0.6	1.1-1.7	3	N
	Bisphenol G	127-54-8			0.5-0.9	1.3-2.4	3	N
	Bisphenol AP	1571-75-1			0.4-0.7	1.2-1.9	3	N
	Bisphenol FL	3236-71-3			0.6-0.9	1.6-2.6	3	N
	Bisphenol B	77-40-7			0.5-0.8	0.7-1.2	3	Y
	2,4-bisphenol S	5397-34-2			0.2-0.4	1.1-10.6	3	Y
	4,4-bisphenol F	620-92-8			0.4-3.6	2.7-9.8	3	Y
	2,4-bisphenol F	2467-03-0			0.9-3.5	8.4-54.5	3	N
	TBBPA	79-94-7			2.8-16.3	0.2-1.8	3	Y
	Bisphenol M	13595-25-0			0.1-0.5	1.8-3.7	3	N
	Bisphenol Z	843-55-0			0.5-1.3	2.9-10.7	3	Y
Alkylphenols Biota and soil	4-tert-octylphenol	140-66-9		In-house methods. Internal standard addition, extraction, clean-up using molecularly imprinted polymer SPE. LC/HRMS (orbitrap)	1.1-3.2	2.7-8.2	3	Y
	4-octylphenol	1806-26-4			1.0-2.5	3.0-30.0	3	N
	4-nonylphenol	104-40-5			0.9-9.0	1.6-20.7	3	Y
	4-dodecylphenol	104-43-8			0.6-6.2	8.7-19.2	3	N
Other phenolic compounds Biota and Soil	MB1	118-82-1		In-house method. Internal standard addition, extraction. GC/MS			3	N

Compound group	Compound name	Cas no	Blank	Method	LOD range ng/g	LOQ range ng/g	Uncertainty category	stable isotope labelled (SIL) analogue
Bisphenols cat liver and dust	4,4-bisphenol A	80-05-7	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stdev respectively (or instrument detection limit if this is higher)	In-house method. Internal standard addition, extraction, clean-up using molecularly imprinted polymer SPE. LC/HRMS (orbitrap)	24.8-130.2	71.6-375.8	3	Y
	2,4-bisphenol A	837-08-1			0.3-4.1	0.9-13.8	3	N
	Bisphenol E	2081-08-5			0.2-3.1	0.6-10.2	3	N
	Bisphenol G	127-54-8			0.1-2.3	0.5-7.7	3	N
	Bisphenol AP	1571-75-1			0.1-2.3	0.5-7.8	3	N
	Bisphenol FL	3236-71-3			0.2-3.7	0.8-12.3	3	N
	Bisphenol B	77-40-7			0.2-2.2	0.2-1.9	3	Y
	2,4-bisphenol S	5397-34-2			0.1-0.6	53.8-282.2	3	Y
	4,4-bisphenol F	620-92-8			17.8-93.6	66.7-350.4	3	Y
	2,4-bisphenol F	2467-03-0			22.1-116.3	18.9-265.7	3	N
	TBBPA	79-94-7			7.0-79.7	0.2-3.8	3	Y
	Bisphenol M	13595-25-0			0.1-1.1	1.3-9.9	3	N
	Bisphenol Z	843-55-0			0.5-3.0	5.2-32.2	3	Y
Alkylphenols cat liver and dust	4-tert-octylphenol	140-66-9		In-house methods. Internal standard addition, extraction, clean-up using molecularly imprinted polymer SPE. LC/HRMS (orbitrap)	2.0-9.6	1.4-32.4	3	Y
	4-octylphenol	1806-26-4			0.5-9.7	0.8-10.4	3	N
	4-nonylphenol	104-40-5			0.3-3.1	0.8-6.9	3	Y
	4-dodecylphenol	104-43-8			0.3-2.1	0.7-4.2	3	N
Other phenolic compounds	MB1	118-82-1		In-house method. Internal standard addition, extraction. GC/MS			3	N

Parameter group	Name parameter	CAS Number	Blank subtraction and determination of LOQ	LOQ range, ng/g or ng/L	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Biocides	Brodifacoum	56073-10-0	One blank pr batch. LOQ based on 10 x signal-to-noise as measured in each sample	1	Internal Standard (IS) added. Solid samples then extracted twice, while water samples were pre-concentrated on SPE. Clean-up via PSA when required. LC-MS/MS detection.	2	
	Bromodiolone	28772-56-7		1		2	
	Difenacoum	56073-07-5		1		2	
	Difethialone	104653-34-1		1		2	
	Flocumafen	90035-08-8		1		2	
	Permitrin (cis)	52645-53-1		3.0-10	IS added. Samples then extracted twice before clean-up via GPC and/or PSA. GC-MS/MS detection	3	
	Permitrin (trans)	52645-53-1		3.0-10		3	

Comment:	
Permethrin	Tests of the extraction and analysis recovery of Permethrin based on spiking experiments give results in the range of 60-140%. The measured results of the analysis of complex samples could be overestimates as a consequence. An alternative and more appropriate internal standard will be considered to improve accuracy in future analyses.

Parameter group	Name of parameter	Cas nr	Blank	LOQ range ng/g	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Phthalates, Soil & dust	DiBP	84-69-5	Three blanks pr batch. Blank subtraction for each batch based on the blank average. LOD and LOQ calculated from 3 x stdev and 10 x stdev. from blanks	1-4	3-5 g of soil was dried overnight and 1 g of dry material and deuterated internal standard was added and was taken for extraction with acetone/Hexane 1/1 using vortex and sonication for 10 min done three times. Samples was evaporated and cleaned up on column packed with Florisil. The extract was evaporated and transferred to analytical glass. Recovery	2	N
	DnBP	84-74-2		1-4		2	N
	DEHP	117-81-7		5-20		2	Y
	DiNP	28553-12-0		2--6		2	N
	DiDP	26761-40-0		2--6		2	N
	BBP	85-68-7		1-4		2	N

	DCHP	84-61-7		1-4	standard added and analysis on LC-MSMS.	2	N
	DHxP	84-75-3		1-4		2	N
	DOP	117-84-0		1-4		2	N
	DNP	84-76-4		2-6		2	N
	DiUnP	96507-86-7/3648-20-2		2-6		2	N

Comment:	DEP is generally lost during evaporation

4.7 GPS coordinates for sampling locations year 2022.

NILU ID	Sample	Location	Latitude	Longitude
22/2233	Soil	Alna	59.92003	10.83463
22/2234	Soil	Alnaparken	59.94475	10.87904
22/2235	Soil	Ammerud	59.96381	10.88067
22/2236	Soil	Hølaløkka	59.95253	10.88226
22/2237	Soil	Svartdalsparken	59.90438	10.79251
22/2238	Earthworm	Alna	59.92003	10.83463
22/2239	Earthworm	Alnaparken	59.94475	10.87904
22/2240	Earthworm	Ammerud	59.96381	10.88067
22/2241	Earthworm	Hølaløkka	59.95253	10.88226
22/2242	Earthworm	Svartdalsparken	59.90438	10.79251
22/2245	Fieldfare	Svartdalsparken	59.90452	10.79153
22/2246	Fieldfare	Ammerud	59.96352	10.8802
22/2247	Fieldfare	Hølaløkka	59.95251	10.88298
22/2248	Fieldfare	Alnaparken	59.94461	10.8787
22/2249	Fieldfare	Alnabru	59.91554	10.83124
22/2250	Brown rat	Trondheimsveien 5	59.91831	10.76144
22/2251	Brown rat	Binneveien 7	59.94988	10.68279
22/2252	Brown rat	Fredensbgveien 37	59.9199	10.74877
22/2253	Brown rat	Grønland T-bane	59.91306	10.75934
22/2254	Brown rat	Tvetenveien 217	59.92725	10.86562
22/2255	Spanish slug	Badedammen and Steinbruvann	59.9724516	10.882589
22/2256	Spanish slug	Hølaløkka	59.951843	10.883246
22/2257	Spanish slug	Svartdalsparken	59.903946	10.798328
22/2258	Spanish slug	Bretvedt prison (Alna)	59.949005	10.859197
Extra rat samples for biocide analysis in addition to the rat sample from Binneveien				
22/2546	Brown rat	Grønland T-bane	59.91306	10.75934
22/2547	Brown rat	Fredensborgveien	59.9199	10.74877
22/2548	Brown rat	Jeriokoveien	59.9357	10.88671
22/2549	Brown rat	Underhaugsveien	59.92517	10.72862

5 Appendix 2: Results

5.1.1 Metals

Metals were analysed in all the samples, except one earthworm (Hølaløkka) and one fieldfare egg sample (Ammerud) due to lack of sample material. The concentrations of metals in the various samples are in agreement with data from previous years in the urban terrestrial monitoring program (Heimstad et al., 2022) where Zn was the dominating metal in all samples. Soil sample form Alna had highest Pb concentration of 132 ng/g dw and second highest concentration after Zn, whereas for the other four soil samples and the earthworm samples, Cr had the second highest concentrations after Zn.

The soil sample from the location Alna exceeded the threshold values of Zn (200 mg/kg) and Pb (60 mg/kg) as part of "Chapter 2, Appendix 1 of the Regulations Relating to Pollution Control for when soil legally is considered to be contaminated"[6]. The Zn concentration in soil from Hølalokka of 275 mg/kg also exceeded the threshold value of 200 mg/kg. For comparison, none of the indoor dust samples exceeded these thresholds. The concentrations were similar or higher in soil samples than in indoor dust samples, except Sn and Sb which were higher in indoor dust. The concentrations of metals in indoor dust were comparable to concentration in indoor dust recently investigated in a study from southern part of Norway (Østerholt, A.K., 2017).

Cd in earthworms from all the five locations exceeded the PNECoral value of 160 ng/g food for predators of earthworms, and the earthworm sample from Ammerud exceeded the PNECoral value of Ni of 8500 ng/g in food for predators. The concentration of As in four brown rat liver samples exceeded the PNECoral value for predators of 1000 ng/g ww.

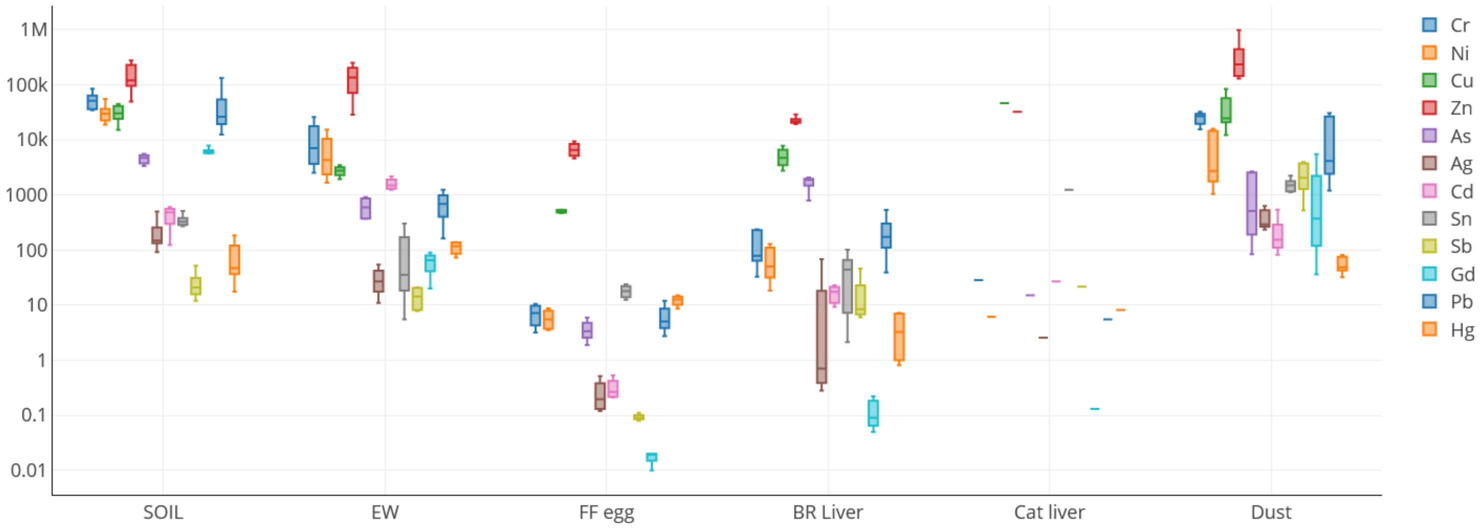


Figure 19: Box plot of metals in environmental samples. Concentrations are given in ng/g ww, except ng/g dw in soil and ng/g dust in indoor dust samples. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers. LOD/2 included for compound with at least one detection. Compounds that are not detected in any of the five samples are not shown.

[6] https://lovdata.no/dokument/SF/forskrift/2004-06-01-931/KAPITTEL_1-2#KAPITTEL_1-2

Table 16: Metal concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg, and Brown rat (BR) liver, dust and cat liver with average concentration and min-max range. All concentrations, except in soil (ng/g dw) and dust (ng/g dust), are given in ng/g ww. Concentrations exceeding PNEC or other thresholds are shown in bold.

	Soil n=5	EW n=4	FF egg n=4	BR liver n=5	Cat liver n=1	Dust n=5
Cr	52812 34305- 84733	10667 2532-26021	7.00 3.19-10.50	130 32.9-236	28.5	24848 15573-32365
Ni	31629 18962-55021	6422 1664-15402	5.81 3.51-8.68	67.2 18.3-128	6.15	7145 1044-15898
Cu	31409 15116-44754	2732 1935-3483	506 466-541	5032 2757-7787	46205	38504 12206-83299
Zn	153557 49369-**275401**	137168 28502-249064	6777 4612-9425	22477 19218-29100	32240	350187 129181-977312
As	4523 3356-5555	618 368-907	3.65 1.89-5.95	1681 794-2075	15.2	1200 83.8-2667
Ag	213 92-500	29.8 10.6-54.4	0.25 0.12-0.51	14.2 0.28-67.9	2.55	385 235-631
Cd	421 123-**599**	1598 1244-2171	0.32 0.21-0.53	16.4 9.30-22.7	27.0	219 81.6-537
Sn	346 270-510	94.3 5.5-301	18.0 12.4-23.8	41.9 2.12-101	1242	1529 1117-2229
Sb	25 12-52	14.3 7.8-21	0.09 0.08-0.11	16.6 6.00-46.1	21.6	2337 523-3936
Gd	6223 5642-7903	60.2 20.4-90.2	0.02 0.01-0.02	0.12 0.05-0.22	0.13	1434 35.6-5494
Pb	44134 12404-**132105**	694 161-1242	6.20 2.73-12.0	220 38.8-532	5.49	12749 1195-30517
Hg	78 17-185	112 73-139	12.2 8.65-15.1	3.85 0.81-7.20	8.15	56.4 32.2-81.5

5.1.2 PCB

Seven PCB congeners were analysed in all samples, see Figure 20 PCB-153 was the dominating congener in most of the samples as previous years have shown (Heimstad et al., 2021; Heimstad et al., 2020). On a wet weight basis, the highest PCB concentrations were detected in fieldfare egg.

Highest sum7PCB concentration in soil was detected at Alna with 7.65 ng/g dw, and below the threshold of 0.01 mg/kg (10 ng/g); i.e. "Chapter 2, Appendix 1 of the Regulations Relating to Pollution Control for when soil legally is considered to be contaminated". None of the concentration in biota exceeded known threshold effect levels.

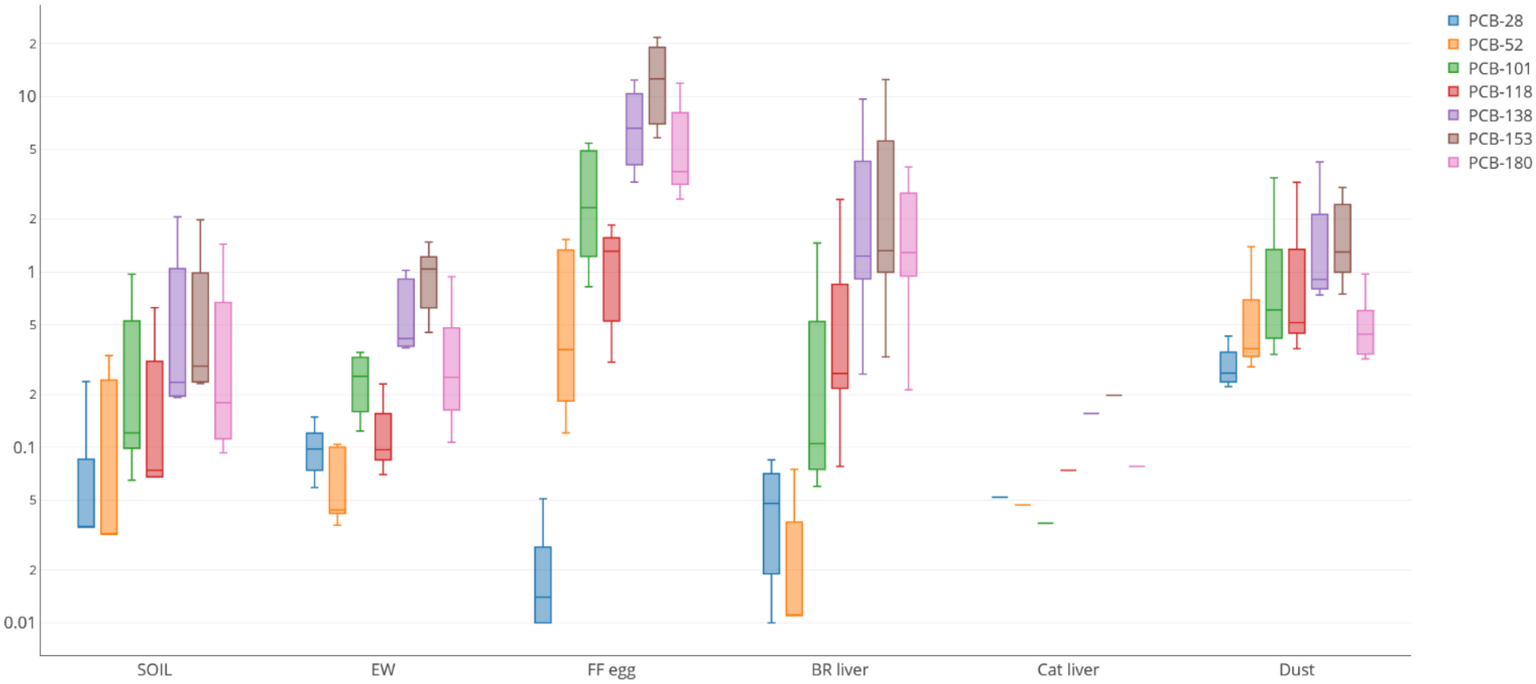


Figure 20: Box plot of PCBs in environmental samples. Concentrations are given in ng/g ww, except ng/g dw in soil and ng/g dust for dust samples. The upper and lower boundaries of the box are representing the 25th and 75th percentile. The whiskers represent the minimum and maximum values without outliers. LOD/2 included for compounds with at least one detected concentration. Compounds that are not detected in any of the samples are not shown.

Table 17: PCB concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg, Brown rat (BR) liver, cat liver and indoor dust with average concentration and min-max range. All concentrations are given in ng/g ww except for soil (ng/g dw) and dust (ng/g dust).

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Cat liver n=1	Indoor dust n=5
PCB-28	0.08 0.04-0.237	0.10 0.06-0.15	0.02 0.01-0.05	0.05 0.01-0.08	<0.10	0.30 0.22-0.43
PCB-52	0.13 0.03-0.33	0.07 0.04-0.10	0.70 0.12-1.53	0.03 0.01-0.07	<0.09	0.57 0.29-1.39
PCB-101	0.33 0.07-0.10	0.24 0.12-0.35	2.93 0.82-5.42	0.38 0.06-1.46	<0.07	1.09 0.34-3.44
PCB-118	0.21 0.07-0.63	0.12 0.07-0.23	1.11 0.31-1.85	0.69 0.08-2.59	0.07	1.06 0.37-3.24
PCB-138	0.68 0.19-2.06	0.61 0.37-1.02	7.25 3.25-12.4	2.95 0.26-9.66	0.16	1.63 0.74-4.24
PCB-153	0.68 0.23-1.98	0.96 0.45-1.48	13.1 5.82-21.7	3.73 0.33-12.5	0.20	1.68 0.75-3.03
PCB-180	0.45 0.09-1.44	0.36 0.11-0.94	5.67 2.60-11.9	1.82 0.21-3.96	0.08	0.51 0.32-0.97

5.1.3 BFR

Hardly any BFR compounds were detected in the samples of soil, earthworm, and fieldfare eggs. The detection was somewhat higher in rat liver, while the highest detection frequencies and concentrations were observed in the indoor house dust samples. The compound DBDPE and TBPH had highest concentrations in indoor house dust, see Table 18**.** DBDPE concentration in indoor house dust was below PNEC soil of 156 mg/kg dw (ECHA chemical information).

Table 18: BFR concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg and liver, Brown rat (BR) liver and indoor dust samples with average concentration and min-max range. All concentrations are given in ng/g ww, except in soil (ng/g dw) and dust (ng/g dust). LOD/2 is included for the calculations of mean values. Concentrations below LOD are shown in grey font colour. Dust concentrations above 100 ng/g are marked in bold font.

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Indoor dust n=5
ATE (TBP-AE)	<0.07	<0.04	<0.05	<0.07	<0.18
α-TBECH	<0.41	<0.24	<0.28	<0.41	<1.08
β-TBECH	<0.27	<0.16	<0.19	<0.27	0.52 0.19-0.72
γ/δ-TBECH	<0.19	0.14 0.05-0.45	<0.13	<0.19	<0.51
BATE	<0.08	<0.05	<0.06	<0.08	<0.21
PBT	<0.15	<0.09	<0.10	<0.15	0.69 0.11-1.78
PBEB	<0.07	<0.04	<0.05	<0.07	<0.19
PBBZ	<0.59	<0.36	<0.42	<0.59	<1.57
HBB	<0.25	0.09 0.06-0.13	<0.17	<0.25	0.81 0.23-1.27
DPTE	<0.06	<0.04	<0.04	<0.06	0.28 0.04-0.56
EHTBB	<0.06	<0.04	<0.04	<0.07	4.93 2.14-8.83
BTBPE	<0.12	<0.07	<0.09	<0.12	0.47 0.39-0.60
TBPH (BEH/TBP)	<0.27	<0.16	<0.21	8.12 0.14-40.0	103 15.5-**246**
DBDPE	<5.41	<3.25	<3.79	8.19 2.84-29.6	258 62.7-**909**
α-HBCD	0.04 0.01-0.10	0.01 0.01-0.03	0.09 0.01-0.25	0.64 0.01-2.61	14.8 1.13-58.5
β-HBCD	0.01 0.01-0.02	<0.01	<0.01	<0.02	2.01 0.06-7.95
γ-HBCD	0.03 0.01-0.07	0.02 0.01-0.04	<0.03	<0.12	22.2 0.78-**107**

5.1.4 PFAS

The PFAS group consists of numerous per- and polyfluorinated compounds. We have chosen to separate this large class of compounds into four subgroups dependent on functional groups and properties: The perfluorinated sulfonates (PFSA), the perfluorinated carboxylates (PFCA) included TFA, the neutral polyfluorinated compounds (nPFAS) with the compounds PFOSA, meFOSA, etFOSA, meFOSE, etFOSE, 6:2 FTOH, 8:2 FTOH, 10:2 FTOH and 12:2 FTOH; and the relatively new fluorotelomer sulfonates (newPFAS) with the compounds 4:2 FTS, 6:2 FTS, 8:2 FTS and 10:2 FTS. In this chapter and in the summary, SumPFAS is the sum of all sub-groups. While sumPFOS is the sum of branched and linear PFOS, the term PFOS, denotes the linear isomer. PFOS had highest concentration across all PFAS groups for all type of samples.

Highest PFOS concentrations were detected in brown rat liver and fieldfare egg. PFOS concentrations in brown rat liver from Tvetenveien (219 ng/g ww) and Binneveien (83.9 ng/ ww) locations, and fieldfare egg from Alnaparken and Alnabru exceeded the PNECoral of 37 ng/g ww (see Appendix) and QSbiota of 33 ng/g ww for secondary poisoning of predators, set by the European Commission (Ankley et al., 2021). For comparison, EFSA assessed the risks to human health related to the presence of perfluoroalkyl substances (PFASs) in food based on sum of the four PFASs PFOS, PFOA, PFNA and PFHxS and established a tolerable weekly intake (TWI) of 4.4 ng/ kg body weight per week[7]

PFOA in four of the earthworm samples and one fieldfare egg exceeded QSbiota of 0.9 ng/g for secondary poisoning of predators set by Valsecchi et al., 2017 (Ankley et al., 2021). A relatively high PFOA concentration of 20 ng/g ww was detected at Svartdalsparken, ten times higher than second highest concentration.

Among the fieldfare eggs, the fieldfare egg from Alnaparken had the highest PFCA concentrations where PFDoDA dominated with 11.7 ng/g ww. One brown rat liver sample from Binneveien in Oslo had very high concentration of PFOA and PFNA of 510 and 202 ng/g ww, respectively. The rat from Binneveien had second highest PFOS concentration among rat livers.

PFOSA was detected in all five dust samples. 6:2 FTS was only detected in cat liver at 0.53 ng/g ww.
8:2 FTS was detected in three out of five dust samples.

To succeed with the TOP assay, oxidation reagent must be adjusted in accordance with sample amount (Cioni et al., 2022). Fluorotelomer sulfonates are oxidized in TOP assay, however the presence of 8:2 FTS and 10:2 FTS in two rat liver sample (see appendix) indicate an incomplete oxidation.

[7] https://www.efsa.europa.eu/en/news/pfas-food-efsa-assesses-risks-and-sets-tolerable-intake

Table 19: PFSA concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg and liver, Brown rat (BR) liver, cat liver and indoor dust with average concentration and min-max range. All concentrations are given in ng/g ww except for soil (ng/g dw) and dust (ng/g dust). LOD/2 is included in the calculations of mean values. LOD and concentrations below LOD are shown in grey colour. Concentrations exceeding PNEC or other thresholds are shown in bold.

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Indoor dust n=5	Cat liver n=1	Spanish Slug n=4
PFEtS	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PFPrS	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PFBS	0.02 0.01-**0.03**	0.45 0.01-1.30	0.01 0.01-0.03	<0.02	<0.02	0.20 0.01-0.97	<0.02
PFPS	<0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PFHxS	<0.03	0.75 0.01-1.30	0.18 0.09-0.35	<0.02	<0.02	<0.02	<0.02
PFHpS	<0.06	1.10 0.03-2.49	0.15 0.08-0.27	0.19 0.03-0.82	<0.05	<0.05	0.04 0.03-**0.10**
PFOS	0.46 0.21-0.67	9.22 4.20-18.6	22.6 11.0-**38.4**	**53.2** 2.73-**191**	3.27	<0.05	0.17 0.10-0.29
SumPFOS	0.49 0.21-0.71	9.60 4.52-19.2	24.9 11.9-**40.8**	**65.8** 11.3-**219**	3.27	<0.05	0.24 0.10-0.37
PFNS	<0.12	<0.10	<0.10	0.48	<0.10	<0.10	<0.10
PFDcS	<0.12	0.18 0.05-0.24	1.51 0.44-3.85	15.2 0.05-71.7	<0.10	<0.10	<0.10
PFUnS	<0.25	<0.20	<0.20	<0.20	<0.15	<0.15	<0.20
PFDoS	<0.25	<0.20	<0.20	<0.20	<0.15	<0.15	<0.20
PFTrS	<0.25	<0.20	<0.20	<0.20	<0.15	<0.15	<0.20
PFTS*	<0.25	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20

*no standard available. Identification based on similar compound with respect to m/z, MS settings and retention time.

Table 20: PFCA concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg and Brown rat (BR) liver, Dust and Cat liver with average concentration and min-max range. Concentration exceeding PNEC or other thresholds are shown in bold. LOD/2 is included in the mean calculations.

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Cat liver n=1	Indoor dust n=5	Spanish slug n=4
TFA	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1
PFPrA	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1
PFBA	<0.25	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
PFPA	0.05 0.03-0.12	1.41 0.03-2.83	<0.05	1.41 0.03-4.13	<0.05	<0.05	0.10 0.03-0.33
PFHxA	<0.12	0.98 0.05-2.87	<0.10	0.09 0.05-0.24	<0.10	1.27 0.05-2.87	<0.10
PFHpA	0.21 0.11-0.32	2.02 0.05-7.54	<0.10	0.09 0.05-0.24	<0.10	<0.10	<0.10
PFOA	0.41 0.17-1.06	**5.08** **0.82-20.2**	0.50 0.31-0.94	**128** 0.17-**510**	0.55	2.31 1.56-3.31	0.06 0.05-0.07
PFNA	0.14 0.06-0.19	1.75 0.34-6.03	0.63 0.37-1.08	40.8 0.13-202	0.11	0.34 0.04-1.17	<0.07
PFDA	<0.09	0.89 0.32-2.72	1.54 0.67-3.13	4.69 0.50-11.9	<0.07	<0.07	0.08 0.04-0.13
PFUnDA	0.08 0.06-0.16	0.67 0.31-1.52	1.67 0.96-3.68	1.83 0.32-4.15	<0.10	<0.10	<0.10
PFDoDA	<0.12	1.23 0.05-2.88	5.69 2.52-11.7	4.30 0.30-8.62	<0.10	0.28 0.05-0.83	<0.10
PFTrDA	<0.19	1.91 1.05-1.32	4.76 2.51-8.93	1.42 0.13-2.51	<0.15	<0.15	<0.15
PFTeDA	<0.12	3.34 2.14-5.16	5.59 2.45-10.0	2.01 0.05-4.22	<0.10	<0.10	<0.10
PFHxDA	<0.19	0.56 0.30-0.89	0.31 0.17-0.50	0.10 0.08-0.22	<0.15	<0.15	<0.15
PFOcDA	<0.19	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
PFOSA	<0.10	<0.10	<0.10	<0.10	<0.10	0.89 0.62-1.11	<0.10
6:2 FTS	<0.15	<0.15	<0.15	<0.15	0.53	<0.15	<0.15
8:2 FTS	<0.15	<0.15	<0.15	<0.15	<0.15	0.81 0.08-2.54	<0.15

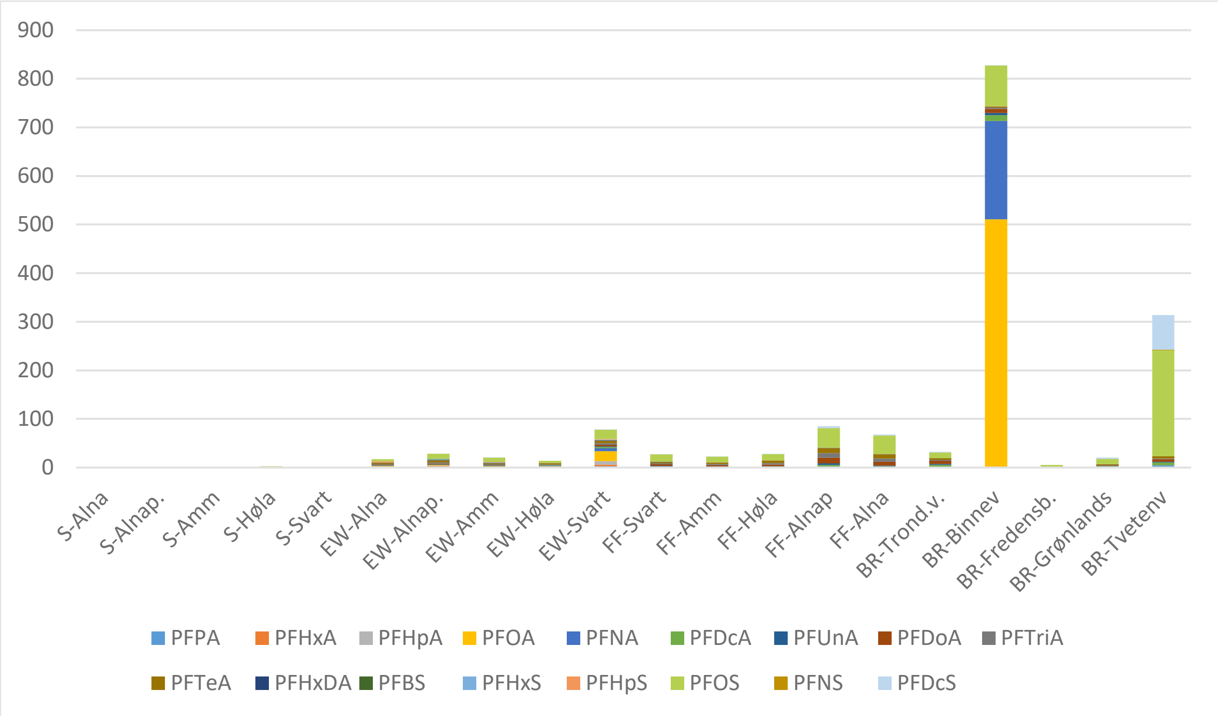


Figure 21: PFAS distribution at various locations (Alna, Alnap.: Alnparken, Amm: Ammerud, Høla: Hølaløkka, Svart: Svartdalsparken) for soil (S), earthworm (EW), fieldfare egg (FF) and brown rat liver (BR). Only detectable concentrations are shown.

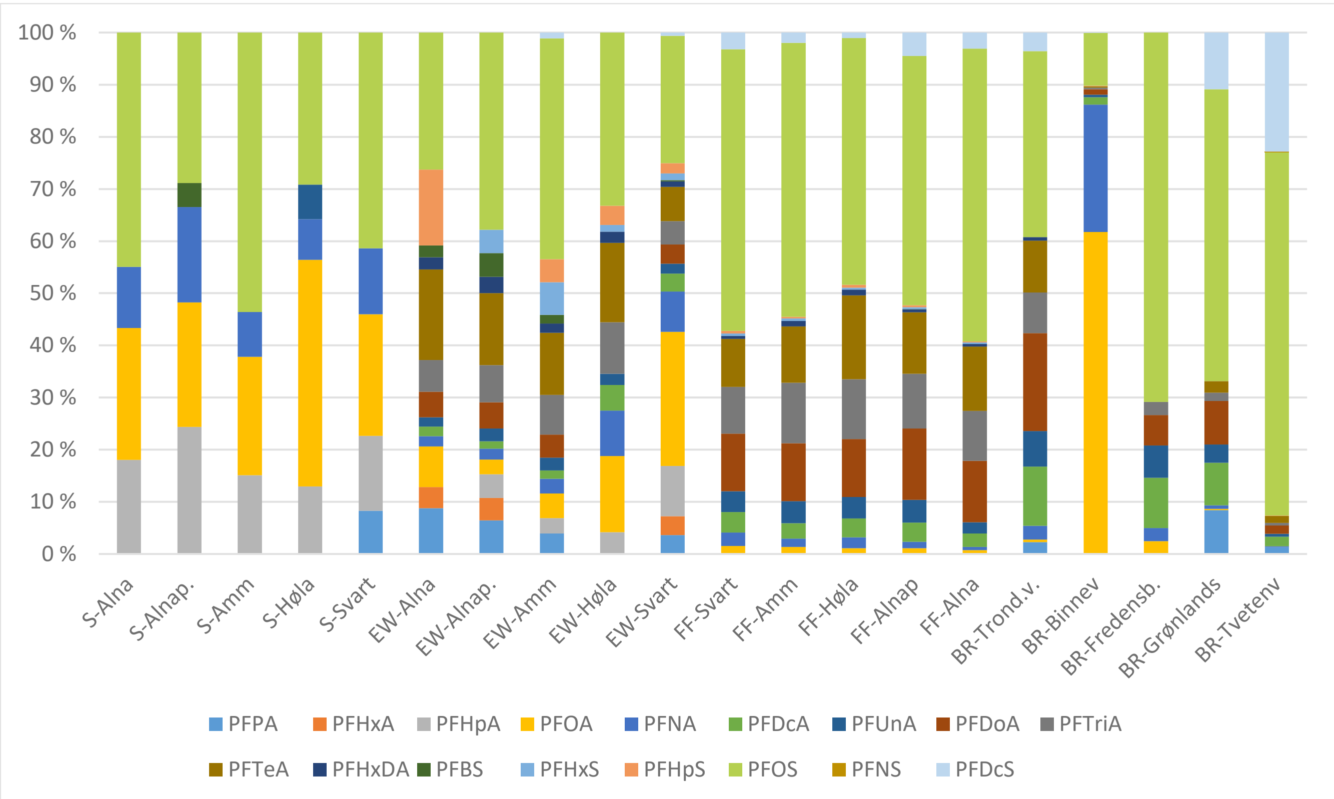


Figure 22: Percentage PFAS distribution at various locations (Alna, Alnap.: Alnparken, Amm: Ammerud, Høla: Hølaløkka, Svart: Svartdalsparken) for soil (S), earthworm (EW), fieldfare egg (FF) and brown rat liver (BR). Only detectable concentrations are shown.

5.1.5 Chlorinated paraffins, CP

MCCPs dominated in all the sample types with detected concentration, see Table 21.

Table 21: CP concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg and liver, Brown rat (BR) liver, cat liver and indoor dust samples with average concentration and min-max range. LOD/2 is included in the calculations and values below LOD is coloured in grey font colour. All concentrations are given in ng/g ww except for soil (ng/g dw) and dust (ng/g dust).

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Indoor dust n=5	Cat liver n=1
SCCPs	<57	7.1 5.5-13.5	8.9 5.5-12.7	22.1 10.5-42.9	1224 870-1693	<70
MCCPs	<58	32.4 15.0-86.6	90.3 44.8-204	664 30.5-2193	3424 1658-3954	<135

Figure 23 shows the detected concentrations of SCCP and MCCP in earthworm (EW), fieldfare (FF) egg and brown rat (BR) liver at various locations.

The fractional contribution from each congener group to the relative total abundance is multiplied by the total SCCPs or MCCPs amount to provide the contribution of each congener group expressed as concentration. The most dominating isomer groups (highest % contribution) in the various samples, are shown in Figure 24 for SCCPs and MCCPs, respectively. The isomer groups are given as, number of C-atoms, number of Cl- atoms.

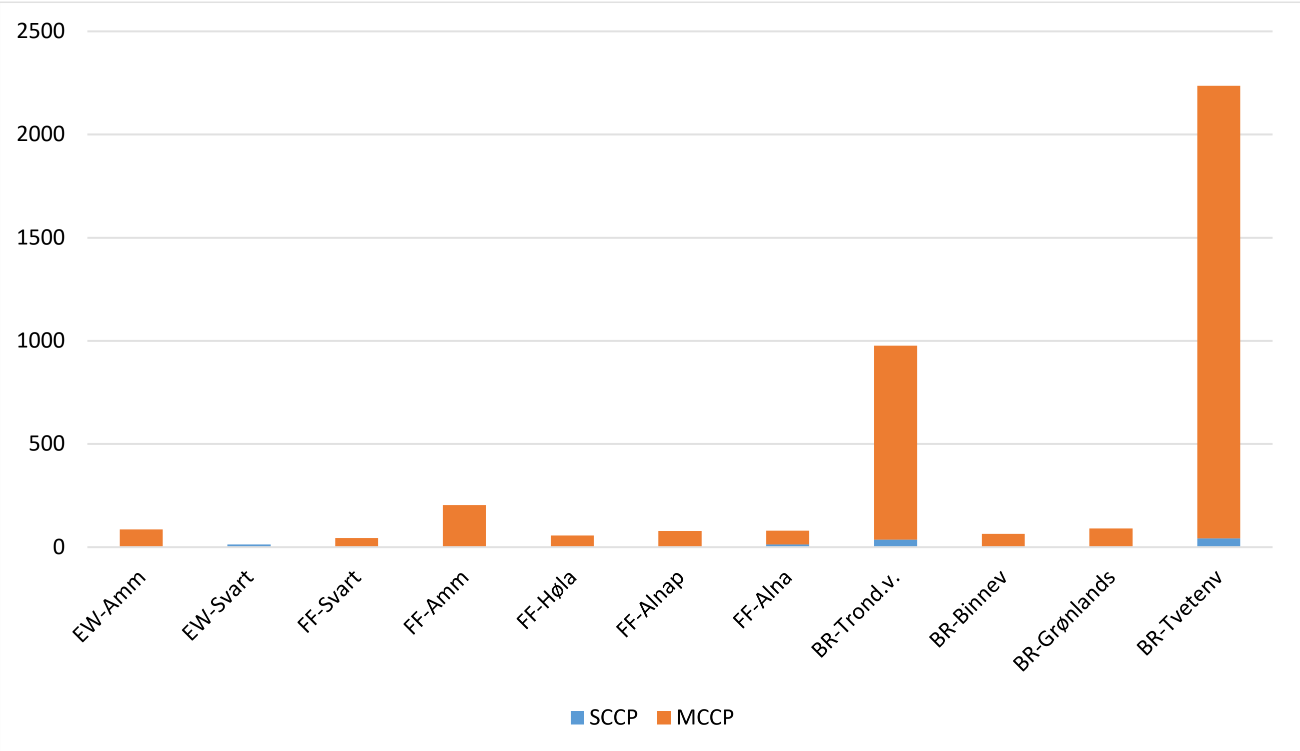
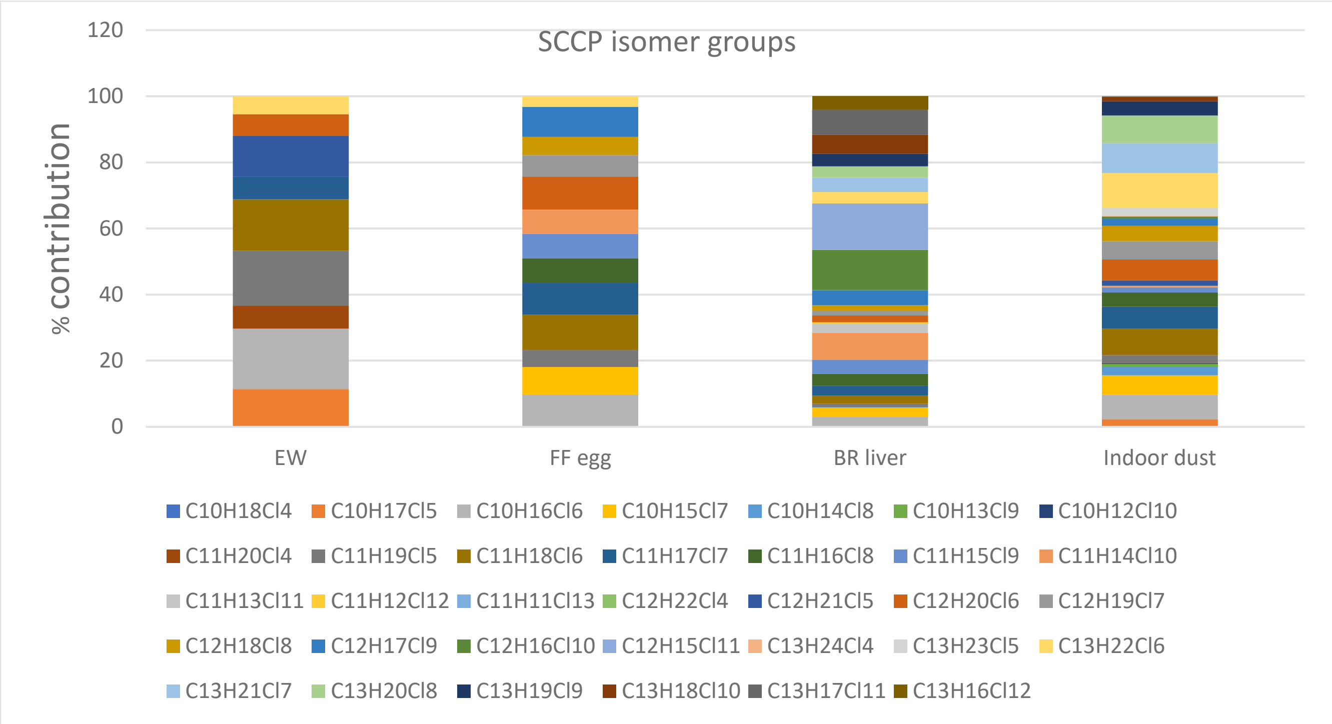


Figure 23: Detected concentrations (ng/g ww) of SCCP and MCCP in the various species at different locations



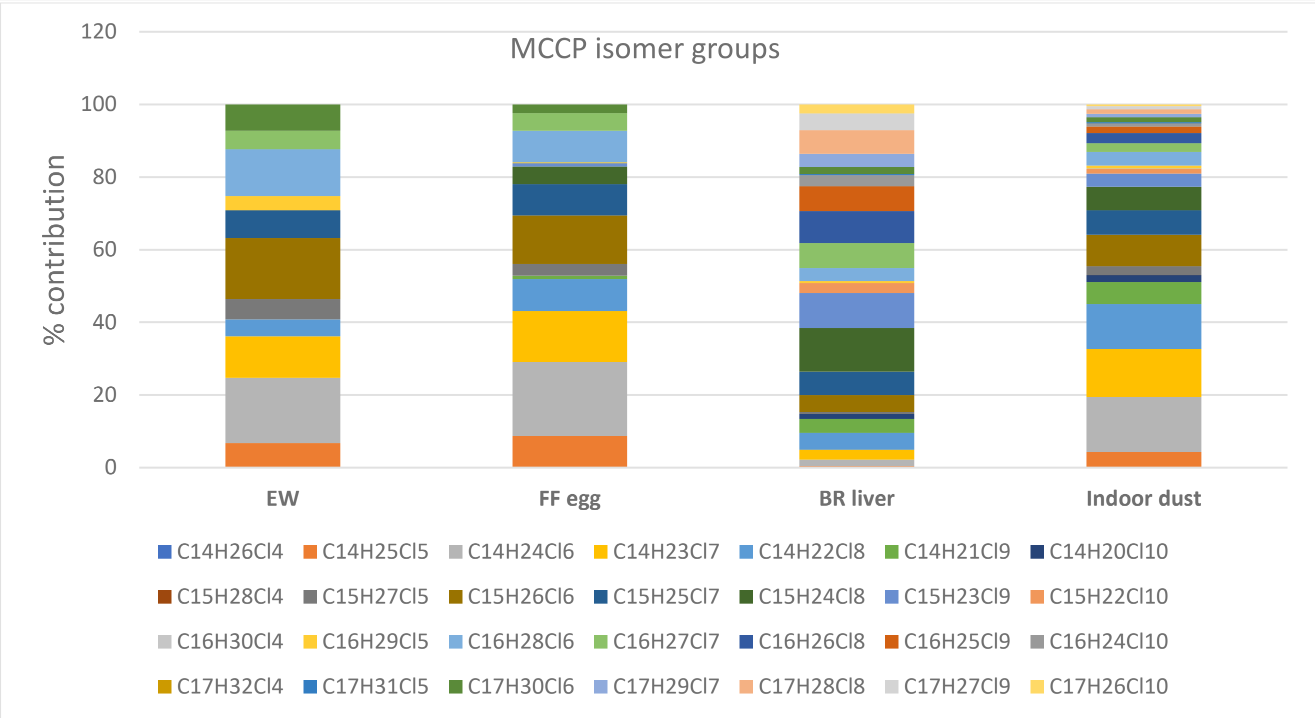


Figure 24: Percentage (%) contribution of SCCP and MCCP isomer groups in samples with detected concentrations.

Table 22: The most dominating isomer classes in the various samples with detected concentrations, expressed as % of the total concentration in SCCPs: Earthworm (EW), Fieldfare (FF) egg, Brown rat (BR liver) and Inddor dust. Detection frequency in percentage (Df).

Dominating isomer classes *	EW Df=20 %	FF Df=20 %	BR liver Df=40 %	Indoor dust Df=100 %
10 C, 5 Cl	11			
10 C, 6 Cl	18	10		7
10 C, 7 Cl		8		6
11 C, 5 Cl	17			
11 C, 6 Cl	16	11		8
11 C, 7 Cl		10		7
12 C, 5 Cl	12			
12 C, 6 Cl	7	10		6
12 C, 9 Cl		9		
12 C, 10 Cl			12	
12 C, 11 Cl			14	
13 C, 6 Cl				11
13 C, 7 Cl			7	9
13 C, 8 Cl				9
13 C, 11 Cl			8	

* first number before comma represents the number of carbons and second number after comma denotes the number of chlorine atoms.

Table 23: The most dominating isomer classes (above 5 %) in the various samples with detected concentratrions, expressed as averaae % of the total concentration in MCCPs: Earthworm (EW), Fieldfare (FF) egg , Brown rat (BR liver) and Inddor dust.

Dominating isomer classes*	EW Df=20 %	FF egg Df=100 %	BR liver Df=75 %	Indoor dust Df 100 %
14 C, 5 Cl	7	9		
14 C, 6 Cl	18	20		15
14 C, 7 Cl	11	14		13
14 C, 8 Cl	5	9		12
15 C, 6 Cl	17	13		9
15 C, 7 Cl	8	9	9	7
15 C, 8 Cl			16	7
15 C, 9 Cl			13	
16 C, 6 Cl	13	9		
16 C, 7 Cl			9	
16 C, 8 Cl			12	
16 C, 9 Cl			9	
17 C, 8 Cl			9	
17 C, 6 Cl	7			
17C, 8 Cl			9	

* first number before comma represents the number of carbons and second number after comma denotes the number of chlorine atoms.

5.1.6 *Cyclic siloxanes (cVMS)*

The cyclic siloxanes D4, D5, D6 had high detection frequencies in all samples, except for D4 in fieldfare egg.

Table 24: Cyclic siloxane concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg and Brown rat (BR) liver, Cat liver and indoor dust (Dust) with average concentration and min-max range. All concentrations are given in ng/g ww except for soil (ng/g dw) and dust (ng/g dust).

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Cat liver n=1	Indoor dust n=5
D4	0.12 0.04-0.23	0.84 0.49-1.07	0.27 0.22-0.50	3.85 0.76-10.9	2.85	16.1 9.67-26.7
D5	0.18 0.05-0.35	0.82 0.35-1.41	3.81 1.15-6.97	33.5 1.27-148	3.24	35.9 8.84-75.7
D6	0.20 0.02-0.51	0.98 0.29-3.27	1.12 0.65-1.57	38.5 0.98-184	3.91	29.1 10.9-51.9

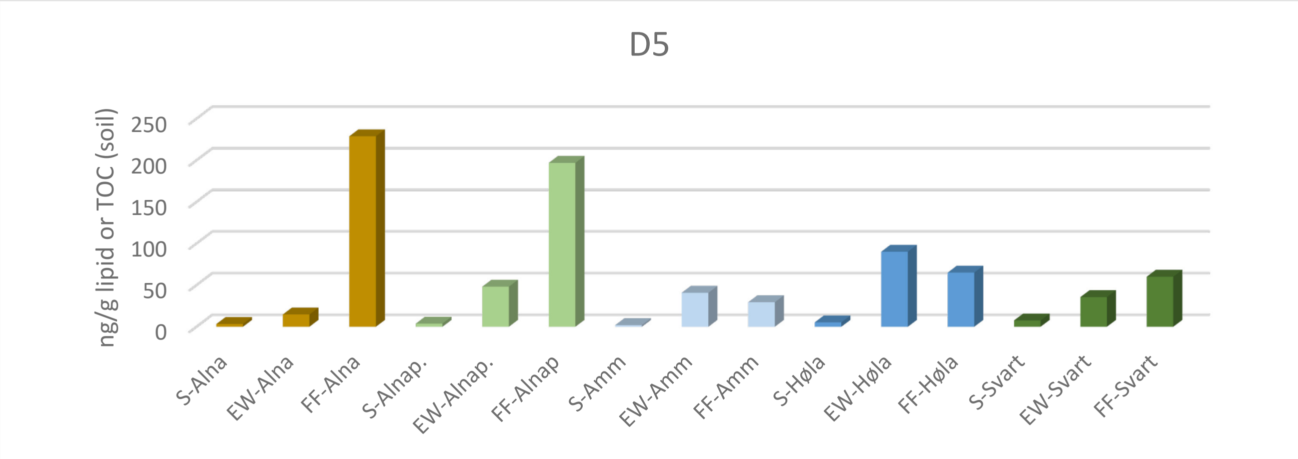


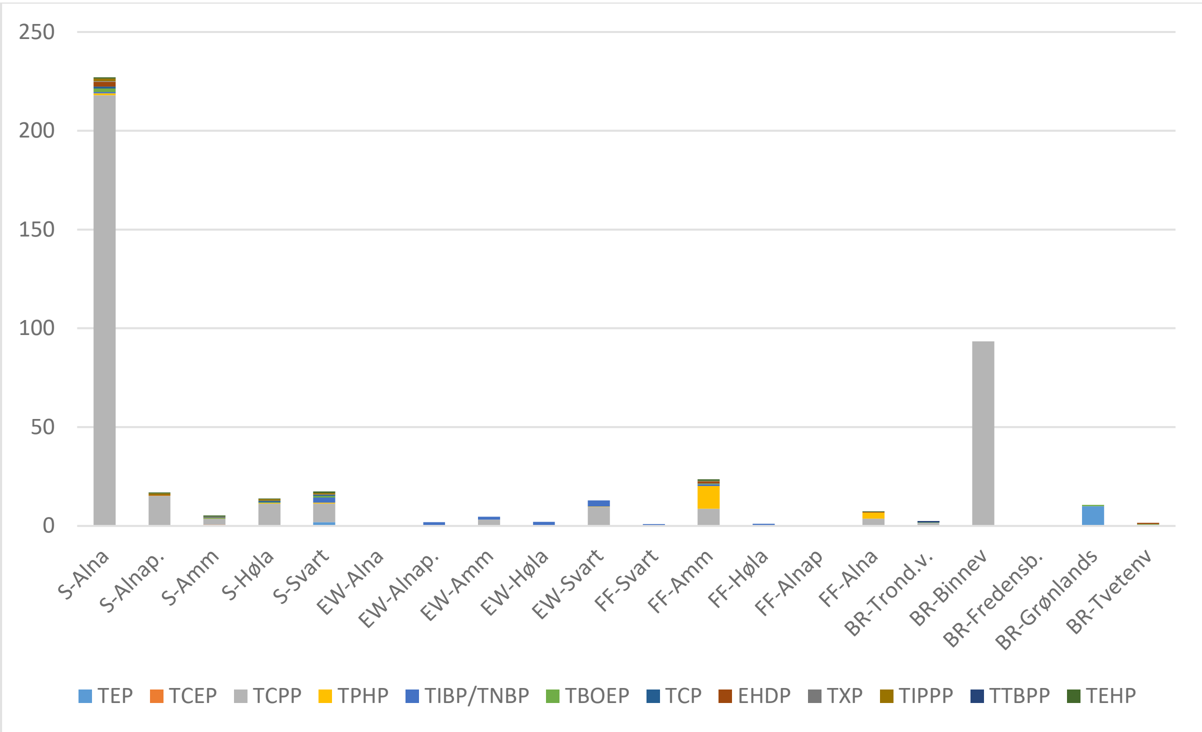
Figure 25: Comparison of D5 in soil (S), earthworm (EW) and fieldfare egg (FF) at specific locations: Alnap.: Alnaparken, Amm: Ammerud, Høla: Hølaløkka, Svart: Svartdalsparken. Concentations given in ng/g TOC for soil and ng/g lw for biota.

5.1.7 OPFR

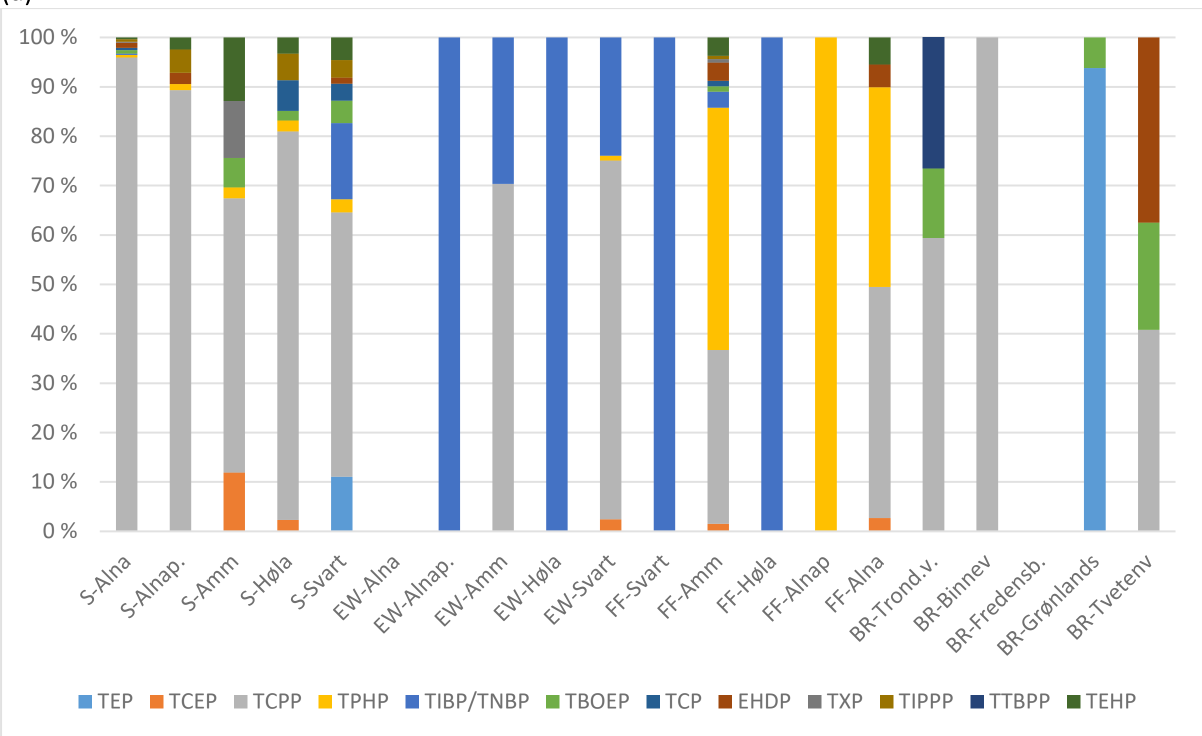
Most OPFR compounds were detected in the soil and even more in indoor house dust samples. TCPP had the highest concentrations in both soil, indoor house dust and species. Soil samples from Alna had highest concentrations of TCPP (218 ng/g dw), and higher concentrations of most OPFR compounds compared to the other soil locations. For earthworm and rat liver many OPFR compounds were below LOD, some more OPFR compounds above LOD for fieldfare egg, especially from the location Ammerud, where highest concentration in egg of TCPP (8.32 ng/g ww) and TPHP (11.2 ng/g ww) were detected. Rat liver from Binneveien had a TCPP concentration of 93.5 ng/g ww, 60 times higher than detected concentrations from the other locations. None of the OPFR concentrations in soil exceeded known PNECsoil values and none in biota exceeded PNECoral values.

Table 25: OPFR concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg, Brown rat (BR) liver, Indoor dust and Cat liver with average concentration and min-max range. All concentrations are given in ng/g ww except for soil (ng/g dw). LOD and concentrations below LOD are shown in grey coloured font.

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Indoor dust n=5	Cat liver n=1
TEP	1.11 0.9-1.93	<20.1	<5.2	5.77 4.7-10.0	n.a.	n.a.
TCEP	0.27 0.05-0.64	0.10 0.05-0.31	0.14 0.05-0.40	<0.1	178 146-229	< 2.0
TPrP	<0.1	<0.1	<0.1	<0.1	< 10	< 2.0
TCPP	51.2 2.98-218	2.82 0.50-9.34	2.87 0.85-8.32	19.2 0.25-93.5	2242 764-6027	3.64
TDCPP	<0.2	<0.2	<0.2	<0.2	188 15.0-550	< 2.0
TPHP	0.44 0.12-1.13	0.06 0.05-0.12	3.01 0.10-11.6	<0.1	540 59.0-1678	< 2.0
BdPhP	<0.1	<0.1	<0.1	<0.1	< 2.0	< 2.0
DBPhP	<0.1	<0.1	<0.1	<0.1	22.7 2.5-96	< 2.0
TIBP/TNBP	0.81 0.25-2.69	1.71 0.05-3.08	0.68 0.25-1.16	<0.6	1265 453-2787	< 2.0
TBOEP	0.64 0.10-169	<0.6	0.13 0.10-0.27	0.31 0.10-0.66	6794 20-33190	< 2.0
TCP	0.53 0.10-0.96	<0.2	0.13 0.10-0.25	<0.3	33.3 17.1-49.9	< 5.0
EHDP	0.64 0.10-2.43	<0.2	0.30 0.10-0.87	0.23 0.15-0.57	297 42.0-496	< 2.0
TXP	0.26 0.10-0.62	<0.2	0.07 0.05-0.17	<0.3	206 46.6-507	< 5.0
TIPPP	0.71 0.10-1.27	<0.2	0.07 0.05-0.15	<0.3	63.8 5-72.2	< 5.0
TTBPP	<0.3	<0.2	<0.2	0.26 0.15-0.68	35.5 5-63.8	< 5.0
TEHP	0.62 0.41-0.80	<0.2	0.32 0.10-0.89	<0.2	38.6 5-72.2	< 2.0



(a)



(b)

Figure 26: Contribution to sum of all OPFR compounds, concentrations in ng/g ww (a) and percentage contribution of OPFR compounds (b) in soil, earthworm and fieldfare egg sampled at the same locations. Only detected concentrations are shown.

5.1.8 UV compounds

Some UV compounds could be detected in the various sample types, but many were below LOD, see Table 26, except in dust where all UV compounds could be detected.

Table 26: UV compound concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg and Brown rat (BR) liver, Cat liver and indoor dust with average concentration and min-max range. All concentrations are given in ng/g ww except for soil (ng/g dw) and dust (ng/g dust).

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Cat liver n=1	Indoor dust n=5
OC	2.0 0.50-5.73	1.05 0.75-1.24	<0.4	0.98 0.50-2.65	<0.3	8723 3978- 16778
BP3	0.30 0.15-0.66	<1	<0.5	<0.5	0.61	127 31.7-408
EHMC-Z	<0.2	0.13 0.05-0.29	0.10 0.05-0.14	0.10 0.05-0.31	<0.5	235 15.7-714
EHMC-E	0.12 0.05-0.24	0.38 0.25-0.63	0.19 0.15-0.30	0.10 0.05-0.31	<0.1	246 35.7-692
UV-327	<0.3	<0.6	<0.4	<0.4	<0.1	11.6 3.66-18.6
UV-328	0.69 0.25-1.28	0.43 0.20-1.07	<.4	1.38 0.25-5.67	<0.1	67.0 29.7-135
UV-329	<0.2	<2	<2	<2	1.36	22.9 12.7-33.9
Homosalate	1.85 1.50-3.26	<5	<2	<2	<15	1129 87.8-3708

5.1.9 Dibromoaldrin and dechloranes

Dechloranes were detected in few samples. Anti-DP was detected in most samples and had highest concentrations, see Table 27. Highest amount of dechlorane compounds were detected in the fieldfare egg where dec-603 (1.65 ng/g ww) had the highest concentration. Much higher concentrations of syn- and anti-DP were detected in indoor house dust compared to soil samples.

Table 27: Dibromoaldrine and dechlorane concentrations in Soil, Earthworm (EW), Fieldfare (FF) egg and Brown rat (BR) liver, Indoor dust and cat liver with average concentration and min-max range. All concentrations are given in ng/g ww except for soil (ng/g dw) and dust (ng/g dust).

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Indoor dust N=5	Cat liver n=1
DBA	<0.26	<0.12	<0.15	<0.30	<0.52	<0.41
Dec-602	<0.03	0.01 0.01-0.02	0.10 0.04-0.29	<0.04	<0.08	<0.04
Dec-603	<0.04	<0.02	0.43 0.02-1.65	0.03 0.02-0.06	<0.11	<0.06
Dec-604	<0.73	<0.37	<0.05	<0.73	<1.93	<1.07
Dec-601	<0.07	<0.04	<0.05	<0.07	<0.18	<0.10
syn-DP	0.24 0.08-0.49	<0.09	0.08 0.08-0.12	0.31 0.08-0.55	8.27 0.49-24.7	<0.23
anti-DP	0.56 0.19-1.37	0.05 0.06-0.07	0.11 0.05-0.26	1.09 0.06-2.54	28.0 1.44-104	<0.19

5.1.10 Phenols and bisphenols

Of the phenol and bisphenol compounds, 4,4 Bis-F and 2,4 Bis-F were the compounds found in highest number of samples, followed by the alkylated phenols and 4,4-Bis-A. Indoor house dust contained much higher concentrations compared to dust, especially for 4,4-Bis-A.

Table 28: Concentrations of phenols in Soil, Earthworm (EW), Fieldfare (FF) egg, Brown rat (BR) liver, Indoor dust and cat liver with average concentration and min-max range. All concentrations are given in ng/g ww except for soil (ng/g dw) and indoor dust (ng/g dust).

	Soil n=5	EW n=5	FF egg n=5	BR liver n=5	Indoor dust n=5	Cat liver n=1
TBBPA	<4.32	<4.30	<6.46	<3.30	<53.7	<7.0
4,4 Bis-A	<3.90	<4.84	<4.08	3.72 2.13-7.20	1871 645-3970	<31
2,4 Bis-A	<1.82	n.a.	<1.38	<1.38	4.50	<0.28
2,4 Bis-S	<0.26	<0.35	<0.36	0.40 0.17-1.30	16.3	<0.069
4,4 Bis-F	1.26 0.30-2.6	5.76 1.8-12.0	<0.46	1.49 0.24-6.50	349	<22
2,4 Bis-F	2.02 0.75-5.2	13.2 7.40-19.0	<1.14	2.17 1.14-6.30	78.0	<28
Bis-G	<0.81	<0.65	<0.62	<0.61	<1.36	<0.15
Bis-FL	<0.89	<0.79	<0.69	<0.69	<2.20	<0.23
Bis-AP	<0.66	<0.56	<0.51	<0.50	<1.39	<0.15
Bis-Z	<1.28	<0.94	<0.96	<0.79	<1.66	<0.45
Bis-E	<0.60	<0.56	<0.47	<0.49	<1.82	<0.19
Bis-B	<0.79	<0.65	<0.61	<0.60	<1.59	<0.18
Bis-M	<0.11	<0.20	<0.25	<0.23	<0.66	<0.080
4-dodecyl-phenol	<0.78	<1.04	<1.98	<2.26	<1.30	<0.29
4-n-nonyl-phenol	<2.10	1.68 0.90-3.00	3.19 1.79-8.80	4.72 1.20-17.0	6.85 0.70-19.0	0.46
4-n-octyl-phenol	<1.52	7.25 0.75-21.0	0.80 0.55-1.80	1.56 0.60-3.70	13.4 2.20-40.0	3.40
4-t-octyl-phenol	<1.18	2.14 0.75-4.80	1.26	<1.26	52.0 19.0-129	6.00

5.1.11 Biocides (rodenticides) in brown rat and cat liver

Biocides (rodenticides) were analysed for in five rat liver sample and one cat liver sample. Six biocides (bromadiolone, brodifacoum, flocumafen, difenacoum, difethialone and primethrin) were selected for analyses in these samples.

Bromadiolone was detected in all the five rat liver samples, where rat liver from Jerikoveien had highest concentration of 611 ng/g ww, over 200 times higher than the average of the other four samples. Brodifacoum (cis and trans) was only analysed in one sample from Jerikoveien with concentrations of 1.50 and 110 ng/g ww. Permethrin (both cis and trans) was detected in one sample from Underhaugsvegen of 20.3 and 44.9 ng/g ww, respectively. The other biocides were below limit of detection in rat liver. In the one cat liver sample, lower concentrations were detected compared to rat liver for bromadiolone, cis- and trans permethrin. Maximum concentrations of cis- and trans permethrin in dust samples (262 and 368 ng/g dust) were detected in the same house and living room were also the highest Cu concentration (83 mg/kg dust) and second highest OC concentration (1184 ng/g dust) were detected.

Bromadiolone is acutely toxic to mammals with acute oral rat LD50 of 0.56-1.31 mg/kg bw.[5] The concentration in brown rat is well below this acute toxicity. PNECoral (concentration in food) for bromadiolone has been set to 0.00019 mg/kg-0.00044 mg/kg for mammals; i.e. 0.19-0.44 ng/g[8], see also chapter 4.3 in Appendix 1. The concentration in brown rat and cat liver, as potential prey, exceeded this threshold.

Table 29: Mean concentrations with min-max interval below of biocides in brown rat liver, cat liver and indoor dust. All concentrations are given in ng/g ww for biota and ng/g dust for indoor dust.

Compounds	Brown rat liver n=5	Cat liver n=1	Indoor dust n=5
Bromadiolone	124 1.10-6.11	0.7	<0.5
cis-Brodifacoum	0.50 0.25-1.50	<0.50	<0.5
trans-Brodifacoum	0.42 0.25-1.10	<0.50	<0.5
trans-Flocumafen	<0.50	<0.50	<0.5
cis-Flocumafen	<0.50	<0.50	<0.5
cis-Difenacoum	<0.50	<0.50	<0.5
trans-Difenacoum	<0.50	<0.50	<0.5
trans-Difethialone	<0.50	<0.50	<0.5
cis-Difethialone	<0.50	<0.50	<0.5
cis-permethrin	4.33 0.35-20.3	1.8	77.2 24.3-262
trans-permethrin	9.37 0.50-44.9	2.1	126 51.9-368

[8] https://circabc.europa.eu/sd/a/861933f1-29f7-4758-8d69-7d9eafea4ca5/Assessment%20Report%20revised%2016122011.pdf

5.1.12 Musk compounds

Musk compounds were only detected in two of the five indoor house dust samples, and none detected above LOD in the other samples.

Table 30: Musk compound concentrations Soil, Earthworm (EW), Fieldfare (FF) egg, Brown rat (BR) liver, Indoor dust and cat liver with average concentration and min-max range. All concentrations are given in ng/g ww except for soil (ng/g dw) and indoor dust (ng/g dust).

Compounds	Soil	Earthworm	Fieldfare egg	Brown rat liver	Cat liver	Indoor dust n=5
OTNE	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Galaxolide	<0.10	<0.10	<0.10	<0.10	<0.10	4.60 0.53-7.79
Tonalide (=AHMT)	<0.10	<0.10	<0.10	<0.10	<0.10	1.10 0.27-1.85
Traseolid	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phantolide	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Celestolide	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

5.1.13 *Phthalates in soil*

Phthalates were only analysed in five soil samples. DEHP and DiNP were the dominating compound with average concentrations of 56.0 and 40.3 ng/g dw, respectively. DEHP was in agreement with result from last year result in the one polled soil sample of 41 ng/g dw. The soil DiNP concentrations from last year was below LOD.

The concentration of DEHP is well below the PNECsoil value of 13 mg/kg dw, and DPHP is also below the PNECsoil value of 26.5 mg/kg dw (ECHA chemical information).

Table 31: Concentrations of phthalate compounds in soil samples

Compounds	Soil ng/g dw
DEHP	56.0 29.3-72.3
DPHP+ Diisodecyl phthalate (DiDP)	15.1 2.50-25.5
DiNP	40.3 8.50-75.7
DiBP Diisobutyl phthalate	< 3.0
DnBP di-n-butyl phthalate	4.65 1.50-10.8
DEP	< 3.0
BBP	1.63 0.25-4.53
DCHP	0.53 0.25-1.09
DHxP	< 0.5
DOP	0.78 0.25-1.59
DNP	0.73 0.25-1.33
DiUnP	< 5.0

5.1.14 Trophic relationship and potential biomagnification

$\delta^{15}N$ values were used to estimate the relative trophic positions of the different organisms. Terrestrial food chains are in general short, and biomagnification is generally assumed to be positively linked to food chain length such that the longer the food chain is, the higher the pollutant concentrations will be at the top of the food chain. Thus, despite bioaccumulation capabilities of some pollutants, top predators in the terrestrial food webs may be at lower risk for experiencing secondary poisoning than top predators in pelagic food webs, which often are longer (McGarvey et al., 2016). The strength of the relationship between tissue concentrations and trophic position is however also influenced by the properties of the chemicals, the types of tissue analysed, sampling period and location, and feeding habits of the species. In general, more lipophilic chemicals show stronger relationships between measured tissue concentrations and trophic position.

$\delta^{13}C$ values provide information regarding the source of dietary carbon, e.g. whether and to what extent an organism feeds on marine or freshwater organisms or aquatic or terrestrial organisms. For example, samples from marine locations are expected to show a less negative $\delta^{13}C$ value than samples from terrestrial locations. However, direct comparison of the data presented in this report should be done with care, since different tissues were analysed for the different species in the study (egg, liver, whole individuals). Different tissues may have different $\delta^{13}C$ turnover rates and may reflect the dietary exposure differently and in an optimal study design only data from the same tissue type should be compared (optimally muscle tissue due to slow turnover rates).

When relating the samples in the main program 2022 against δ^{13}C and δ^{15}N, the graph in is achieved.

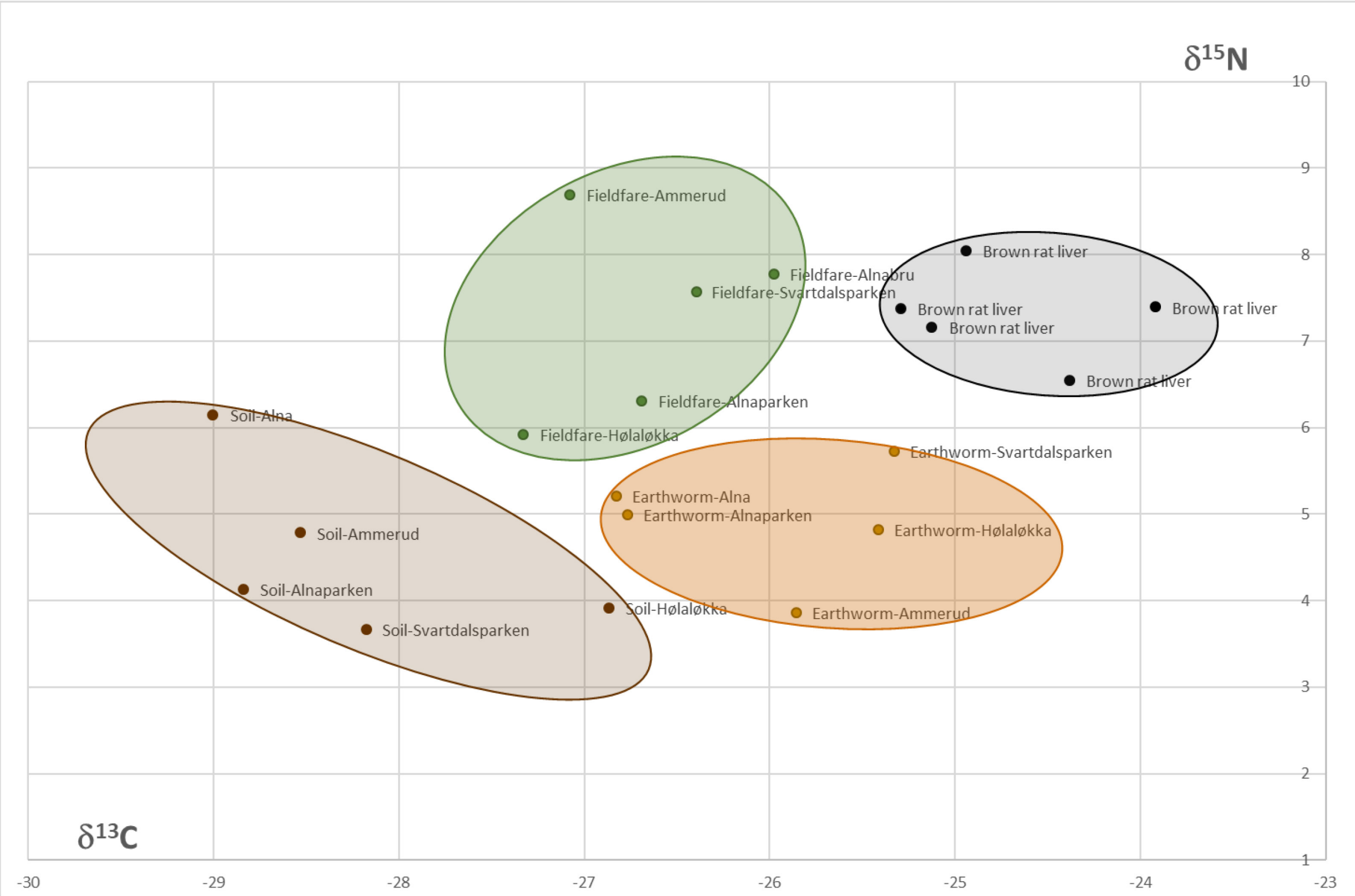


Figure 27: Relationship between the dietary descriptors δ15N and δ13C in soil and biota samples from urban terrestrial environment in Oslo, 2022.

As can been seen from the δ^{15}N and δ^{13}C plot, soil samples belonged to the left corner of the diagram with strongest terrestrial signal with lowest values of δ^{13}C. δ^{15}N values linked to trophic level were comparable to earthworm samples which had higher δ^{13}C values than soil. Most earthworm samples had higher δ^{15}N values than soil samples at the same location, but soil samples from Alna and Ammerud had higher δ^{15}N values than earthworm at the same location. All fieldfare egg samples were at higher trophic level than earthworm samples which are known to be an important prey of fieldfare. Brown rat samples were located in the right corner at higher trophic levels and less terrestrial signal and is known to be an omnivore and will consume almost anything in their environment. They will scavenge through trash or eat any food that is left unprotected.

Earthworm and/or fieldfare are most probable not important diet of brown rats, i.e. therefore not fulfilling the requirement that measurements are on organisms that are known to be linked by diet through the food web (Kidd et al., 2019). Trophic magnification factors which are an estimate of average biomagnification factors (BMF) in a food web were not calculated in 2022 due to the lack of 3 trophic levels (Borgå et al, 2012, Kidd et al, 2019) with only earthworm and fieldfare egg as part of the same food chain and/or the food web. Instead, we chose to assess if bioaccumulation and biomagnification factors could be calculated for compounds with detected concentrations.

5.1.15 Bioaccumulation and biomagnification factors, BSAF/BAF and BMF

Biota soil accumulation factor (BSAF) was calculated for some compounds at specific locations where contaminant data was detected for both soil and earthworm (EW) in the same year. For most compounds except PFAS, soil concentrations were normalised to total organic carbon (TOC) and earthworm concentrations normalised to lipid weight.

BMF was calculated for the most relevant prey-predator pair such as earthworm-fieldfare (EW-FF) where only earthworm (EW) has whole body concentrations. Ideally, when calculating BMF values for fieldfare, the concentration in the total body or muscle concentrations should have been used. This was not possible in our study as concentrations were measured in fieldfare (FF) egg only.

Table 32: % dry matter, % total organic matter (TOC) and pH in soil samples, and % lipids in earthworm from five locations

	% dry matter Soil	TOC µg/mg dw Soil	% TOC dw Soil	pH Soil	% Lipids Earthworm
Alna	80.0	43.6	4.36	6.90	2.34
Alnaparken	77.3	33.0	3.30	5.80	1.26
Ammerud	81.9	26.5	2.65	6.00	1.94
Hølaløkka	81.6	66.2	6.62	6.60	1.56
Svartdalsparken	83.5	27.1	2.71	7.00	2.6

Table 33: BSAF (C_{EWlw}/ $C_{SoilTOC}$) for PCB congeners, cyclic siloxanes, OPFR-, UV compunds and HBCD isomers at the various locations. <LOD is marked where either one or both soil and earthworm conc. were below LOD.

Compounds	BSAF Alna	BSAF Alnaparken	BSAF Ammerud	BSAF Hølaløkka	BSAF Svartdalsp.
PCB-28	0.62	<LOD	<LOD	<LOD	<LOD
PCB-52	0.25	<LOD	<LOD	<LOD	0.49
PCB-101	0.67	5.03	2.14	8.91	0.88
PCB-118	0.68	2.68	1.78	5.59	0.67
PCB-138	0.92	5.05	2.97	6.66	1.29
PCB-153	1.39	4.97	4.03	15.2	1.79
PCB-180	1.21	2.37	2.69	7.69	0.63
D4	5.91	21.8	31.1	19.9	11.2
D5	4.49	12.9	20.8	17.0	4.69
D6	2.78	8.57	<LOD	27.0	3.64
TCPP*	<LOD	<LOD	1.50	<LOD	1.04
TIBP/TNBP*	<LOD	<LOD	<LOD	<LOD	1.19
α-HBCD	<LOD	<LOD	<LOD	<LOD	0.26
γ-HBCD	1.06	<LOD	<LOD	<LOD	<LOD
UV-328	1.56	<LOD	<LOD	<LOD	<LOD

* TCPP has a logKow below 3, and BSAF on a wet weight basis was 1.34 and 1.20 for Ammerud and Svartdalsparken, respectively. BSAF for TIBP/TNBP (LogKow ~4) for Svartdalsparken was 1.37 on a wet weight basis.

Table 34: BMF $(C_{FF}/C_{EW})_{lw}$ for PCBs, cyclic siloxanes, OPFR, CP and UV compounds. <LOD is marked where either one or both of earthworm and fieldfare egg conc. were below LOD.

Compounds	BMF Alna	BMF Alnaparken	BMF Ammerud	BMF Hølaløkka	BMF Svartdalsp.
PCB-28	2.09	<LOD	<LOD	0.49	0.31
PCB-52	63.2	10.2	1.37	7.32	21.4
PCB-101	195	65.5	2.39	48.6	91.6
PCB-118	60.7	37.0	1.59	21.4	31.3
PCB-138	400	186	3.90	156	209
PCB-153	752	356	4.27	263	366
PCB-180	281	105	7.14	119	201
D4	0.99	<LOD	<LOD	<LOD	<LOD
D5	15.5	4.09	0.72	0.72	1.69
D6	5.28	1.72	0.69	0.11	0.92
MCCP	<LOD	<LOD	1.18	<LOD	<LOD
TCPP*	<LOD	<LOD	1.27	<LOD	<LOD
TIBP/TNBP	<LOD	<LOD	0.28	0.32	0.14
EHMC-Z	0.48	<LOD	<LOD	<LOD	<LOD

*BMF of TCPP on a wet weight basis was 0.55 for Ammerud.

None of the other hydrophobic compounds had detectable concentrations for calculation of BSAF and BMF.

PFAS compounds

Some previous studies have revealed correlation between organic content in soil and PFAS concentrations, and BSAF (or BAF) has in some cases been calculated with wet weight concentration for earthworm divided by soil concentration normalized to TOC (Rich et al. 2015; Conder et al. 2020). Using this method, most of the BSAF (BAF) values were below 1 when using soil concentration normalised to the content of TOC, except BSAF for PFOA from Svartdalsparken with 1.7 and PFOS from Alna with 1.8.

Here with tables below, BAF and BMF calculations were calculated on a wet weight basis.

BAF= C_{EW} (ng/g ww) / C_{soil} (ng/g ww)

BMF= C_{FF} (ng/g ww) / C_{EW} (ng/g ww)

Table 35: **BAF (C_{EW} /C_{Soil})$_{ww}$** values for PFAS compounds with detected concentrations on a wet weight basis <LOD is marked where either one or both soil and earthworm conc. were below LOD.

Compounds	Alna	Alnaparken	Ammerud	Hølaløkka	Svartdalsparken
PFPA	<LOD	<LOD	<LOD	<LOD	29.5
PFHpA	<LOD	9.83	6.81	2.27	<LOD
PFOA	5.03	6.36	7.27	2.36	75.2
PFNA	2.75	5.96	11.5	7.85	41.3
PFUnDA	<LOD	<LOD	<LOD	1.90	<LOD
PFBS	<LOD	52.1	<LOD	<LOD	<LOD
PFOS (sum)	9.60	69.3	27.7	8.00	40.1

Most of the BSAF (BAF) values were below 1 when using soil concentration normalised to the content of TOC, except BSAF for PFOA from Svartdalsparken with 1.7 and PFOS from Alna with 1.8.

Table 36: **BMF (C_{FF}/C_{EW})$_{ww}$** values for PFAS compounds with detected concentrations on a wet weight basis.. <LOD is marked where either one or both soil and earthworm conc. were below LOD.

Compounds	Alna	Alnaparken	Ammerud	Hølaløkka	Svartdalsparken
PFOA	**1.33**	**1.14**	0.31	0.15	0.02
PFNA	0.34	**1.83**	0.63	0.47	0.12
PFDcA	0.32	**7.72**	**1.99**	**1.50**	0.41
PFUnA	0.31	**5.24**	**1.88**	**3.70**	0.73
PFDoA	0.84	**8.12**	**2.71**	<LOD	**1.08**
PFTriA	**1.05**	**4.39**	**1.66**	**2.32**	0.71
PFTeA	**2.98**	**2.54**	0.99	**2.10**	0.50
PFHxDA	0.40	0.55	0.62	**1.01**	0.21
PFHxS	0.13	0.52	0.28	0.09	<LOD
PFHpS	0.09	0.30	<LOD	0.09	0.04
PFOS (sum)	0.8	**2.8**	**3.8**	**1.4**	**8.5**
PFDcS	**1.74**	<LOD	<LOD	1.87	<LOD

BSAF and BMF were also calculated with average concentrations across sites for PFAS compounds. Most calculations contained detected concentrations at all sites. For the few cases with less than 5 detected concentrations, LOD/2 values were not included in soil and earthworm for BAF and BMF, respectively in order to not overestimate accumulation.

Table 37: Average values of $BAF_{ww}(C_{EW} / C_{soil})$ and $BMF_{ww}(C_{FF} / C_{EW})$ for PFAS compounds

Compounds	$BAF_{ww}(C_{EW} / C_{soil})$	$BMF_{ww}(C_{FF} / C_{EW})$
PFHpA	**12.1**	
PFOA	**15.3**	0.10
PFNA	**15.3**	0.36
PFDcA		**1.73**
PFUnA		**2.49**
PFDoA		**3.74**
PFTriA		**2.49**
PFTeA		**1.67**
PFHxDA		0.55
PFHxS		0.19
PFHpS		0.11
PFOS (sum)	**23.9**	**2.49**
PFDcS		**4.05**

Slug samples were collected at two locations Svartdalsparken and Hølaløkka which were more or less at the same locations as the soil samples. The BAF ($C_{slug\ ww}$/ $C_{soil\ ww}$) values were below 1 for the compounds PFOA and PFOS that had detectable concentrations in both soil and slug.

Table 38: **BAF (C $Slug_{ww}$ / C $Soil_{ww}$)** values for PFAS compounds with detected concentrations on a wet weight basis.

Compounds	Hølaløkka	Svartdalsparken
PFOA	0.05	0.16
PFOS (sum)	0.14	0.65

The general conclusion is that these bioaccumulation calculations first and foremost can indicate which compounds that are more likely to bioaccumulate with BSAF/BAF and BMF well above 1, and others that are more uncertain with lower values below and near 1. Due to soil and earthworm concentrations at the exact same location, one could expect more same biomagnification factor for the same compound across sites, but the present calculations reveal high variability in both BSAF, BAF, and BMF values.

5.2 References

Ankley, G. T., Cureton, P., Hoke, R. A., Houde, M., Kumar, A., Kurias, J., … & Sample, B. E. (2021). Assessing the ecological risks of per-and polyfluoroalkyl substances: Current state-of-the science and a proposed path forward. *Environmental toxicology and chemistry*, *40*(3), 564-605.

Bohlin-Nizzetto, P., Hanssen, L., & Herzke, D. (2015). *PFASs in house dust* (Norwegian Environment Agency report, M-430|2015) (NILU OR 29/2015). Kjeller: NILU. http://hdl.handle.net/11250/2383253

Bika, S. H., Adeniji, A. O., Okoh, A. I., & Okoh, O. O. (2022). Spatiotemporal distribution and analysis of organophosphate flame retardants in the environmental systems: a review. *Molecules, 27*(2), 573.

Borgå, K., Kidd, K. A, Muir, D. C. G., Berglund, O., Conder, J. M., Gobas, F. A. P. C., … & Powell, D. A. (2012). Trophic magnification factors: considerations of ecology, ecosystems, and study design. *Integrated Environmental Assessment and Management, 8*(1)*,* 64-84.

Cequier, E., Ionas, A. C., Covaci, A., Marcé, R. M., Becher, G., & Thomsen, C. (2014). Occurrence of a broad range of legacy and emerging flame retardants in indoor environments in Norway. *Environmental science & technology, 48(*12), 6827-6835.

Cioni, L., Nikiforov, V., Coêlho, A. C. M., Sandanger, T. M., & Herzke, D. (2022). Total oxidizable precursors assay for PFAS in human serum. *Environment International*, *170*, 107656.

ECHA (2021). *UV-328 Draft risk profile.* ECHA. https://echa.europa.eu/documents/10162/c0604545-a115-9c61-a2ec-fefa5bdc5880

Heimstad, E. S., Moe, B., Nygård, T., Herzke, D., & Bohlin-Nizzetto, P. (2021). *Environmental pollutants in the terrestrial and urban environment 2020* (Norwegian Environment Agency report, M-2049|2021) (NILU report, 20/2021). Kjeller: NILU. https://hdl.handle.net/11250/2823182

Huang, K., Li, Y., Bu, D., Fu, J., Wang, M., Zhou, W., … & Jiang, G. (2022). Trophic Magnification of Short-Chain Per-and Polyfluoroalkyl Substances in a Terrestrial Food Chain from the Tibetan Plateau. *Environmental Science & Technology Letters, 9(*2), 147-152.

Kidd, K. A., Burkhard, L. P., Babut, M., Borgå, K., Muir, D. C., Perceval, O., ... & Embry, M. R. (2019). Practical advice for selecting or determining trophic magnification factors for application under the European Union Water Framework Directive. *Integrated environmental assessment and management, 15*(2), 266-277.

Kim, U. J., Wang, Y., Li, W., & Kannan, K. (2019). Occurrence of and human exposure to organophosphate flame retardants/plasticizers in indoor air and dust from various microenvironments in the United States. *Environment international, 125,* 342-349.

Lu, Q. O., Jung, C. C., Liu, Y. H., & Chang, W. H. (2023). Seasonal and source characteristics of organophosphorus flame retardants in air and house dust in Taiwan residential microenvironments: Implications for young children's exposure and risk assessment using a probabilistic approach. *Environmental Pollution, 318,* 120893.

Marklund, A., Andersson, B., & Haglund, P. (2003). Screening of organophosphorus compounds and their distribution in various indoor environments. *Chemosphere*, *53*(9), 1137-1146.

McGarvey, R., Dowling, N., & Cohen, J. E. (2016). Longer food chains in pelagic ecosystems: trophic energetics of animal body size and metabolic efficiency. *The American Naturalist, 188*(1), 76-86.

Freeling, F., Scheurer, M., Koschorreck, J., Hoffmann, G., Ternes, T. A., & Nödler, K. (2022). Levels and Temporal Trends of Trifluoroacetate (TFA) in Archived Plants: Evidence for Increasing Emissions of Gaseous TFA Precursors over the Last Decades. *Environmental Science & Technology Letters, 9*(5), 400-405.

Sage, M., Fourel, I., Cœurdassier, M., Barrat, J., Berny, P., & Giraudoux, P. (2010). Determination of bromadiolone residues in fox faeces by LC/ESI-MS in relationship with toxicological data and clinical signs after repeated exposure. *Environmental Research, 110*(7), 664-674.

Savoca, D., & Pace, A. (2021). Bioaccumulation, biodistribution, toxicology and biomonitoring of organofluorine compounds in aquatic organisms. *International Journal of Molecular Sciences, 22*(12), 6276.

van den Brink, N. W., Arblaster, J. A., Bowman, S. R., Conder, J. M., Elliott, J. E., Johnson, M. S., ... & Shore, R. F. (2016). Use of terrestrial field studies in the derivation of bioaccumulation potential of chemicals. *Integrated environmental assessment and management, 12*(1), 135-145.

Yuan, B., Tay, J. H., Padilla-Sánchez, J. A., Papadopoulou, E., Haug, L. S., & de Wit, C. A. (2021). Human exposure to chlorinated paraffins via inhalation and dust ingestion in a Norwegian cohort. *Environmental Science & Technology*, 55(2), 1145-1154.

Østerholt, A. K. (2017). *Undersøkelse av grunnstoffinnholdet i husstøv samlet i støvsugerposer fra husholdning* (Master's thesis, NTNU). https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2449859

6 Appendix 3: Concentration data of pollutants in individual samples and supporting parameters, year 2022

Metal concentrations are given in mg/kg, other compound concentrations are given in ng/g

All concentrations in soil are given on a dry weight basis, indoor house dust on dust weight basis and all biological samples on a wet weight basis.

Abbreviations:
EW: Earthworm
FF: Fieldfare
BR: Brown rat

Isotopes and supporting parameters.

NILU-Sample number:	Sample type:	$\delta^{13}C_{VPDB}$	$\delta^{15}N_{AIR}$	% Lipids	% dry matter	% TOC	pH
22/2233	Soil	-29.0008	6.142991		80.0	4.36	6.90
22/2234	Soil	-28.8348	4.122621		77.3	3.30	5.80
22/2235	Soil	-28.5286	4.777222		81.9	2.65	6.00
22/2236	Soil	-26.8627	3.908792		81.6	6.62	6.60
22/2237	Soil	-28.1717	3.665698		83.5	2.71	7.00
22/2238	Earthworm	-26.8264	5.201738	2.34			
22/2239	Earthworm	-26.7622	4.98746	1.26			
22/2240	Earthworm	-25.8522	3.856074	1.94			
22/2241	Earthworm	-25.4102	4.819705	1.56			
22/2242	Earthworm	-25.3229	5.718406	2.6			
22/2245	Fieldfare egg	-26.3912	7.569293	5.92			
22/2246	Fieldfare egg	-27.0743	8.690609	3.88			
22/2247	Fieldfare egg	-27.3268	5.919978	2.8			
22/2248	Fieldfare egg	-26.6872	6.301497	3.54			
22/2249	Fieldfare egg	-25.9764	7.772369	2.42			
22/2250	Brown rat liver	-25.1227	7.157258	3.87			
22/2251	Brown rat liver	-24.94	8.039475	2.95			
22/2252	Brown rat liver	-23.919	7.387448	2.24			
22/2253	Brown rat liver	-24.3793	6.540441	2.26			

NILU-Sample number:	Sample type:	$\delta^{13}C_{VPDB}$	$\delta^{15}N_{AIR}$	% Lipids	% dry matter	% TOC	pH
22/2254	Brown rat liver	-25.2912	7.371333	2.6			
22/2255	Spanish slug	n.a.	n.a.	n.a.			
22/2256	Spanish slug	n.a.	n.a.	n.a.			
22/2257	Spanish slug	n.a.	n.a.	n.a.			
22/2258	Spanish slug	n.a.	n.a.	n.a.			
23/0285	Cat liver	n.a.	n.a.	2.18			

Metals (mg/kg)

NILU-Sample number:	Sample type:	Cr	Ni	Cu	Zn	As	Ag	Cd	Sn	Sb	Gd	Pb	Hg
22/2233	Soil	51.4	29.9	44.8	213	4.70	0.50	0.48	0.33	0.02	5.64	132	0.19
22/2234	Soil	34.3	19.0	15.1	49	3.36	0.09	0.12	0.27	0.02	5.75	12.4	0.02
22/2235	Soil	56.8	30.4	27.1	120	5.15	0.17	0.36	0.29	0.01	7.90	28.4	0.10
22/2236	Soil	84.7	55.0	39.7	275	5.55	0.15	0.54	0.33	0.02	6.01	26.2	0.04
22/2237	Soil	36.8	23.8	30.4	110	3.85	0.15	0.60	0.51	0.05	5.81	21.6	0.05
22/2238	Earthworm	9.29	5.57	3.48	249	0.37	0.03	2.17	0.03	0.02	0.06	1.24	0.07
22/2239	Earthworm	4.82	3.05	2.63	158	0.82	0.02	1.62	0.04	0.02	0.07	0.73	0.14
22/2240	Earthworm	26.0	15.4	2.88	113	0.37	0.05	1.35	0.30	0.01	0.09	0.64	0.10
22/2241	Earthworm	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
22/2242	Earthworm	2.53	1.66	1.93	28.50	0.91	0.01	1.24	<0.01101	0.01	0.02	0.16	0.14
22/2245	Fieldfare egg	3.2E-03	3.9E-03	4.9E-01	7.4E+00	3.2E-03	<0.00023	3.1E-04	2.1E-02	<0.00018	2.3E-05	1.2E-02	1.2E-02
22/2246	Fieldfare egg	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
22/2247	Fieldfare egg	1.0E-02	8.7E-03	4.7E-01	5.7E+00	1.9E-03	<0.00028	2.1E-04	1.2E-02	<0.00022	2.3E-05	2.7E-03	1.3E-02
22/2248	Fieldfare egg	8.9E-03	7.1E-03	5.4E-01	9.4E+00	3.5E-03	5.1E-04	5.3E-04	2.4E-02	<0.00018	1.5E-05	5.2E-03	8.7E-03
22/2249	Fieldfare egg	5.4E-03	3.5E-03	5.3E-01	4.6E+00	5.9E-03	2.5E-04	2.2E-04	1.5E-02	<0.00016	6.4E-06	4.9E-03	1.5E-02
22/2250	Brown rat liver	0.074	0.036	6.194	19.218	2.075	0.068	0.021	0.044	8.5E-03	2.2E-04	0.226	7.2E-03
22/2251	Brown rat liver	0.033	0.018	2.757	20.682	1.902	7.0E-04	0.009	0.101	7.0E-03	5.5E-05	0.039	6.9E-03
22/2252	Brown rat liver	0.236	0.128	3.722	21.505	0.794	4.2E-04	0.012	<0.00423	6.0E-03	6.6E-05	0.134	1.1E-03
22/2253	Brown rat liver	0.226	0.104	4.701	29.100	1.713	2.8E-04	0.017	0.054	4.6E-02	1.7E-04	0.532	8.1E-04
22/2254	Brown rat liver	0.079	0.050	7.787	21.879	1.922	1.6E-03	0.023	0.009	1.5E-02	9.4E-05	0.172	3.2E-03

NILU-Sample number:	Sample type:	Cr	Ni	Cu	Zn	As	Ag	Cd	Sn	Sb	Gd	Pb	Hg
23/0285	Cat liver	0.03	0.01	46.2	32.2	0.02	2.6E-03	0.027	1.24	2.2E-02	1.3E-04	0.005	8.1E-03
22/3051	Indoor dust	28.7	14.1	48.5	261	2.67	0.631	0.537	2.23	1.52	1.12	30.5	0.081
22/3053	Indoor dust	32.4	15.9	83.3	233	2.51	0.292	0.206	1.62	0.523	5.49	25.1	0.032
22/3055	Indoor dust	26.7	1.04	12.2	129	0.08	0.235	0.082	1.18	3.65	0.036	1.195	0.049
22/3057	Indoor dust	15.6	2.00	23.8	150	0.23	0.274	0.153	1.12	3.94	0.147	2.83	0.046
22/3059	Indoor dust	21.0	2.71	24.6	977	0.51	0.493	0.120	1.50	2.05	0.370	4.12	0.073

PCB (ng/g)

NILU-Sample number:	Sample type:	PCB-28	PCB-52	PCB-101	PCB-118	PCB-138	PCB-153	PCB-180
22/2233	Soil	0.24	0.33	0.97	0.63	2.06	1.98	1.44
22/2234	Soil	<0.0708	<0.0633	0.06	0.07	0.20	0.24	0.12
22/2235	Soil	<0.0708	<0.0633	0.11	0.07	0.19	0.23	0.09
22/2236	Soil	<0.0708	<0.0633	0.12	0.07	0.24	0.29	0.18
22/2237	Soil	<0.0708	0.21	0.38	0.20	0.70	0.66	0.41
22/2238	Earthworm	0.08	0.04	0.35	0.23	1.02	1.48	0.94
22/2239	Earthworm	0.06	0.04	0.12	0.07	0.38	0.45	0.11
22/2240	Earthworm	0.10	0.04	0.17	0.10	0.42	0.68	0.18
22/2241	Earthworm	0.15	0.10	0.25	0.09	0.37	1.04	0.33
22/2242	Earthworm	0.11	0.10	0.32	0.13	0.87	1.13	0.25
22/2245	Fieldfare egg	0.02	1.27	5.42	1.85	12.40	21.70	11.90
22/2246	Fieldfare egg	<0.0209	0.12	0.82	0.31	3.25	5.82	2.60
22/2247	Fieldfare egg	0.01	0.21	1.36	0.60	4.36	7.36	3.34
22/2248	Fieldfare egg	<0.0209	0.36	2.32	1.31	6.58	12.60	3.73
22/2249	Fieldfare egg	0.05	1.53	4.72	1.47	9.68	18.20	6.80
22/2250	Brown rat liver	0.05	<0.0229	0.11	0.26	1.13	1.32	1.19
22/2251	Brown rat liver	0.07	0.02	0.08	0.26	2.47	3.27	2.43
22/2252	Brown rat liver	<0.0209	<0.0229	0.06	0.08	0.26	0.33	0.21
22/2253	Brown rat liver	0.02	<0.0229	0.21	0.27	1.23	1.22	1.29
22/2254	Brown rat liver	0.08	0.07	1.46	2.59	9.66	12.50	3.96

NILU-Sample number:	Sample type:	PCB-28	PCB-52	PCB-101	PCB-118	PCB-138	PCB-153	PCB-180
23/0285	Cat liver	<0.104	<0.0931	<0.0741	0.07	0.16	0.20	0.08
22/3050	Indoor dust	0.32	1.39	3.44	3.24	4.24	3.03	0.97
22/3052	Indoor dust	0.27	0.29	0.34	0.37	0.91	1.30	0.35
22/3054	Indoor dust	0.43	0.34	0.45	0.48	0.74	0.75	0.48
22/3056	Indoor dust	<0.443	0.46	0.61	0.71	1.42	2.22	0.44
22/3058	Indoor dust	0.24	0.37	0.64	0.51	0.82	1.08	0.32

PFCA (perfluorinated carboxylates) ng/g

NILU-Sample number:	Sample type:	TFA	PFPrA	PFBA	PFPA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA	PFHxDA	PFOcDA
22/2233	Soil	<1	<1	<0.20	<0.05	<0.10	0.24	0.33	0.15	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/2234	Soil	<1	<1	<0.20	<0.05	<0.10	0.17	0.17	0.13	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/2235	Soil	<1	<1	<0.20	<0.05	<0.10	0.11	0.16	0.06	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/2236	Soil	<1	<1	<0.20	<0.05	<0.10	0.32	1.06	0.19	<0.07	0.16	<0.10	<0.15	<0.10	<0.15	<0.15
22/2237	Soil	<1	<1	<0.20	0.12	<0.10	0.20	0.32	0.17	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/2238	EW	<1	<1	<0.20	1.51	0.70	<0.10	1.33	0.34	0.32	0.31	0.84	1.05	2.98	0.40	<0.15
22/2239	EW	<1	<1	<0.20	1.85	1.22	1.30	0.82	0.59	0.41	0.70	1.44	2.03	3.94	0.89	<0.15
22/2240	EW	<1	<1	<0.20	0.83	<0.10	0.61	0.98	0.59	0.34	0.51	0.93	1.59	2.48	0.38	<0.15
22/2241	EW	<1	<1	<0.20	<0.05	<0.10	0.59	2.05	1.23	0.69	0.31	<0.10	1.38	2.14	0.30	<0.15
22/2242	EW	<1	<1	<0.20	2.83	2.87	7.54	20.2	6.03	2.72	1.52	2.88	3.52	5.16	0.81	<0.15
22/2245	FF egg	<1	<1	<0.20	<0.05	<0.10	<0.10	0.44	0.72	1.11	1.11	3.09	2.51	2.56	0.17	<0.15
22/2246	FF egg	<1	<1	<0.20	<0.05	<0.10	<0.10	0.31	0.37	0.67	0.96	2.52	2.63	2.45	0.24	<0.15
22/2247	FF egg	<1	<1	<0.20	<0.05	<0.10	<0.10	0.31	0.57	1.03	1.14	3.10	3.20	4.48	0.31	<0.15
22/2248	FF egg	<1	<1	<0.20	<0.05	<0.10	<0.10	0.94	1.08	3.13	3.68	11.7	8.93	10.0	0.50	<0.15
22/2249	FF egg	<1	<1	<0.20	<0.05	<0.10	<0.10	0.50	0.41	1.79	1.43	8.04	6.53	8.42	0.34	<0.15
22/2250	BR liver	<1	<1	<0.20	0.73	<0.10	<0.10	0.17	0.84	3.66	2.18	6.04	2.51	3.19	0.22	<0.15
22/2251	BR liver	<1	<1	<0.20	0.44	0.24	0.24	510	202	11.9	4.15	8.62	2.46	2.16	<0.15	<0.15
22/2252	BR liver	<1	<1	<0.20	<0.05	<0.10	<0.10	0.13	0.13	0.50	0.32	0.30	0.13	<0.10	<0.15	<0.15
22/2253	BR liver	<1	<1	<0.20	1.71	<0.10	<0.10	0.04	0.13	1.65	0.71	1.69	0.33	0.44	<0.15	<0.15
22/2254	BR liver	<1	<1	<0.20	4.13	<0.10	<0.10	<0.02	0.59	5.72	1.82	4.86	1.70	4.22	<0.15	<0.15

NILU-Sample number:	Sample type:	TFA	PFPrA	PFBA	PFPA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA	PFHxDA	PFOcDA
23/0285	Cat liver	<1	<1	<0.20	<0.05	<0.10	<0.10	0.55	0.11	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/3051	Indoor dust	<1	<1	<0.20	<0.05	<0.10	<0.10	2.49	<0.07	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/3053	Indoor dust	<1	<1	<0.20	<0.05	3.47	<0.10	1.56	<0.07	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/3055	Indoor dust	<1	<1	<0.20	<0.05	1.25	<0.10	2.46	<0.07	<0.07	<0.10	0.41	<0.15	<0.10	<0.15	<0.15
22/3057	Indoor dust	<1	<1	<0.20	<0.05	<0.10	<0.10	3.31	1.17	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/3059	Indoor dust	<1	<1	<0.20	<0.05	1.52	<0.10	1.71	0.43	<0.07	<0.10	0.83	<0.15	<0.10	<0.15	<0.15
22/2255	Spanish slug	<1	<1	<0.20	<0.05	<0.10	<0.10	0.07	<0.07	0.058	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/2256	Spanish slug	<1	<1	<0.20	<0.05	<0.10	<0.10	0.06	<0.07	<0.07	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/2257	Spanish slug	<1	<1	<0.20	<0.05	<0.10	<0.10	0.05	<0.07	0.13	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15
22/2258	Spanish slug	<1	<1	<0.20	0.33	<0.10	<0.10	0.07	<0.07	0.09	<0.10	<0.10	<0.15	<0.10	<0.15	<0.15

PFSA (perfluorinated sulfonates) ng/g

NILU-Sample number:	Sample type:	PFEtS	PFPrS	PFBS	PFPS	PFHxS	PFHpS	L-PFOS	Sum-PFOS	PFNS	PFDcS	PFUnS	PFDoS	PFTrS	PFTS
22/2233	Soil	<1	<1	<0.02	<0.05	<0.02	<0.05	0.50	0.59	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2234	Soil	<1	<1	0.03	<0.05	<0.02	<0.05	0.20	0.20	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2235	Soil	<1	<1	<0.02	<0.05	<0.02	<0.05	0.39	0.39	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2236	Soil	<1	<1	<0.02	<0.05	<0.02	<0.05	0.67	0.71	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2237	Soil	<1	<1	<0.02	<0.05	<0.02	<0.05	0.52	0.57	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2238	EW	<1	<1	0.40	<0.05	<0.02	2.49	4.20	4.52	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2239	EW	<1	<1	1.30	<0.05	1.27	<0.05	10.2	10.8	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2240	EW	<1	<1	0.35	<0.05	1.30	0.93	8.58	8.84	<0.10	0.24	<0.20	<0.20	<0.20	<0.20
22/2241	EW	<1	<1	<0.02	<0.05	0.18	0.52	4.49	4.66	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2242	EW	<1	<1	0.21	<0.05	1.00	1.54	18.6	19.2	<0.10	0.51	<0.20	<0.20	<0.20	<0.20
22/2245	FF egg	<1	<1	<0.02	<0.05	0.13	0.13	14.3	15.1	<0.10	0.89	<0.20	<0.20	<0.20	<0.20
22/2246	FF egg	<1	<1	<0.02	<0.05	0.11	0.08	11.0	11.9	<0.10	0.44	<0.20	<0.20	<0.20	<0.20
22/2247	FF egg	<1	<1	<0.02	<0.05	0.09	0.15	12.3	13.2	<0.10	0.30	<0.20	<0.20	<0.20	<0.20
22/2248	FF egg	<1	<1	0.03	<0.05	0.35	0.27	38.4	40.8	<0.10	3.85	<0.20	<0.20	<0.20	<0.20
22/2249	FF egg	<1	<1	<0.02	<0.05	0.21	0.09	37.1	38.3	<0.10	2.09	<0.20	<0.20	<0.20	<0.20
22/2250	BR liver	<1	<1	<0.02	<0.05	<0.02	<0.05	9.45	11.5	<0.10	1.14	<0.20	<0.20	<0.20	<0.20
22/2251	BR liver	<1	<1	<0.02	<0.05	<0.02	0.82	52.9	83.8	<0.10	0.72	<0.20	<0.20	<0.20	<0.20
22/2252	BR liver	<1	<1	<0.02	<0.05	<0.02	<0.05	2.73	3.65	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2253	BR liver	<1	<1	<0.02	<0.05	<0.02	<0.05	9.22	11.3	<0.10	2.20	<0.20	<0.20	<0.20	<0.20
22/2254	BR liver	<1	<1	<0.02	<0.05	<0.02	0.055	191	219	0.48	71.7	<0.20	<0.20	<0.20	<0.20

NILU-Sample number:	Sample type:	PFEtS	PFPrS	PFBS	PFPS	PFHxS	PFHpS	L-PFOS	Sum-PFOS	PFNS	PFDcS	PFUnS	PFDoS	PFTrS	PFTS
23/0285	Cat liver	<1	<1	<0.02	<0.05	<0.02	<0.05	3.27	3.27	<0.10	<0.10	<0.15	<0.15	<0.15	<0.20
22/3051	Indoor dust	<1	<1	0.971	<0.05	<0.02	<0.05	<0.05	<0.05	<0.10	<0.10	<0.15	<0.15	<0.15	<0.20
22/3053	Indoor dust	<1	<1	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.10	<0.10	<0.15	<0.15	<0.15	<0.20
22/3055	Indoor dust	<1	<1	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.10	<0.10	<0.15	<0.15	<0.15	<0.20
22/3057	Indoor dust	<1	<1	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.10	<0.10	<0.15	<0.15	<0.15	<0.20
22/3059	Indoor dust	<1	<1	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.10	<0.10	<0.15	<0.15	<0.15	<0.20
22/2255	Spanish slug	<1	<1	<0.02	<0.05	<0.02	<0.05	0.15	0.22	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2256	Spanish slug	<1	<1	<0.02	<0.05	<0.02	<0.05	0.10	0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2257	Spanish slug	<1	<1	<0.02	<0.05	<0.02	0.10	0.29	0.37	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20
22/2258	Spanish slug	<1	<1	<0.02	<0.05	<0.02	<0.05	0.15	0.25	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20

nPFAS (polyfluorinated neutral compounds) ng/g

NILU-Sample number:	Sample type:	PFOSA	NMeFBSA	NEtFBSA	PFBSA	MeFOSA	EtFOSA	MeFOSE	EtFOSE	FOSAA	MeFOSAA	EtFOSAA
22/2233	Soil	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.250	<0.250	<0.250	<0.250	<0.250
22/2234	Soil	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.258	<0.258	<0.258	<0.258	<0.258
22/2235	Soil	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.244	<0.244	<0.244	<0.244	<0.244
22/2236	Soil	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.246	<0.246	<0.246	<0.246	<0.246
22/2237	Soil	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.240	<0.240	<0.240	<0.240	<0.240
22/2238	EW	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/2239	EW	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/2240	EW	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/2241	EW	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/2242	EW	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/2245	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2246	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2247	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2248	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2249	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2250	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2251	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2252	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2253	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2254	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20

NILU-Sample number:	Sample type:	PFOSA	NMeFBSA	NEtFBSA	PFBSA	MeFOSA	EtFOSA	MeFOSE	EtFOSE	FOSAA	MeFOSAA	EtFOSAA
23/0285	Cat liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/3051	Indoor dust	1.08	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/3053	Indoor dust	0.620	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/3055	Indoor dust	0.848	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/3057	Indoor dust	1.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/3059	Indoor dust	0.775	<0.10	<0.10	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
22/2255	Spanish slug	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2256	Spanish slug	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2257	Spanish slug	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2258	Spanish slug	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

Fluorotelomer sulfonates (New PFAS) ng/g

NILU-Sample number:	Sample type:	6:2 FTS	8:2 FTS	10:2 FTS	12:2 FTS	4:2 FTS	PFECHS
22/2233	Soil	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2234	Soil	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2235	Soil	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2236	Soil	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2237	Soil	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2238	EW	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2239	EW	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2240	EW	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2241	EW	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2242	EW	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2245	FF egg	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2246	FF egg	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2247	FF egg	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2248	FF egg	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2249	FF egg	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2250	BR liver	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2251	BR liver	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2252	BR liver	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2253	BR liver	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2254	BR liver	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15

NILU-Sample number:	Sample type:	6:2 FTS	8:2 FTS	10:2 FTS	12:2 FTS	4:2 FTS	PFECHS
23/0285	Cat liver	0.534	<0.15	<0.15	<0.15	<0.15	<0.15
22/3051	Indoor dust	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/3053	Indoor dust	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/3055	Indoor dust	<0.15	0.98	<0.15	<0.15	<0.15	<0.15
22/3057	Indoor dust	<0.15	2.54	<0.15	<0.15	<0.15	<0.15
22/3059	Indoor dust	<0.15	0.39	<0.15	<0.15	<0.15	<0.15
22/2255	Spanish slug	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2256	Spanish slug	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2257	Spanish slug	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
22/2258	Spanish slug	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15

Brominated flame retardants (BFR) ng/g

NILU-Sample number:	Sample type:	ATE (TBP-AE)	α-TBECH	β-TBECH	γ/δ-BECH	BATE	PBT	PBEB	PBBZ	HBB	DPTE	EHTBB	BTBPE
22/2233	Soil	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2234	Soil	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2235	Soil	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2236	Soil	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2237	Soil	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2238	EW	<0.0348	<0.202	<0.133	<0.0957	<0.04	<0.0734	<0.0357	<0.297	<0.124	<0.0295	<0.0303	<0.0618
22/2239	EW	<0.0348	<0.202	<0.133	<0.0957	<0.04	<0.0734	<0.0357	<0.297	0.132	<0.0295	<0.0303	<0.0618
22/2240	EW	<0.0348	<0.202	<0.133	0.449	<0.04	<0.0734	<0.0357	<0.297	<0.124	<0.0295	<0.0303	<0.0618
22/2241	EW	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2242	EW	<0.0348	<0.202	<0.133	<0.0957	<0.04	<0.0734	<0.0357	<0.297	<0.124	<0.0295	<0.0303	<0.0618
22/2245	FF egg	<0.0348	<0.202	<0.133	<0.0957	<0.04	<0.0734	<0.0357	<0.297	<0.124	<0.0295	<0.0303	<0.0618
22/2246	FF egg	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	0.075	0.069	<0.124
22/2247	FF egg	<0.0348	<0.202	<0.133	<0.0957	<0.04	<0.0734	<0.0357	<0.297	<0.124	<0.0295	<0.0303	<0.0618
22/2248	FF egg	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2249	FF egg	<0.0348	<0.202	<0.133	<0.0957	<0.04	<0.0734	<0.0357	<0.297	<0.124	<0.0295	<0.0303	<0.0618
22/2250	BR liver	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.114	<0.124
22/2251	BR liver	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2252	BR liver	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2253	BR liver	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124
22/2254	BR liver	<0.0696	<0.405	<0.267	<0.191	<0.0799	<0.147	<0.0713	<0.593	<0.248	<0.059	<0.0606	<0.124

NILU-Sample number:	Sample type:	ATE (TBP-AE)	α-TBECH	β-TBECH	γ/δ-BECH	BATE	PBT	PBEB	PBBZ	HBB	DPTE	EHTBB	BTBPE
23/0285	Cat liver	<0.102	<0.595	<0.393	<0.282	<0.118	<0.216	<0.105	<0.873	<0.365	<0.0868	<0.0891	<0.182
22/3050	Indoor dust	<0.0994	<0.578	<0.381	<0.274	<0.114	<0.21	<0.102	<0.848	0.594	0.188	2.14	0.389
22/3052	Indoor dust	<0.174	<1.01	0.72	<0.479	<0.2	0.61	<0.178	<1.48	1.18	0.23	7.10	0.60
22/3054	Indoor dust	<0.0828	0.52	0.37	<0.228	<0.0952	0.19	<0.0849	<0.706	1.27	<0.0703	3.68	0.59
22/3056	Indoor dust	<0.435	<2.53	<1.67	<1.2	<0.5	1.78	<0.446	<3.71	<1.55	0.41	2.90	<0.773
22/3058	Indoor dust	<0.129	<0.75	0.50	<0.355	<0.148	0.76	<0.132	<1.1	<0.46	0.56	8.83	0.38

Brominated flame retardants (BFR) ng/g

NILU-Sample number:	Sample type:	TBPH (BEH/TBP)	DBDPE	α-HBCD	β-HBCD	γ-HBCD
22/2233	Soil	<0.273	<5.41	0.064	<0.0198	0.070
22/2234	Soil	<0.273	<5.41	<0.049	<0.0198	0.054
22/2235	Soil	<0.273	<5.41	<0.049	<0.0198	<0.0487
22/2236	Soil	<0.273	<5.41	<0.049	<0.0198	<0.0487
22/2237	Soil	<0.273	<5.41	0.103	<0.0198	<0.0487
22/2238	EW	<0.136	<2.71	<0.0245	<0.0145	0.040
22/2239	EW	<0.136	<2.71	<0.0245	<0.0121	<0.0251
22/2240	EW	<0.136	<2.71	<0.0245	<0.016	<0.0243
22/2241	EW	<0.273	<5.41	<0.049	<0.0198	<0.0487
22/2242	EW	<0.136	<2.71	0.026	<0.0106	<0.0243
22/2245	FF egg	<0.136	<2.71	<0.0245	<0.0099	<0.0243
22/2246	FF egg	<0.349	<5.41	<0.049	<0.0198	<0.0487
22/2247	FF egg	<0.136	<2.71	0.066	<0.0099	<0.0243
22/2248	FF egg	<0.273	<5.41	0.095	<0.0198	<0.0487
22/2249	FF egg	<0.136	<2.71	0.254	<0.0099	<0.0243
22/2250	BR liver	40.0	<6.47	2.61	0.02	<0.0831
22/2251	BR liver	<0.273	<5.41	<0.049	<0.0198	<0.102
22/2252	BR liver	<0.273	<5.41	<0.049	<0.0198	<0.0487
22/2253	BR liver	<0.273	<5.41	0.09	<0.0198	<0.122
22/2254	BR liver	<0.399	29.6	0.45	<0.0198	<0.265

NILU-Sample number:	Sample type:	TBPH (BEH/TBP)	DBDPE	α-HBCD	β-HBCD	γ-HBCD
23/0285	Cat liver	<0.401	<7.96	n.a.	n.a.	n.a.
22/3050	Indoor dust	15.5	104	6.08	0.82	1.56
22/3052	Indoor dust	246	909	6.40	0.97	1.19
22/3054	Indoor dust	18.1	118	58.5	7.95	107
22/3056	Indoor dust	45.5	62.7	1.13	<0.124	0.78
22/3058	Indoor dust	189	96.5	1.82	0.25	0.41

Chlorinated paraffins (CP) ng/g

NILU- Sample number:	Sample type:	SCCP	MCCP
22/2233	Soil	<57	<58
22/2234	Soil	<57	<58
22/2235	Soil	<57	<58
22/2236	Soil	<57	<58
22/2237	Soil	<57	<58
22/2238	EW	<11	<30
22/2239	EW	<11	<30
22/2240	EW	<11	86.6
22/2241	EW	<21	<61
22/2242	EW	13.5	<30
22/2245	FF egg	<11	44.8
22/2246	FF egg	<21	203.8
22/2247	FF egg	<11	57.2
22/2248	FF egg	<21	78.4
22/2249	FF egg	12.7	67.4
22/2250	BR liver	36.1	941
22/2251	BR liver	<21	63.9
22/2252	BR liver	<21	<61
22/2253	BR liver	<21	91
22/2254	BR liver	42.9	2193

NILU- Sample number:	Sample type:	SCCP	MCCP
23/0285	Cat liver	<70	<135
22/3050	Indoor dust	870	1658
22/3052	Indoor dust	1693	5271
22/3054	Indoor dust	921	2396
22/3056	Indoor dust	1588	3840
22/3058	Indoor dust	1048	3954

Cyclic siloxanes (cVMS) ng/g

NILU- Sample number:	Sample type:	D4	D5	D6	M3T (ph)
22/2233	Soil	0.155	0.144	0.193	< LOQ
22/2234	Soil	0.100	0.124	0.097	< LOQ
22/2235	Soil	0.042	0.052	<0.045	< LOQ
22/2236	Soil	0.227	0.350	0.514	< LOQ
22/2237	Soil	0.079	0.206	0.157	< LOQ
22/2238	EW	0.492	0.346	0.288	< LOQ
22/2239	EW	0.832	0.607	0.318	< LOQ
22/2240	EW	0.954	0.792	0.493	< LOQ
22/2241	EW	1.07	1.41	3.27	< LOQ
22/2242	EW	0.847	0.927	0.547	< LOQ
22/2245	FF egg	<0.430	3.56	1.14	< LOQ
22/2246	FF egg	<0.430	1.15	0.684	< LOQ
22/2247	FF egg	<0.430	1.82	0.646	< LOQ
22/2248	FF egg	<0.430	6.97	1.54	< LOQ
22/2249	FF egg	0.503	5.54	1.57	< LOQ
22/2250	BR liver	0.755	1.27	0.984	< LOQ
22/2251	BR liver	10.9	148	184	< LOQ
22/2252	BR liver	5.58	12.4	1.74	< LOQ
22/2253	BR liver	1.19	1.73	1.53	< LOQ
22/2254	BR liver	0.80	3.96	3.87	< LOQ

NILU- Sample number:	Sample type:	D4	D5	D6	M3T (ph)
23/0285	Cat liver	2.85	3.24	3.91	< LOQ
22/3051	Indoor dust	13.7	22.6	10.9	< LOQ
22/3053	Indoor dust	10.3	8.84	20.2	< LOQ
22/3055	Indoor dust	9.67	10.4	19.0	< LOQ
22/3057	Indoor dust	20.2	61.9	43.4	< LOQ
22/3059	Indoor dust	26.7	75.7	51.9	< LOQ

Linear siloxanes ng/g

NILU- Sample number:	Sample type:	L3	L4	L5
22/2233	Soil	<0.871	<1.814	<1.940
22/2234	Soil	<0.871	<1.814	<1.940
22/2235	Soil	<0.871	<1.814	<1.940
22/2236	Soil	<0.871	<1.814	<1.940
22/2237	Soil	<0.871	<1.814	<1.940
22/2238	EW	<1.565	<4.902	<8.466
22/2239	EW	<1.565	<4.902	<8.466
22/2240	EW	<1.565	<4.902	<8.466
22/2241	EW	<1.565	<4.902	<8.466
22/2242	EW	<1.565	<4.902	<8.466
22/2245	FF egg	<1.397	<4.582	<6.617
22/2246	FF egg	<1.397	<4.582	<6.617
22/2247	FF egg	<1.397	<4.582	<6.617
22/2248	FF egg	<1.397	<4.582	<6.617
22/2249	FF egg	<1.397	<4.582	<6.617
22/2250	BR liver	<1.392	<4.498	<8.198
22/2251	BR liver	<1.392	<4.498	<8.198
22/2252	BR liver	<1.392	<4.498	<8.198
22/2253	BR liver	<1.392	<4.498	<8.198
22/2254	BR liver	<1.392	<4.498	<8.198

NILU- Sample number:	Sample type:	L3	L4	L5
23/0285	Cat liver	<0.504	<2.294	<5.722
22/3051	Indoor dust	<4.378	<8.745	<7.910
22/3053	Indoor dust	<4.378	<8.745	<7.910
22/3055	Indoor dust	<4.378	<8.745	<7.910
22/3057	Indoor dust	<4.378	<8.745	<7.910
22/3059	Indoor dust	<4.378	<8.745	<7.910

Organic phosphorous flame retardants (OPFR) ng/g

NILU-Sample number:	Sample type:	TEP	TCEP	TPrP/ TPP	TCPP/ TCIPP	TDCPP	TPHP	BdPhP	DBPhP	TIBP/ TNBP
22/2233	Soil	< 1.8	0.27	< 0.1	218	< 0.2	1.13	< 0.1	< 0.1	0.61
22/2234	Soil	< 1.8	< 0.1	< 0.1	15.16	< 0.2	0.21	< 0.1	< 0.1	< 0.5
22/2235	Soil	< 1.8	0.64	< 0.1	2.98	< 0.2	0.12	< 0.1	< 0.1	< 0.5
22/2236	Soil	< 1.8	0.32	< 0.1	11.0	< 0.2	0.3	< 0.1	< 0.1	< 0.5
22/2237	Soil	1.93	< 0.1	< 0.1	9.34	< 0.2	0.46	< 0.1	< 0.1	2.69
22/2238	EW	< 20.1	< 0.1	< 0.1	< 1.0	< 0.2	< 0.1	< 0.1	< 0.1	< 0.1
22/2239	EW	< 20.1	< 0.1	< 0.1	< 1.0	< 0.2	< 0.1	< 0.1	< 0.1	1.98
22/2240	EW	< 20.1	< 0.1	< 0.1	3.27	< 0.2	< 0.1	< 0.1	< 0.1	1.38
22/2241	EW	< 20.1	< 0.1	< 0.1	< 1.0	< 0.2	< 0.1	< 0.1	< 0.1	2.04
22/2242	EW	< 20.1	0.31	< 0.1	9.34	< 0.2	0.12	< 0.1	< 0.1	3.08
22/2245	FF egg	< 5.2	< 0.1	< 0.1	< 1.7	< 0.2	< 0.2	< 0.1	< 0.1	0.99
22/2246	FF egg	< 5.2	0.4	< 0.1	8.32	< 0.2	11.59	< 0.1	< 0.1	0.76
22/2247	FF egg	< 5.2	< 0.1	< 0.1	< 1.7	< 0.2	< 0.2	< 0.1	< 0.1	1.16
22/2248	FF egg	< 5.2	< 0.1	< 0.1	< 1.7	< 0.2	0.24	< 0.1	< 0.1	< 0.5
22/2249	FF egg	< 5.2	0.2	< 0.1	3.48	< 0.2	3.01	< 0.1	< 0.1	< 0.5
22/2250	BR liver	< 9.4	< 0.1	< 0.1	1.52	< 0.2	< 0.1	< 0.1	< 0.1	< 0.6
22/2251	BR liver	< 9.4	< 0.1	< 0.1	93.5	< 0.2	< 0.1	< 0.1	< 0.1	< 0.6
22/2252	BR liver	< 9.4	< 0.1	< 0.1	< 0.5	< 0.2	< 0.1	< 0.1	< 0.1	< 0.6
22/2253	BR liver	10.0	< 0.1	< 0.1	< 0.5	< 0.2	< 0.1	< 0.1	< 0.1	< 0.6
22/2254	BR liver	< 9.4	< 0.1	< 0.1	0.62	< 0.2	< 0.1	< 0.1	< 0.1	< 0.6

NILU-Sample number:	Sample type:	TEP	TCEP	TPrP/ TPP	TCPP/ TCIPP	TDCPP	TPHP	BdPhP	DBPhP	TIBP/ TNBP
23/0285	Cat liver	n.a.	< 2.0	< 2.0	3.64	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
22/3051	Indoor dust	n.a.	188	< 10	1699	15.0	59.0	< 2.0	96	1547
22/3053	Indoor dust	n.a.	229	< 10	764	100	227	< 2.0	< 10	453
22/3055	Indoor dust	n.a.	149	< 10	1526	550	221	< 2.0	< 10	810
22/3057	Indoor dust	n.a.	177	< 10	1192	61.9	1678	< 2.0	< 10	727
22/3059	Indoor dust	n.a.	146	< 10	6027	211	515	< 2.0	2.5	2787

Organic phosphorous flame retardants (OPFR) ng/g

NILU-Sample number:	Sample type:	TBOEP	TCP	EHDP	TXP	TIPPP	TTBPP	TEHP
22/2233	Soil	1.69	0.96	2.43	0.36	1.27	< 0.3	0.76
22/2234	Soil	< 0.2	< 0.2	0.38	< 0.2	0.81	< 0.3	0.41
22/2235	Soil	0.32	< 0.2	< 0.2	0.62	< 0.2	< 0.3	0.69
22/2236	Soil	0.27	0.87	< 0.2	< 0.2	0.75	< 0.3	0.46
22/2237	Soil	0.80	0.60	0.21	< 0.2	0.62	< 0.3	0.8
22/2238	EW	< 0.6	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
22/2239	EW	< 0.6	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
22/2240	EW	< 0.6	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
22/2241	EW	< 0.6	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
22/2242	EW	< 0.6	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
22/2245	FF egg	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1	< 0.2	< 0.2
22/2246	FF egg	0.27	0.25	0.87	0.17	0.15	< 0.2	0.89
22/2247	FF egg	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1	< 0.2	< 0.2
22/2248	FF egg	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1	< 0.2	< 0.2
22/2249	FF egg	< 0.2	< 0.2	0.34	< 0.1	< 0.1	< 0.2	0.41
22/2250	BR liver	0.36	< 0.3	< 0.3	< 0.3	< 0.3	0.68	< 0.2
22/2251	BR liver	< 0.2	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.2
22/2252	BR liver	< 0.2	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.2
22/2253	BR liver	0.66	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.2
22/2254	BR liver	0.33	< 0.3	0.57	< 0.3	< 0.3	< 0.3	< 0.2

NILU-Sample number:	Sample type:	TBOEP	TCP	EHDP	TXP	TIPPP	TTBPP	TEHP
23/0285	Cat liver	< 2.0	< 5.0	< 2.0	< 5.0	< 5.0	< 5.0	< 2.0
22/3051	Indoor dust	20	49.9	42.0	46.6	< 10	45.1	< 10
22/3053	Indoor dust	299	22.6	93.6	85.2	18.7	18.5	42.3
22/3055	Indoor dust	374	17.1	496	308	21.1	< 10	< 10
22/3057	Indoor dust	87	47.5	435	82.3	248	63.8	72.2
22/3059	Indoor dust	33190	29.7	419	507	26.1	45.1	68.4

Dechloranes and dibromoaldrin ng/g

NILU Sample number:	Sample type:	Dibromoaldrin	Dechlorane 602	Dechlorane 603	Dechlorane 604	Dechlorane 601	Dechlorane plus syn	Dechlorane plus anti
22/2233	Soil	<0.283	<0.0304	<0.0422	<0.73	<0.0679	0.464	0.532
22/2234	Soil	<0.282	<0.0304	<0.0422	<0.73	<0.0679	<0.156	0.398
22/2235	Soil	<0.257	<0.0304	<0.0422	<0.73	<0.0679	<0.156	0.187
22/2236	Soil	<0.215	<0.0304	<0.0422	<0.73	<0.0679	<0.156	0.328
22/2237	Soil	<0.207	0.0337	<0.0422	<0.73	<0.0679	0.489	1.37
22/2238	EW	<0.115	<0.016	<0.0211	<0.365	<0.0339	<0.078	<0.0636
22/2239	EW	<0.104	<0.0152	<0.0211	<0.365	<0.0339	<0.078	<0.0636
22/2240	EW	<0.107	<0.0152	<0.0211	<0.365	<0.0339	<0.078	<0.0636
22/2241	EW	<0.213	<0.0304	<0.0422	<0.73	<0.0679	<0.156	<0.127
22/2242	EW	<0.119	0.018	<0.0211	<0.365	<0.0339	<0.078	0.066
22/2245	FF egg	<0.0962	0.291	0.195	<0.365	<0.0339	0.124	0.264
22/2246	FF egg	<0.193	0.0373	0.225	<0.73	<0.0679	<0.156	<0.127
22/2247	FF egg	<0.146	0.0572	1.65	<0.365	<0.0339	<0.078	<0.0636
22/2248	FF egg	<0.204	0.0608	<0.0422	<0.73	<0.0679	<0.156	<0.127
22/2249	FF egg	<0.0962	0.055	0.0564	<0.365	<0.0339	0.0949	0.127
22/2250	BR liver	<0.242	<0.0323	<0.0422	<0.73	<0.0679	0.547	2.54
22/2251	BR liver	<0.345	<0.046	<0.0422	<0.73	<0.0679	<0.156	<0.127
22/2252	BR liver	<0.389	<0.0519	<0.0443	<0.786	<0.0679	<0.156	<0.127
22/2253	BR liver	<0.279	<0.0372	<0.0422	<0.73	<0.0679	0.343	1.26
22/2254	BR liver	<0.254	<0.0338	0.0577	<0.73	<0.0679	0.481	1.54

NILU Sample number:	Sample type:	Dibromoaldrin	Dechlorane 602	Dechlorane 603	Dechlorane 604	Dechlorane 601	Dechlorane plus syn	Dechlorane plus anti
23/0285	Cat liver	<0.414	<0.0447	<0.0621	<1.07	<0.0998	<0.229	<0.187
22/3050	Indoor dust	<0.261	<0.0434	<0.0603	<1.04	<0.0969	12.8	18.6
22/3052	Indoor dust	<0.407	<0.0759	<0.106	<1.83	<0.17	2.29	12.1
22/3054	Indoor dust	<0.199	<0.0362	<0.0503	<0.869	<0.0808	24.7	104.0
22/3056	Indoor dust	<1.44	<0.19	<0.264	<4.56	<0.424	<0.975	3.72
22/3058	Indoor dust	<0.278	<0.0563	<0.0782	<1.35	<0.126	1.07	1.44

UV stabilizing compounds ng/g

NILU-Sample number:	Sample type:	OC	BP3	EHMC-Z	EHMC-E	UV-327	UV-328	UV329	Homo-salate
22/2233	Soil	2.77	<0.3	<0.2	0.21	<0.3	1.28	<0.2	3.27
22/2234	Soil	<1	0.66	<0.2	<0.1	<0.3	1.06	<0.2	<3
22/2235	Soil	<1	<0.3	<0.2	<0.1	<0.3	<0.5	<0.2	<3
22/2236	Soil	5.73	<0.3	<0.2	0.24	<0.3	<0.5	<0.2	<3
22/2237	Soil	<1	0.403	<0.2	<0.1	<0.3	0.59	<0.2	<3
22/2238	EW	1.24	<1	0.29	<0.5	<0.6	1.07	<2	<5
22/2239	EW	<3	<2	<0.2	<1	<0.6	<1	<3	<7
22/2240	EW	<1.5	<1	0.10	0.63	<0.6	<0.4	<2	<5
22/2241	EW	<1.5	<1	<0.1	<0.5	<0.6	<0.4	<2	<5
22/2242	EW	<2	<1	0.13	<0.5	<0.6	<0.4	<2	<5
22/2245	FF egg	<1	<0.5	<0.1	<0.3	<0.4	<0.4	<2	<2
22/2246	FF egg	<1	<0.5	n.a.	n.a.	<0.4	<0.4	n.a.	<2
22/2247	FF egg	<1.5	<0.5	n.a.	<0.3	<0.4	<0.4	n.a.	<2
22/2248	FF egg	<1	<0.5	0.10	<0.3	<0.4	<0.4	<2	<2
22/2249	FF egg	<1	<0.5	0.14	0.30	<0.4	<0.4	<2	<2
22/2250	BR liver	<1.5	<1	<0.1	<0.3	<1	5.67	<5	<2
22/2251	BR liver	2.65	<0.5	0.31	0.44	<0.3	<0.5	<2	<4
22/2252	BR liver	<1	<0.5	<0.1	<0.3	<0.3	<0.5	<2	<2
22/2253	BR liver	<1	<0.5	<0.1	<0.3	<0.3	<0.5	<2	<2
22/2254	BR liver	<1	<0.5	<0.1	<0.3	<0.3	<1	<2	<2

NILU-Sample number:	Sample type:	OC	BP3	EHMC-Z	EHMC-E	UV-327	UV-328	UV329	Homo-salate
23/0285	Cat liver	<0.3	0.61	<0.5	<0.1	<0.1	<0.1	1.36	<15
22/3050	Indoor dust	4565	40.5	15.7	35.7	3.66	29.7	12.7	87.8
22/3052	Indoor dust	11884	93.3	205	202	10.8	38.0	20.4	926
22/3054	Indoor dust	3978	31.7	104	138	8.55	62.7	13.4	253
22/3056	Indoor dust	6410	408.4	136	163	18.6	135	33.9	668
22/3058	Indoor dust	16778	60.8	714	691.7	16.5	69.7	33.9	3708

Bisphenols and phenols ng/g

NILU Sample number:	Sample type:	TBBPA	4,4 Bis-A	2,4 Bis-A	2,4 Bis-S	4,4-Bis-F	2,4 Bis-F	Bis-G	Bis-FL	Bis-AP	Bis-Z	Bis-E
22/2233	Soil	<4.3	4.1	<1.8	<0.26	2.6	5.2	<0.81	<0.89	<0.66	<1.3	<0.60
22/2234	Soil	<4.6	<4.0	<1.9	<0.27	<0.62	<1.5	<0.85	<0.93	<0.69	<1.3	<0.64
22/2235	Soil	<4.3	3.9	<1.8	<0.26	<0.59	<1.5	<0.81	<0.89	<0.66	<1.3	<0.60
22/2236	Soil	<4.3	<3.8	<1.8	<0.26	2.3	2.7	<0.81	<0.89	<0.66	<1.3	<0.60
22/2237	Soil	<4.1	<3.7	<1.8	<0.25	0.78	<1.4	<0.77	<0.84	<0.63	<1.2	<0.58
22/2238	EW	<4.5	<5.8	NA	<0.31	6.6	19	<0.59	<0.72	<0.51	<0.85	<0.52
22/2239	EW	<5.7	<4.7	NA	<0.37	<3.6	6.4	<0.68	<0.84	<0.59	<0.99	<0.60
22/2240	EW	<3.7	<4.5	NA	<0.35	3.8	11	<0.65	<0.79	<0.56	<0.94	<0.57
22/2241	EW	<3.9	<4.7	NA	<0.37	4.6	7.4	<0.68	<0.80	<0.59	<0.99	<0.55
22/2242	EW	<3.7	<4.5	NA	<0.35	12	22	<0.65	<0.79	<0.56	<0.94	<0.57
22/2245	FF egg	<3.5	<4.3	<1.5	<0.38	<0.49	<1.2	<0.65	<0.72	<0.53	<1.0	<0.50
22/2246	FF egg	<16	<4.7	<1.6	<0.42	<0.54	<1.3	<0.73	<0.80	<0.59	<1.1	<0.55
22/2247	FF egg	<6.4	<3.6	<1.2	<0.32	<0.41	<0.99	<0.54	<0.60	<0.44	<0.84	<0.41
22/2248	FF egg	<3.2	<3.9	<1.3	<0.34	<0.44	<1.1	<0.59	<0.66	<0.49	<0.92	<0.45
22/2249	FF egg	<3.2	<3.9	<1.3	<0.34	<0.44	<1.1	<0.59	<0.68	<0.49	<0.92	<0.45
22/2250	BR liver	<2.8	7.2	<1.2	<0.26	<0.45	<0.95	<0.49	<0.64	<0.43	<0.72	<0.50
22/2251	BR liver	<3.7	<4.5	<1.6	<0.40	<0.51	<1.3	<0.69	<0.76	<0.56	<0.94	<0.52
22/2252	BR liver	<3.9	<4.7	<1.6	<0.37	<0.54	<1.3	<0.73	<0.80	<0.59	<0.99	<0.55
22/2253	BR liver	<3.2	5.0	<1.3	1.3	6.5	6.3	<0.59	<0.66	<0.49	<0.54	<0.45
22/2254	BR liver	<2.9	<3.6	<1.2	<0.32	<0.41	<0.99	<0.54	<0.60	<0.44	<0.75	<0.41

NILU Sample number:	**Sample type:**	TBBPA	4,4 Bis-A	2,4 Bis-A	2,4 Bis-S	4,4-Bis-F	2,4 Bis-F	Bis-G	Bis-FL	Bis-AP	Bis-Z	Bis-E
23/0285	Cat liver	<7.0	<31	<0.28	<0.069	<22	<28	<0.15	<0.23	<0.15	<0.45	<0.19
22/3050	Indoor dust	n.a.	779	<4.1	1.7	68	104	<2.3	<3.7	<2.3	<1.4	<3.1
22/3052	Indoor dust	<55	2910	4.1	22	58	50	<0,69	<1.1	<0.70	<1.4	<0.91
22/3054	Indoor dust	<26	645	<1.3	13	188	55	<0.73	<1.2	<0.74	<0.83	<0.96
22/3056	Indoor dust	<80	3970	5.7	14	360	<116	<1.7	<2.8	<1.8	<3.0	<2.3
22/3058	Indoor dust	n.a.	1050	10	31	1070	123	<0.51	<0.82	<0.52	<1.4	<0.68

Bisphenols and phenols

NILU Sample number:	Sample type:	Bis-B	Bis-M	4-Dodecyl-phenol	4-n-Nonyl-phenol	4-n-Octyl-phenol	4-t-Octyl-phenol
22/2233	Soil	<0.79	<0.11	<0.78	<2.1	<1.5	<1.2
22/2234	Soil	<0.83	<0.11	<0.82	<2.2	<1.6	<1.2
22/2235	Soil	<0.79	<0.11	<0.78	<2.1	<1.5	<1.2
22/2236	Soil	<0.79	<0.11	<0.78	<2.1	<1.5	<1.2
22/2237	Soil	<0.75	<0.10	<0.74	<2.0	<1.5	<1.1
22/2238	EW	<0.59	<0.16	<0.61	3.0	<1.9	2.8
22/2239	EW	<0.69	<0.19	<0.71	<1.7	21.0	4.8
22/2240	EW	<0.65	<0.25	<1.2	<1.8	<1.3	1.6
22/2241	EW	<0.69	<0.23	<1.4	2.7	13.0	<1.5
22/2242	EW	<0.65	<0.18	<1.3	<1.9	<1.3	<1.5
22/2245	FF egg	<0.64	<0.18	<1.6	<2.3	<1.2	<1.32
22/2246	FF egg	<0.71	<0.34	<0.95	8.8	1.8	<1.5
22/2247	FF egg	<0.53	<0.53	<6.2	<9.0	<1.0	<1.1
22/2248	FF egg	<0.58	<0.10	<0.58	<1.5	<1.1	<1.2
22/2249	FF egg	<0.58	<0.093	<0.58	<1.5	<1.1	<1.2
22/2250	BR liver	<0.51	<0.25	<5.4	17	1.5	<1.1
22/2251	BR liver	<0.67	<0.23	<1.9	<2.9	3.7	<1.4
22/2252	BR liver	<0.71	<0.32	<2.2	<3.4	<1.3	<1.5
22/2253	BR liver	<0.58	<0.19	<0.59	<0.91	<1.1	<1.2
22/2254	BR liver	<0.53	<0.16	<1.2	3.0	1.4	<1.1

NILU Sample number:	Sample type:	Bis-B	Bis-M	4-Dodecyl-phenol	4-n-Nonyl-phenol	4-n-Octyl-phenol	4-t-Octyl-phenol
23/0285	Cat liver	<0.18	<0.080	<0.29	0.46	3.4	6.0
22/3050	Indoor dust	<2.1	<0.53	<2.1	19	n.a.	n.a.
22/3052	Indoor dust	<0.96	<0.58	<0.71	3.1	3.9	19
22/3054	Indoor dust	<1.1	<0.70	<1.2	4.6	40	129
22/3056	Indoor dust	<2.2	<0.84	<1.2	<1.4	7.3	39
22/3058	Indoor dust	<0.68	<1.1	n.a.	n.a.	2.2	21

Biocides (rodenticides) ng/g

NILU Sample number:	Sample type:	Bromadiolon	cis-Brodifacoum	trans-Brodifacoum	trans-Flocumafen	cis-Floccmafen	cis-Difenacoum	trans-Difenacoum	trans-Difethialone	cis-Difethialone	cis-Permethrin	trans-Permethrin
22/2546	BR liver	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.7	<1
22/2547	BR liver	5.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.7	<1
22/2548	BR liver	611	1.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.7	<1
22/2549	BR liver	2.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	20	45
22/2251	BR liver	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.7	<1
23/0285	Cat liver	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.8	2.1
22/3051	Dust	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	26.0	70.7
22/3053	Dust	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	262	368
22/3055	Dust	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	35.8	58.9
22/3057	Dust	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	37.8	80.4
22/3059	Dust	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	24.3	51.9

Musk compounds ng/g

NILU-Sample number:	Sample type:	OTNE	Galaxolide	Tonalide= AHMT	Traseolide	Phantolide	Celestolide
22/2233	Soil	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2234	Soil	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2235	Soil	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2236	Soil	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2237	Soil	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2238	EW	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2239	EW	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2240	EW	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2241	EW	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2242	EW	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2245	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2246	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2247	FF egg	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
22/2248	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2249	FF egg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2250	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2251	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2252	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2253	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/2254	BR liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

NILU-Sample number:	Sample type:	OTNE	Galaxolide	Tonalide= AHMT	Traseolide	Phantolide	Celestolide
23/0285	Cat liver	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22/3051	Indoor dust	<0.10	3.68	0.27	<0.10	<0.10	<0.10
22/3053	Indoor dust	<0.10	5.64	1.77	<0.10	<0.10	<0.10
22/3055	Indoor dust	<0.10	0.53	0.30	<0.10	<0.10	<0.10
22/3057	Indoor dust	<0.10	7.79	1.29	<0.10	<0.10	<0.10
22/3059	Indoor dust	<0.10	5.34	1.85	<0.10	<0.10	<0.10

Phthalates ng/g

NILU-Sample number:	Sample type:	DEHP	DPHP+ DiDP	DiNP	DiBP	DnBP	DEP	BBP	DCHP	DHxP	DOP	DNP	DiUnP
22/2233	Soil	56.9	25.5	75.7	< 3.0	7.92	< 3.0	4.53	1.09	< 0.5	1.58	1.33	< 5.0
22/2234	Soil	29.3	8.7	< 17	< 3.0	< 3.0	< 3.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 5.0
22/2235	Soil	51.6	5.0	30.7	< 3.0	10.8	< 3.0	< 0.5	< 0.5	< 0.5	1.59	0.97	< 5.0
22/2236	Soil	72.3	13.9	60.4	< 3.0	< 3.0	< 3.0	2.87	< 0.5	< 0.5	< 0.5	0.87	< 5.0
22/2237	Soil	70.0	25.0	26.4	< 3.0	< 3.0	< 3.0	< 0.5	0.79	< 0.5	< 0.5	< 0.5	< 5.0

ISBN: 978-82-425-3136-0
ISSN: 2464-3327