

# Screening program 2018

Volatiles, Gd, BADGE, UV filters, Additives, and  
Medicines

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## Summary

***The screening programme 2018 part 2, conducted by NILU-Norwegian Institute for Air Research and the Norwegian Institute for Water Research (NIVA), has focused on the occurrence and expected environmental problems of several chemicals, which were selected based on possible PBT-properties (persistence, bioaccumulation, and toxicity). Some of the selected chemicals need to be studied in more detail and one UV-filter compound shows a potential environmental risk.***

Most of the compounds selected for this screening study cannot be assigned to a single emission source as they are widely used in different technical products, cosmetics, and medicines. It was therefore decided to study the area around the Alna valley (Oslo East) which is an area with dense population and is home to a variety of industries, trade, and transport. Samples were collected from indoor environments (residential and non-residential), surface waters, municipal wastewater, and the receiving marine environment (sediment and biota).

The rare earth element gadolinium (Gd) was detected in all selected matrices including sewage and surface water, sediment, blue mussels, gull eggs and indoor settled floor dust. However, Gd originating from natural sources is normally found in detectable concentrations in nearly all environmental samples and any additional anthropogenic source is difficult to identify. For comparison, the other rare earth elements (REE) were also quantified and discussed in this study. For Gd, more than half of the wastewater samples were significantly impacted by anthropogenic influence, and approximately 50% of the surface waters samples were moderately impacted.

The *linear siloxanes* were detected in all selected sample types, including indoor environments. It is expected that the exposure via environmental pathways is much lower compared to the exposure via use of personal care products. The measured concentrations are below the predicted no-effect levels. The measured concentration pattern of the linear siloxanes reflect the dissemination tonnage estimated by ECHA, which is roughly the same for both L3 and L4 and a higher tonnage for L5.

The *volatile aromatic compounds* di-isopropylbenzenes (except o-DiBP) and 4-Isopropyl-1,1'-biphenyl, typically used as solvents, were frequently detected in indoor air and sewage water samples indicating widespread use and emissions. Terphenyls and hydrogenated terphenyls, used as solvents and heat transfer fluids, were found in all indoor air, sewage water and sediment samples. The hydrogenated terphenyls were found in the 100 ng/g range in marine sediments and should consequently be studied in more detail.

The targeted *alkylphenols* were detected to low extent in this study, only 4-tert octylphenol and 4-n-dodecylphenol were detected. 4-tert octylphenol were detected in 46% of the settled floor dust samples and 4-n-dodecylphenol in 90% of the Gull eggs and in 8% of the settled floor dust samples (i.e. at two sites). The observed concentrations of the two alkylphenols were similar in settled floor dust.

Of the targeted nine *BAGDE-related compounds*, four were detected in most of the settled floor dust samples. BADGE-2H<sub>2</sub>O, the compound with highest concentrations in settled floor dust, was also detected in all samples of sewage water. The same four was not detected in any of the other sample types and the other five BAGDE-related compounds were not detected in any sample type.

With the exception of Tinuvin622 and BC-3, all selected *UV-filters* were found in indoor air, settled floor dust, sewage water, frequently in surface water, and to a lesser extent in sediments. Highest concentrations in settled floor dust were found for UV-328, UV-329, OC, 2-EHMC(E) and 2-EHMC. In one surface water sample, the measured concentration of OC is exceeding the fresh water PNEC by a factor of three, showing a potential environmental risk for this compound.

The *corrosion inhibitors benzotriazole and tolyltriazole* were found very frequently in sewage water, surface water, and sediment samples, but were not detected in settled floor dust samples. Benzotriazole shows a generally higher concentration than tolyltriazole in sewage water. However, tolyltriazole is dominating in surface water, and has even a higher concentration in surface water than sewage water. The most obvious difference in the use of these two compounds might be that benzotriazole can be an ingredient in dishwasher detergents. This use will have direct emission to the waste water system, whereas use in cars (antifreeze formulations and brake fluids) may give rise to elevated levels in surface water receiving run-off from roads.

The organotin compound *di-n-octyltin oxide*, used in many industrial applications like water-based paints, was found in all indoor air, settled floor dust, and sewage water samples. In addition, it was frequently found in surface water from the Alna river and in related sediments. The concentrations measured in settled floor dust were significantly higher in this study compared to similar measurements in 2016. However, the buildings selected for these studies were not the same and it is not clear if the difference is caused by a temporal trend. Together with an already high level and a potential for endocrine effects, this compound should be prioritized for a comprehensive risk assessment.

The synthetic musk compound acetyl cedrene was found in indoor air, settled floor dust, and sewage water.

The following substances were not or only rarely detected in this study: The *reactive siloxane vinyl-D4*, the *fluorinated siloxanes F-D3 and F-D4*, some of the *alkylphenols*, *BFDGE and BFDGE-related compounds*, the *UV filter Tinuvin622*, the *plasticizer n-butylbenzene sulphonamide (NBBsulfone)*, and the *pharmaceuticals benzocaine and dapsone*. This can be attributed to the fact that these compounds are not emitted to the environment in sufficient quantities to be detected, or the chosen sample locations were not suitable, or they are degraded rapidly. In addition, the compounds selected for this study were of quite different chemical nature and it was not always possible to choose the analytical method with the optimal performance for a given compound, resulting in sub-optimal LoD and higher numbers of non-detects.

## Sammendrag

**Screening programmet 2018, del 2 som ble gjennomført av NILU – Norsk institutt for luftforskning i samarbeid med Norsk institutt for vannforskning (NIVA), hadde fokus på å kartlegge forekomst, tilførsel, og miljøkonsekvens av nye miljøgifter i norsk miljø. Stoffene ble valgt på grunnlag av forventete PBT egenskaper (persistens, bioakkumulering og toksisitet). Noen av stoffene i denne studien bør undersøkes grundigere og en av de undersøkte UV-stoffene kan utgjøre en miljøfare.**

De fleste stoffer valgt for denne screening-studien kan ikke koples til en bestemt punktkilde, men det antas at de brukes i mange forskjellige tekniske produkter, kosmetikk og legemidler. Man valgte derfor Alnadalen øst i Oslo som et modellområde med høy befolkningstetthet, mye forskjellige type industri, handel og transport på et avgrenset område. For å få best mulig oversikt, ble det valgt å se både på inne- og utemiljø med følgende prøvetyper: Inneluft og husstøv fra både boliger og offentlig bygg, overflate- og avløpsvann samt sediment og biota fra innerste delen av Oslofjord.

Metallet gadolinium (Gd) ble påvist i alle undersøkte prøvetyper: Avløpsvann, overflatevann, sediment, blåskjell, måkeegg og husstøv. Gd finnes naturlig i alle disse prøvetyper og det er derfor vanskelig å bedømme om forekomst er påvirket av antropogene utslipp. For å kunne avgjøre om det var et antropogent bidrag, ble flere sjeldne jordartmetaller analysert og vurdert. Mer enn halvparten av alle avløpsvannprøver var tydelig påvirket av antropogene utslipp. Også halvparten av prøvene av overflatevann hadde en moderat antropogen komponent.

Lineære siloksaner ble funnet i alle valgte prøvetyper, også prøver fra innemiljøet. Det antas at eksponering via miljøet er lavere enn eksponering via kosmetiske produkter. De målte konsentrasjoner er under PNEC (predikerte null effekt konsentrasjoner). Konsentrasjonsfordelingen mellom de forskjellige lineære siloksaner gjenspeiler hva ECHA har registrert av forbruket i Europa.

De flyktige aromatiske forbindelsene di-isopropylbenzen og 4-isopropyl-1,1'-bifenyl, som brukes som løsemiddel, ble hyppig påvist i inneluft og avløpsvann. Dette indikerer utstrakt bruk og utslipp av disse stoffer. Terfenyl og hydrerte terfenyl, som også brukes som løsemiddel og kjølevæsker, ble funnet i alle prøver av inneluft, avløpsvann og sediment. De hydrerte terfenylene forekommer i 100 ng/g nivå i sedimenter og på grunn av denne høye konsentrasjonen bør disse følges opp nærmere.

De utvalgte alkylfenolene ble kun funnet i lave konsentrasjoner i denne studien og det er bare 4-tert-oktylfenol og 4-n-dodekylfenol som ble påvist. 4-tert-oktylfenol ble funnet i 46% av husstøv-prøvene og 4-n-dodekylfenol i 90% av alle måkeegg og 8 % av alle husstøvprøver. Konsentrasjonen av disse to stoffer i husstøvprøver var på omtrent samme nivå.

Fire av ni utvalgte BADGE forbindelser ble påvist i nesten alle husstøvprøver. BADGE-2H<sub>2</sub>O, som er BADGE-stoffet med høyest konsentrasjon i husstøv, ble også påvist i alle prøver av avløpsvann. Ingen av disse fire stoffer ble påvist i de andre undersøkte prøvetypene og resten av BADGE-stoffene ble ikke påvist i det hele tatt.

Med unntak av Tinuvin622 og BC-3, ble alle utvalgte UV-filtre påvist i alle prøver av inneluft, husstøv, og avløpsvann, i de fleste prøver av overflatevann, og i varierende grad i sedimentprøver. UV-328, UV-329, OC, 2-EHMC(E) og 2-EHMC var i høyeste konsentrasjoner i husstøvet. UV-stoffet octocrylene (OC) viste i et tilfelle overskridelse av PNEC for ferskvannsorganismer med en faktor 3 og er dermed potensielt miljøfarlig.

Korrosjonsinhibitorer benzotriazol og tolyltriazol ble hyppig påvist i avløpsvann, overflatevann og sediment, men ikke i husstøv. Benzotriazol dominerer i avløpsvann, mens tolyltriazol dominerer i

overflatevann og viser til og med en høyere absoluttkonsentrasjon i overflatevannprøvene. Benzotriazol brukes trolig mye i vaskemidler for oppvaskmaskin, mens tolytriazol brukes antakeligvis mer i bilprodukter som kjølevæske og bremsevæske som lett kan ha avrenning til overflatevann.

Den organiske tinnforbindelsen di-n-oktyltinnoksid, som brukes blant annet i vannbasert maling, ble påvist i inneluft, husstøv og avløpsvann. Videre ble den hyppig funnet i overflatevann og i sediment. Konsentrasjoner i husstøv fra denne studien er vesentlig høyere enn det som ble funnet i 2016. Det er stor variasjon i konsentrasjoner målt i de forskjellige bygningene og siden det ikke er de samme husene som inngår i de to undersøkelsene, er det vanskelig å avgjøre om dette utgjør en trend. På grunnlag av de forholdsvis høye konsentrasjonene og siden stoffet kan ha endokrine effekter, bør man prioritere en grundig risikovurdering av stoffet.

Parfymestoffet acetylcedren ble påvist i inneluft, husstøv og avløpsvann i konsentrasjoner langt under PNEC.

Følgende stoffer blir sjelden eller aldri funnet i noen av prøver fra studien: Den reaktive siloksanforbindelsen vinyl-D4, de fluorerte siloksanene F-D3 og F-D4, noen av de utvalgte alkylfenoler, UV-filtre tinuvin622, mykgjører NBBsulfon og legemidler benzocain og dapson. Dette kan være på grunn av at (1) utslippsmengdene er så lave at resulterende miljøkonsentrasjoner faller under deteksjonsgrensen, (2) at valgt lokalitet eller prøvetype ikke var hensiktsmessig eller (3) at stoffet brytes ned til andre stoffer. Siden det er stor variasjon i de kjemiske egenskapene av de utvalgte stoffer, så var det ikke alltid mulig å velge den mest optimale analysemetoden med de aller laveste deteksjonsgrenser.



# Screening 2018 – UV compounds and follow-up of earlier findings

## 1 Background and introduction

### 1.1 General

For part 2 of the 2018 screening programme, the Norwegian Environment Agency nominated a large and diverse group of compounds for analysis. Most of the compounds selected have been part of previous Norwegian screening programs (REF) and the actual study was designed to verify and support earlier findings.

### 1.2 Selected compounds

In the following sections the compounds selected for this screening study are described, together with their acronym, structure, CAS-number, function or use, and calculated Log  $K_{ow}$ .

#### 1.2.1 Metals

Rare Earth Elements (REE), as defined by IUPAC, are the 15 lanthanides (La – Lu including the radioactive Pr) in addition to Scandium and Yttrium. In this report we will only discuss the lanthanides, onwards referred to as REE. REEs tend to occur in the same ore deposits, and despite their name are relatively plentiful in the Earth's crust. REEs are increasingly exploited for critical uses in high-tech industries, including electronics, medicine, clean energy and agriculture (Barry and Meehan, 2000, Gonzalez et al., 2014). They are used for magnets, metal alloys, catalysts, fertilizers and ceramics as well as eutrophication management in fresh waters (Copetti et al., 2016). In particular, Gd has no large-scale applications, but due to the strong paramagnetic properties of the  $Gd^{3+}$  ion it is used as intravenous magnetic resonance imaging (MRI) contrast agent to enhance images in medical MRI (Caravan, Ellison, McMurry, & Lauffer, 1999). Except Ce ( $Ce^{3+}$ ,  $Ce^{4+}$ ) and Eu ( $Eu^{2+}$ ,  $Eu^{3+}$ ), the REE's occur in a trivalent state in nature and their ionic radii decrease with an increase of atomic number, and this characteristic is the main attribute that governs the subtle differences in the REE geochemical behaviour. The REE distribution pattern reflects the Oddo-Harkins rule; even atomic-numbered elements are an order of magnitude more abundant than the adjacent odd-numbered elements, and additionally highlighted by a larger number of isotopes. In order to eliminate the characteristic zig-zag REE distribution pattern and identify any individual REE anomalies in various geologic and environmental material, the measured REE concentrations are normalized to different reference data sets. This method eliminates any abundance variation between even and odd atomic-numbered lanthanides and enables determination of fractionation between these elements. Such reference data sets include amongst others Chondrite (Boynton, 1984), North American Shale Composite (NASC) (Haskin, Haskin, Frey, & Wildeman, 1968), Upper continental crust (Taylor & McLennan, 1995) and Post-Archean Australian Shale (PAAS) (Taylor & McLennan, 1995). Shales are commonly utilized in environmental studies (Migaszewski & Galuszka, 2015), and PAAS have been used for normalization in this report.

Table 1: Selected metals

Name, Atomic number	Symbol	Stabile isotopes	Abundance ppm	Application
Scandium	Sc	$^{45}Sc$ (100%)	22	Light aluminium-scandium alloys for aerospace components, additive in metal-halide lamps and mercury-vapour lamps

Name, Atomic number	Symbol	Stabile isotopes	Abundance ppm	Application
Yttrium	Y	<sup>89</sup> Y (100%)	33	Garnets and lasers, energy-efficient light bulbs, spark plugs, gas mantles, additive to steel, cancer treatments
Lanthanum, 57	La	<sup>139</sup> La (99,91%)	39	Anodic material in NiMH batteries, camera lenses, metallurgic industry
Cerium, 58	Ce	<sup>136</sup> Ce (0,185%) <sup>138</sup> Ce (0,251%) <sup>140</sup> Ce (88,45%) <sup>142</sup> Ce (11,11%)	66.5	Chemical oxidizing agent, polishing powder, yellow colors in glass and ceramics, catalyst for self-cleaning ovens, fluid catalytic cracking catalyst for oil refineries
Praseodymium, 59	Pr	<sup>141</sup> Pr (100%)	9.2	Rare-earth magnets, lasers, core material for carbon arc lighting, colorant in glasses and enamels, additive in didymium glass used in welding goggles
Neodymium, 60	Nd	<sup>142</sup> Nd (27,2%) <sup>143</sup> Nd (12,2%) <sup>145</sup> Nd (8,3%) <sup>146</sup> Nd (17,2%) <sup>148</sup> Nd (5,7%)	41.5	Permanent magnets, as blue-violet colour in porcelain, glass and enamel, lasers, electric motors
Promethium, 61	Pm	None	1x10 <sup>-15</sup>	Has no stabile isotope. Nuclear batteries, luminous paint
Samarium, 62	Sm	<sup>144</sup> Sm (3,1%) <sup>150</sup> Sm (7,4%) <sup>152</sup> Sm (26,7%) <sup>155</sup> Sm (22,7%)	7.05	Magnets, catalysts, lasers, neutron capture, control rods of nuclear reactors
Europium, 63	Eu	<sup>151</sup> Eu (47,8%) <sup>153</sup> Eu (52,2%)	2	Red and blue phosphors, lasers, mercury vapour lamps, fluorescent lamps, NMR relaxation agent
Gadolinium, 64	Gd	<sup>154</sup> Gd (2,2%) <sup>155</sup> Gd (14,8%) <sup>156</sup> Gd (20,5%) <sup>157</sup> Gd (15,7%) <sup>158</sup> Gd 24,9%) <sup>160</sup> Gd (21,9%)	6.2	MRI contrast agent, specialty glass and garnets, CD-records, microwave ovens,
Terbium, 65	Tb	<sup>159</sup> Tb (100%)	1.2	Additive in Neodymium based magnets, green phosphors, lasers, fluorescent lamps
Dysprosium, 66	Dy	<sup>156</sup> Dy (0,06%) <sup>158</sup> Dy (0,1%) <sup>160</sup> Dy (2,3%) <sup>161</sup> Dy (18,9%) <sup>162</sup> Dy (25,5%) <sup>163</sup> Dy (24,9%) <sup>164</sup> Dy (28,2%)	5.2	Additive in Neodymium based magnets, lasers, magnetostrictive alloys, hard disk drives
Holmium, 67	Ho	<sup>165</sup> Ho (100%)	1.3	Lasers, wavelength calibration standards for optical spectrophotometers, magnets
Erbium, 68	Er	<sup>162</sup> Er (0,14%) <sup>164</sup> Er (1,6%) <sup>166</sup> Er (33,6%) <sup>167</sup> Er (22,9%) <sup>168</sup> Er (26,8%) <sup>170</sup> Er (14,9%)	3.5	Infrared lasers, vanadium steel, fiber-optic technology
Thulium, 69	Tm	<sup>169</sup> Tm (100%)	0.52	Portable X-ray machines, metal-halide lamps, lasers

Name, Atomic number	Symbol	Stabile isotopes	Abundance ppm	Application
Ytterbium, 70	Yb	<sup>168</sup> Yb (%) <sup>170</sup> Yb (%) <sup>171</sup> Yb (%) <sup>172</sup> Yb (21,9%) <sup>173</sup> Yb (16,1%) <sup>174</sup> Yb (31,8%) <sup>176</sup> Yb (%)	3.2	Infrared lasers, chemical reducing agent, decoy flares, stainless steel, stress gauges, nuclear medicine, monitoring earthquakes
Lutetium, 71	Lu	<sup>175</sup> Lu (97,4%) <sup>176</sup> Lu (2,6%)	0.8	PET scan detectors, high-refractive-index glass, lutetium tantalate hosts for phosphors, catalyst used in refineries, LED light bulb

In 1996, Bau and Dulski reported the first anthropogenic impact of REE distribution consisting in a positive Gd anomaly (Gd/Gd\*) (Bau & Dulski, 1996). Gd anomaly has been interpolated from the shale-normalized concentrations (suffix N) of its two neighbouring REE (Sm and Tb) using the following equation:

$$\frac{Gd}{Gd^*} = \frac{Gd_N}{(Sm_N^{0,33} \times Tb_N^{0,67})}$$

Where Gd is the concentration of Gd in the sample under investigation, Gd\* is the geogenic/background concentration of Gd, Gd<sub>N</sub> is the shale-normalized Gd concentration, Sm<sub>N</sub> is the shale normalized Sm concentration and Tb<sub>N</sub> is the shale normalized Tb concentration.

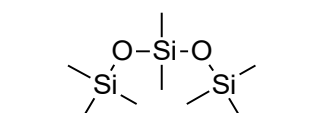
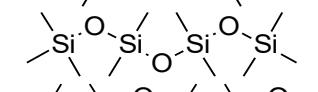
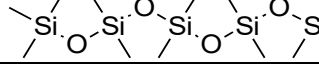
The anthropogenic excess Gd concentration (Gd<sub>anth</sub>) is calculated using the following equation:

$$Gd_{anth} = Gd - Gd^*$$

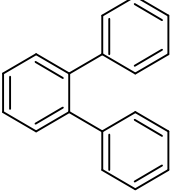
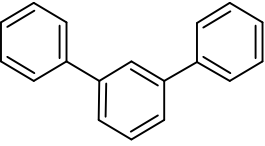

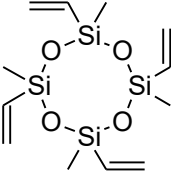
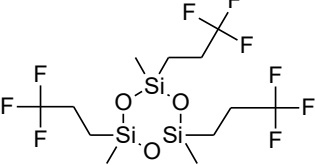
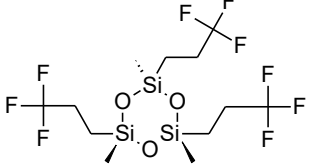
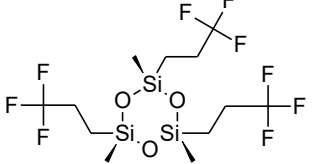
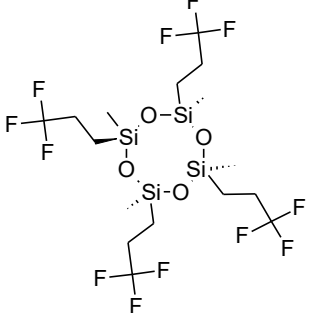
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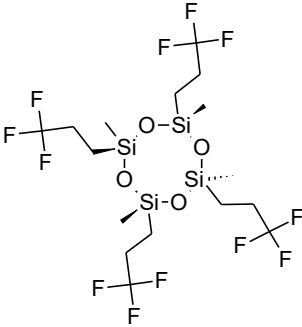
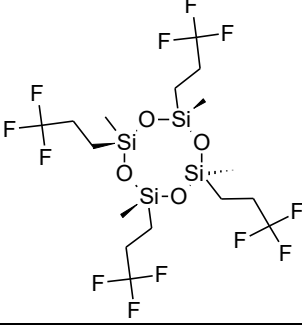
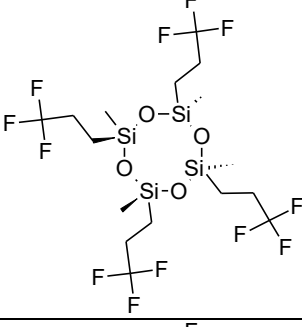
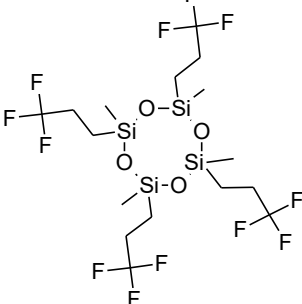
Different volatile organic compounds with a quite different spectra of use were selected for screening in 2018 (Table 2).

Table 2: Selected volatiles

Name	Acronym	Structure	CAS	Function	Log Kow	Tonnage
<b>Linear siloxanes</b>	<b>Sum LinSIL</b>					
Octamethyl-trisiloxane	L3		107-51-7	Solvent and cosmetics	5.48	2
Decamethyl-tetrasiloxane	L4		141-62-8	Solvent and cosmetics	6.68	2
Dodecamethyl-pentasiloxane	L5		141-63-9	Solvent and cosmetics	7.35	3

Name	Acronym	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
<b>Diisopropylbenzenes</b>	<b>Sum DiPB</b>					
1,2-Diisopropylbenzene	oDiPB		577-55-9	Solvent	4.57	-
1,3-Diisopropylbenzene	mDiPB		99-62-7	Solvent	4.59	2
1,4-Diisopropylbenzene	pDiPB		100-18-5	Solvent	4.62	1
4-Isopropylbiphenyl	iPbP		7116-95-2	Solvent	5.23	-
<b>Hydrogenated terphenyls</b>	<b>Sum HT</b>		<b>61788-32-7</b>	<b>Thermal fluids</b>	<b>6.5</b>	<b>3</b>
Octadecahydro-p-terphenyl or p-Tercyclohexyl	H18pT		1795-19-3	Thermal fluids	7.98	-
Symmetric Dodecahydro-m-terphenyl	sH12mT		4016-06-2	Thermal fluids	5.31	-
Unsymmetric Dodecahydro-m-terphenyl	uH12mT		20273-26-1	Thermal fluids	-	-
Unsymmetric Dodecahydro-p-terphenyl	uH12pT		20273-27-2	Thermal fluids	7.08	-
Symmetric Dodecahydro-p-terphenyl	sH12pT		1087-02-1	Thermal fluids	7.04	-
Unsymmetric Hexahydro-m-terphenyl	uH6mT		1973-15-5	Thermal fluids	5.97	-
cis Hexahydro-m-terphenyl	csH6mT		21072-39-9	Thermal fluids	-	-
trans Hexahydro-p-terphenyl	tsH6pT		21072-42-4	Thermal fluids	5.09	-

Name	Acronym	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
<b>Terphenyls</b>	<b>Sum T</b>					
o-Terphenyl	oT		84-15-1	Thermal fluids	5.29	-
m-Terphenyl	mT		92-06-8	Thermal fluids	5.65	-
p-Terphenyl	pT		92-94-4	Thermal fluids	5.55	-
1,3,5,7-Tetramethyl-1,3,5,7-tetravinylcyclotetrasiloxane	Vinyl-D4		2554-06-5	Reagents	6.69	2
2,4,6-Trimethyl-2,4,6-tris(3,3,3-trifluoropropyl)cyclotrisiloxane	F-D3a		2374-14-3	Reagents	7.12	2
(2 $\alpha$ ,4 $\alpha$ ,6 $\beta$ )-2,4,6-Trimethyl-2,4,6-tris(3,3,3-trifluoropropyl)cyclotrisiloxane	F-D3b		2810-62-0	Reagents	7.12	-
(2 $\alpha$ ,4 $\alpha$ ,6 $\alpha$ )-2,4,6-Trimethyl-2,4,6-tris(3,3,3-trifluoropropyl)cyclotrisiloxane	F-D3c		2810-63-1	Reagents	7.12	-
(2 $\alpha$ ,4 $\alpha$ ,6 $\alpha$ ,8 $\alpha$ )-2,4,6,8-tetramethyl-2,4,6,8-tetrakis(3,3,3-trifluoropropyl)-cyclotetrasiloxane	F-D4a		141901-56-6	Reagents	8.47	-

Name	Acronym	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
(2 $\alpha$ ,4 $\beta$ ,6 $\alpha$ ,8 $\beta$ )- 2,4,6,8-tetramethyl- 2,4,6,8-tetrakis(3,3,3- trifluoropropyl)- cyclotetrasiloxane	F-D4b		141901-57-7	Reagents	8.47	-
(2 $\alpha$ ,4 $\alpha$ ,6 $\beta$ ,8 $\beta$ )- 2,4,6,8-tetramethyl- 2,4,6,8-tetrakis(3,3,3- trifluoropropyl)- cyclotetrasiloxane	F-D4c		141901-58-8	Reagents	8.47	-
(2 $\alpha$ ,4 $\alpha$ ,6 $\alpha$ ,8 $\beta$ )- 2,4,6,8-tetramethyl- 2,4,6,8-tetrakis(3,3,3- trifluoropropyl)- cyclotetrasiloxane	F-D4d		141901-59-9	Reagents	8.47	-
2,4,6,8-tetramethyl- 2,4,6,8-tetrakis(3,3,3- trifluoropropyl)- cyclotetrasiloxane	F-D4		429-67-4	Reagents	8.47	-

Tonnage: Total tonnage band as registered by ECHA (REACH registered substance factsheets, 2019):

- 0: 1 -10 tonnes per annum
- 1: 10 -100 tonnes per annum
- 2: 100 -1 000 tonnes per annum
- 3: 1 000 – 10 000 tonnes per annum
- 4: 10 000 – 100 000 tonnes per annum
- : No tonnage registered

Three linear siloxanes were selected for a follow-up screening. Octamethyltrisiloxane (L3) is laboratory reagent, and is used in personal care products, coatings, sealants, heat transfer fluid, non-metal surface treatment agent - in situ treatment, electronics and in the manufacture of optical products. (UK-REACH-CA, 2014). Decamethyltetrasiloxane (L4) is used in similar applications to L3 (UK-REACH-CA, 2015a). For dodecamethylpentasiloxane (L5), use in personal care products, polymer preparation - formulation of release agent, in-situ non-metal surface treatment, and as a laboratory reagent is reported (UK-REACH-CA, 2015b). In addition dodecamethylpentasiloxane is used for the production of silicone oils or fluids designed to withstand extremes of temperature and as a foam suppressant in petroleum lubricating oil (Dodecamethylpentasiloxane, 2018).

Three diisopropylbenzenes (DiBPs) were selected for a follow-up screening. These compounds are produced as by-products of cumene synthesis in closed systems. Japan reported a yearly production of about 30 000 t/a, and these chemicals were reported to be blended into gasoline and diesel (INCHEM, 2002). Eastman advertises 1,4-DIBP as a chemical intermediate for the preparation of stabilizers, polymers, synthetic lubricants, hydroperoxides, and a variety of other products. Reactions of DIPB include side chain modification by oxidation, dehydrogenation, and bromination. Ring substitution reactions include nitration, sulfonation, bromination, and acetylation (Eastman, 2017). According to ECHA's CoRAP justification reports DiBPs were mainly used at industrial sites as process solvents for print inks and as intermediates.

According to an ECHA CoRAP document 4-Isopropyl-1,1'-biphenyl is used in coatings and adhesives. The use includes wide dispersive indoor and outdoor use resulting in inclusion into or onto a matrix (MSCA-Germany, 2017). It is suspected to be PBT/vPvB.

For the first time hydrogenated terphenyls were selected for screening. These compounds are used as additives in plastic applications, as solvent/process medium for adhesives and sealants, as heat transfer fluid, and for industrial coatings/inks applications (Annex XV – Identification of terphenyl, hydrogenated as SCVH, 2018).

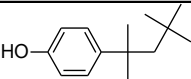
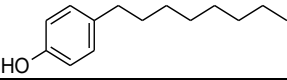
Terphenyl mixtures were selected for screening. The mixture containing o-, m-, and p-terphenyl are produced and used industrially as heat storage and transfer agents, as textile dye carriers, and as intermediates in the production of nonspreading lubricants (M-TERPHENYL, 2018).

In 2018, eight fluorinated siloxanes and one vinyl siloxane were included for the first time in screening programmes in Norway.

### 1.2.3 Alkylphenols

Two alkylphenols were on the original list of selected compounds, but the list was also extended with four standard alkylphenols as reference compounds.

Table 3: Selected alkylphenoles

Name	Acronym	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
4-tert-Octylphenol	4tOP		140-66-9	Additive, precursor	4.83	4
4-n-Octylphenol	4nOP		1806-26-4	Additive, precursor	5.58	-

Name	Acronym	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
4-n-Heptylphenol	4nHP		1987-50-4	Additive, precursor	4.89	-
Heptylphenol (branched)	4HP(br)		30784-32-8	Additive, precursor		-
4-n-Nonylphenol	4nNP		104-40-5	Additive, precursor	6.04	0
4-n-Dodecylphenol	4nDDP		104-43-8	Additive, precursor	7.56	-

Tonnage: See footnote below Table 2.

Alkylphenols are used in manufacturing antioxidants, lubricating oil additives, laundry and dish detergents, emulsifiers, and solubilizers. Alkylphenols have attracted attention due to their prevalence in the environment and estrogenic activity. Nonyl- and octylphenols are also precursors of the degradation products alkylphenol ethoxylates.

#### 1.2.4 BADGE and BFDGE and their derivatives

Bisphenol A diglycidyl ether (BADGE) and Bisphenol F diglycidyl ether (BFDGE) were included in a previous screening programme and there detected in settled floor dust (Schlabach et al., 2017), so this compound group was selected for a follow-up study.

Table 4: BADGE and BFDGE and their derivatives

Name	Acronym	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
Bisphenol A diglycidyl ether	BADGE		1675-54-3	Resin	3.43	5
	BADGE-HCl		13836-48-1	Resin	3.66	-
	BADGE-2HCl		4809-35-2	Resin	4.01	-
	BADGE-H <sub>2</sub> O		76002-91-0	Resin	2.96	-
	BADGE-2H <sub>2</sub> O		5581-32-8	Resin	1.86	-
	BADGE-HCl-H <sub>2</sub> O		227947-06-0	Resin	2.24	-
Bisphenol F diglycidyl ether	BFDGE		2095-03-6	Resin	2.49	-
	BFDGE-2HCl		374772-79-9	Resin	2.97	-
	BFDGE-2H <sub>2</sub> O		72406-26-9	Resin	1.47	-

Tonnage: See footnote below Table 2.

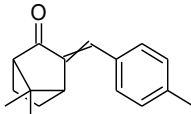
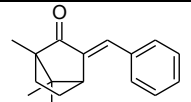
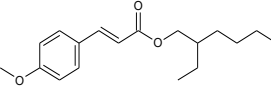
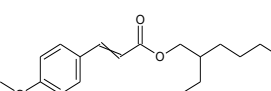
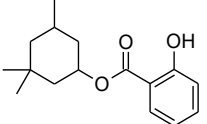
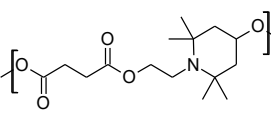
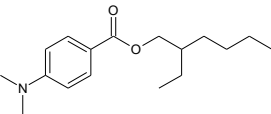


Bisphenol A diglycidyl ether (BADGE) are produced by reaction of BPA with epichlorhydrin. A similar reaction with BPF results in Bisphenol F diglycidyl ether (BFDGE). Both are used in the production of epoxy resins. Like their parent compounds BPA, BPF BADGE and BFDGE are high production volume (HPV) chemicals used in different applications. BADGE-containing resins are used extensively in polymers for coating food and beverage cans (Berger & Oehme, 2000).

### 1.2.5 UV Filters

UV filters have been reported in environmental samples on numerous occasions. In order to fill data gaps and support earlier findings this group were selected for analysis in the present study.

Table 5: Selected UV filters used in cosmetics and technical applications

Name	Acronym	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
4-methylbenzylidene camphor (Enzacamene)	4-MBC		36861-47-9	Cosmetic UV filter		1
3-Benzylidene-1,7,7-trimethylbicyclo [2.2.1]heptan-2-one	3-BC		15087-24-8	Cosmetic UV filter		0
2-Ethylhexyl (2E)-3-(4-methoxyphenyl) prop-2-enoate	2-EHMC(E)		83834-59-7	Cosmetic UV filter	5.49	3
2-Ethylhexyl 3-(4-methoxyphenyl) prop-2-enoate (Octinoxate)	2-EHMC		5466-77-3	Cosmetic UV filter	5.49	-
3,3,5-Trimethylcyclohexyl salicylate (Homosalate)	Homosalate		118-56-9	Cosmetic UV filter	5.43	0
Dimethyl butanedioate polymer with 4-hydroxy-2,2,6,6-tetramethyl-1-piperidineethanol (Tinuvin 622)	Tinuvin 622		65447-77-0	UV filter		0
2-Ethylhexyl 4-(dimethylamino) benzoate (ODPABA)	ODPABA		21245-02-3	Cosmetic UV filter	5.29	2

Name	Acronym	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
2-Ethylhexyl 2-cyano-3,3-diphenylacrylate (Octocrylene)	OC		6197-30-4	Cosmetic UV filter	6.32	0
2-Benzotriazol-2-yl-4,6-di-tert-butylphenol	UV-320		3846-71-7	Techn. UV filter	5.66	-
2-tert-Butyl-6-(5-chloro-2H-benzotriazol-2-yl)-4-methylphenol	UV-326		3896-11-5	Techn. UV filter	5.06	0
2,4-Di-tert-butyl-6-(5-chloro-2H-benzotriazol-2-yl)phenol	UV-327		3864-99-1	Techn. UV filter	6.30	-
2-(2H-Benzotriazol-2-yl)-4,6-bis(1,1-dimethylpropyl)phenol	UV-328		25973-55-1	Techn. UV filter	6.43	2
2-(2H-Benzotriazol-2-yl)-4-(2,4,4-trimethylpentan-2-yl)phenol	UV-329		3147-75-9	Techn. UV filter	5.56	0
2-Phenyl-1H-benzimidazole-5-sulfonic acid	Ensulizole		27503-81-7	Cosmetic UV filter	0.51	2
2,4-Dihydroxybenzophenone (Benzophenone-1)	BP1		131-56-6	T/C UV filter	2.85	2
2,2',4,4'-Tetrahydroxybenzophenone (Benzophenone-2)	BP2		131-55-5	T/C UV filter	2.58	-
2-Hydroxy-4-methoxybenzophenone (Benzophenone-3)	BP3		131-57-7	T/C UV filter	3.45	2
2,2'-Dihydroxy-4-methoxybenzophenone (Benzophenone-8)	BP8		131-53-3	T/C UV filter	3.31	0

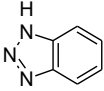
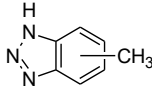
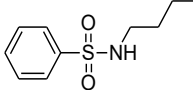
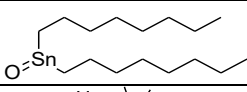
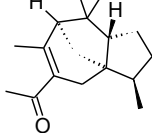
Tonnage: see footnote below Table 2.

UV filters or UV stabilizers absorb UV light and protect skin and products for sun damage. They can be divided into two classes; UV filters used in personal care products, and UV stabilizers used in technical products such as plastics and paints. The latter is to protect polymers and pigments against photodegradation and fading. Some of the compounds in the present study are used for both applications. It is frequently reported that UV filters enter the aquatic environment indirectly via sewage effluent discharges and directly from water sports activities causing them to wash directly from skin surfaces into receiving waters (K. H. Langford, Reid, Fjeld, Oxnevad, & Thomas, 2015). UV filter occurrence can be dependent on season and weather conditions (K. H. Langford & Thomas, 2008). A short review of the use of the different products is given in (Heimstad, Nygård, Herzke, & Bohlin-Nizzetto, 2018). UV filters have raised concern for negative impacts on the marine and freshwater ecosystem. As a consequence, the government of Palau banned a list of 10 sunscreen products to save coral reefs around their Pacific islands (McGrath, 2018).

### 1.2.6 Other additives

In addition to UV filters a short list of other additives or ingredients in technical products and personal care products were selected.

Table 6: Selected additives

Name	Acronym	Structure	CAS	Function	Log Kow	Tonnage
1H-Benzotriazole	BTA		95-14-7	Corrosion inhibitor	1.24	3
Tolyltriazole	TTA		29385-43-1	Corrosion inhibitor	1.52	3
NBBsulfone	NBBs		3622-84-2	Plasticiser	2.1	3
Di-n-octyltin oxide	DOTO		870-08-6	Catalyst		3
Acetyl cedrene	AC		32388-55-9	Fragrance	4.88	3

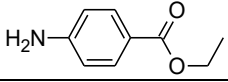
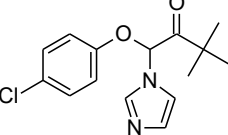
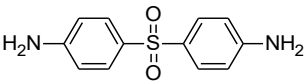
Tonnage: see footnote below Table 2.

Both benzotriazole and tolyltriazole are used as a corrosion inhibitors in lubricants and greases, in de-icing fluids for aircraft, automotive antifreeze formulations, brake fluids, metal-cutting fluids, in washing and cleaning products and industrial cooling systems (Benzotriazole, 2018; Tolyltriazole, 2018). N-Butylbenzenesulfonamide (NBBS) is widely used as a plasticizer. It also possesses antifungal properties (*Chemical Information Review Document for N-Butylbenzenesulfonamide*, 2010). Di-n-octyltin oxide (DOTO) is used as cross-linking catalyst in different technical products such as adhesives, sealants, coatings, paintings, textile dyes, and washing and cleaning products (AT-EE, 2015). Acetyl cedrene (AC) is used as fragrance, mainly in personal care products.

### 1.2.7 Pharmaceuticals

A small selection of pharmaceuticals were included in the present investigation. None of these compounds were included in the earlier screening studies that were dedicated to pharmaceuticals.

Table 7: Selected pharmaceuticals

Name	Structure	CAS	Function	Log K <sub>ow</sub>	Tonnage
Benzocaine		94-09-7	Anaesthetic	1.86	-
Climbazole		38083-17-9	Antifungal medicine and personal care products	3.83	1
Dapsone		80-08-0	Antibiotic medicine and personal care products	0.97	3

Tonnage: see footnote below Table 2.

Benzocaine is local anaesthetic used in many over-the-counter medicine, and is used in the anaesthesia of fish in aquaculture (Benzocaine, 2019). Climbazole is a current antifungal medicine frequently used in the treatment of fungal skin infections such as eczema and dandruff (Climbazole, 2019). Dapsone is an antibiotic pharmaceutical used in both humans and in aquaculture (Dapsone, 2019)

In addition to these three selected pharmaceuticals a suspect screening of other pharmaceuticals were performed.

## 2 Materials and methods

Most of the compounds selected for this screening study cannot be assigned to a single emission source as they are widely used in different technical products, cosmetics, and medicines. It was therefore decided to study the area around the Alna valley (Oslo East) which is an area with dense population and is home to a variety of industries, trade, and transport. Samples were collected from indoor environments (residential and non-residential), surface waters, municipal wastewater, and the receiving marine environment (sediment and biota).

### 2.1 Sampling stations, sample collection and sample pre-treatment

#### 2.1.1 Indoor environments- settled dust and indoor air

##### 2.1.1.1 Sampling strategy

Screening of indoor environments was performed by collecting settled floor dust samples and passive air samples from 16 residential buildings and five non-residential buildings in the Oslo area. The buildings were selected to cover the catchment area of the waste water treatment plant, Bekkelaget renseanlegg, to the extent it was possible. The sampling locations also includes sites that represent different levels of population density, from the urban centre of Oslo to the semi-rural areas around Oslo. The non-residential buildings included offices, a school, and one veterinary clinic. Passive air

samples were collected using two types of samplers: i) polyurethane foam passive air samplers (PUF-PAS), and ii) XAD resin PAS (XAD-PAS). The two sampler types were deployed concurrently inside the selected buildings, in the main living area of the residential sites, or in a selected room in the non-residential sites, at ~2.5 m height, for 4-5 weeks in September and October 2018. Floor-dust samples were collected in each site at the retrieval of the PUF-PAS. At two sites, duplicate dust samples were collected.

A questionnaire was completed by the inhabitants/users at the end of the sampling period in order to provide information on building characteristics.

*Table 8: Description of the indoor sampling sites*

House ID	Classification	Split	Construction year	Size, m <sup>2</sup>	Building material	Inhabitants, total	Inhabitants,	Last painted
House 1	SFH	Vertically split	1957	103	Wood	3	1	>1 year
House 2	SFH	Vertically split	1995	115	Wood	2	0	>1 year
House 3	SFH	Vertically split	2007	143	Wood	3	0	>1 year
House 4	SFH	Vertically split	2007	143	Wood	3	0	>1 year
House 5	SFH		1967	220	Wood	4	2	>1 year
House 6	SFH		1986	140	Wood	5	3	>1 year
House 7	AB		1975	50	Bricks	2	0	>1 year
House 8	SFH		1985	136	Wood	4	2	<1 year
House 9	SFH	Vertically split	1998	125	Wood	4	2	>1 year
House 10	SFH	Vertically split	1998	125	Wood	4	2	<1 year
House 11	SFH		1997	120	Wood	3	1	>1 year
House 12	AB		2001	80	Concrete, bricks	4	2	<1 year
House 13	AB		1934	50	Concrete, bricks	1	0	<1 year
House 14	AB		2018	50	Concrete	1	0	<1 year
House 15	AB		1896	75	Bricks	2	0	>1 year
House 16	AB		2007	37	Bricks	1	0	>1 year
House 17	NRB				Concrete, bricks			
House 18	NRB				Concrete, bricks			
House 19	NRB				Concrete, bricks			

House ID	Classification	Split	Construction year	Size, m <sup>2</sup>	Building material	Inhabitants, total	Inhabitants,	Last painted
House 20	NRB				Concrete, bricks			
House 21	NRB		1965		Bricks, wood			>1 year
House 22	NRB		1960	500	Wood			>1 year
House 23	NRB		2006		Concrete, bricks	500		>1 year
House 24	NRB		1994	6800	Concrete, bricks	150		>1 year

SFH: Single-Family House

TH: Terrace House

AB: Apartment Block

NRB: Non-residential building

### 2.1.1.2 Passive air sampling

The PUF-PAS consisted of PUF disks with 15 cm diameter, 1.5 cm thickness, 424 cm<sup>2</sup> total surface area, 0.030 g/cm<sup>3</sup> density (Sunde Skumplast, Norway). The PUF disks were deployed in protective chambers consisting of one stainless steel bowl (30 cm diameter) above the disk to protect from gravitational deposition of large particles. The PUF disks were pre-cleaned by soxhlet extraction in acetone for 8 h and hexane for 8 h, dried under vacuum and then wrapped in double layers of aluminium foil and zip-lock bags.

XAD-PAS consisted of an XAD-2 adsorbent placed inside a metal mesh cylinder (10 cm long, 2 cm diameter, 63 cm<sup>2</sup> total surface area). The mesh cylinders were pre-cleaned in soap and solvent and further baked in 450°C. The XAD-2 was dried over night at 105°C, pre-cleaned by soxhlet extraction in acetone for 8 h and dichloromethane for 8 h, and dried in room temperature. The mesh cylinders were filled with approximately 10 g of XAD-2, capped at both ends and wrapped in double layers of aluminium foil and zip lock bags.

At site, the PUF disks and XAD filled mesh cylinders were taken out from the ziplock bags and aluminium foil, and deployed according to *Figure 1*.



Figure 1: Air sampling equipment: PUF-PAS (top) and XAD-PAS (bottom), used to perform screening in indoor residential and non-residential environments.

### 2.1.1.3 Settled floor dust sampling

The participants were asked to clean normally until one week before sampling and then not to vacuum clean or wet clean the floors in the rooms so that all settled floor dust samples would reflect an accumulation time of approximately one week.

Floor 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 (Bornehag et al., 2004; Huber, Haug, & Schlabach, 2011) (Figure 2). 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  $-20^{\circ}\text{C}$  until sample preparation.



Figure 2: Sampling equipment for sampling of floor dust in indoor residential environments.

The filter housings were weighed before and after sampling in order to measure the total amount of collected dust. Before the second weighing, larger pieces in the dust (such as hair, food and stones etc.) were discarded leaving a defined dust sample. The amount of dust was used to obtain measurements in nanogram per gram of dust, and to allow for an estimate of the dust-loading at each site.

Each settled floor dust sample (including the cellulose filter) was then split in six parts based on the total amount of dust in the sample. The amount in each fraction ranged from 100-200 mg of dust.

#### **2.1.1.4 QA/QC**

Field blanks for the three sampling methods were collected and analysed to control for possible contamination during sampling, transport, storage and analysis. The field blanks included one filter for dust sampling, and one PUF disk plus one XAD in mesh cylinder for passive air sampling. These were transported together with the real samples on each sampling day (i.e. one set per day, n=3 in total). Each dust filter was opened and inserted into the nozzle once, then repacked in double layer of alumina foil, two plastic bags and stored in freezer next to exposed samples until sample preparation. The PUF disks and XAD mesh cylinders were opened and kept in the room during deployment of the real samples, then repacked and stored as the dust filters. All field blanks underwent the same analytical procedure as the real samples.

### **2.1.2 Surface water, sediment and municipal wastewater**

#### **2.1.2.1 Household wastewater and industry-influenced wastewater sampling**

All wastewater samples were collected as time-integrated composite samples (50 mL sub-samples every 10 min) using ISCO 6700 automatic samplers fitted with LDPE tubing. ISCO 2150 flow meters were used to measure the flow during sampling. Household wastewater samples were collected from a manhole downstream of the residential area at Hellerud during dry weather conditions only with the flowmeter mounted in the 300 mm pipeline entering the same manhole. Industry-influenced wastewater samples were collected from a manhole situated downstream of the industrial areas in Groruddalen during both dry weather conditions and at the beginning of heavy rain events with the flowmeter mounted in the 1400 mm pipeline entering the same manhole. See details in Table 9 and Figure 3.

#### **2.1.2.2 River water sampling**

River water samples were collected as time-integrated composite samples (50 mL sample every 5 min or 10 min) using Avalanche automatic samplers (with integrated cooling and fitted with LDPE tubing) at two different sites along the river Alna. Location 1 was within the premises of Veflen Entreprenør AS at Brubak, 30 meters downstream from where Fossumbekken meets the river. Location 2 was at Kværnerbyen with the sampler located inside the monitoring station of the Water and Sanitation Agency (VAV) in Oslo Municipality (see Figure 3). The river flow at Brubak was roughly estimated from the measured level in the river using an ISCO 2150 flow meter and the estimated expanding width of the river with rising river level. River flow data at Kværnerbyen was supplied by VAV. Samples were collected during heavy rain (both locations) and during dry weather conditions (only Kværnerbyen). See details in Table 9.

#### **2.1.2.3 Water sampling at popular bathing locations**

One bathing water sample was collected as a time-integrated composite sample (50 mL every 10 min) using an Avalanche automatic sampler (with integrated cooling and fitted with LDPE tubing) downstream of Vesletjern (see Figure 3) during a warm sunny afternoon with a reasonable number of bathers in the lake (about 100). The flow in the small stream leaving the lake was estimated using a 100-L bucket and a stopwatch to measure the time to fill the bucket (average of six measurements) at both the start and end of the sampling period. Additional bathing water samples were collected as composite grab samples at the usually very popular marine bathing sites Sjørenga and Tjuvholmen. These samples were however collected somewhat late in the season (2<sup>nd</sup> of September), but during sunny and relatively hot (ca. 21°C) weather. At the time of sampling about 20-30 people were bathing or resting in bathing suites at each location.



### 2.1.2.4 Sampling of river sediments

Composite river sediment samples were collected a few meters upstream from the river sampling sites at Brubak and Kværnerbyen using a sediment core sampler. Each composite sample consisted of five separate grab samples of the upper two centimetres of the sediments.

Table 9: Overview of locations (see also Figure 3), periods, types and weather conditions during sampling of wastewater (1 and 2), bathing water (3, 6 and 7) and river water (4 and 5).

Sampling location		Sampling period	SampleID	Type of sample	Weather condition (-24h to end of sampling)	Measured/estimated flow
1	Manhole No. 198323 downstream Hellerud residential area N 6643135.46; Ø 603079.78)	28.6 15:57 - 29.6 11:15	1-1	Time-integrated composite of household wastewater	Dry (0 mm)	15-20 L/s
		2.7 10:00 - 3.7 11:00	1-2		Dry (0 mm)	15-20 L/s
		3.7 11:10 - 4.7 9:20	1-3		Dry (0 mm)	15-20 L/s
2	Manhole No. 182238 downstream industrial areas in Groruddalen N 6644209.13; Ø 602904.37	28.6 14:50 - 29.6 12:36	2-1	Time-integrated composite of industry-influenced wastewater	Dry (0 mm)	150-400 L/s
		2.7 10:00 - 3.7 10:00	2-2		Dry (0 mm)	150-400 L/s
		29.7 01:30 - 29.7 11:10	2-3		Wet (11.2 mm; 9.2 mm in 11 h)	300-700 L/s
		30.8 00:13 - 30.8 10:00	2-4		Wet (6.0 mm in 5 h)	300-700 L/s
3	Downstream Vesletjern N 6653836.1 Ø 268988.94	4.7 12:00 - 4.7 22:40	3-1	Time-integrated composite of bathing water	Dry (0 mm)	5.7 L/s
4	In river Alna at Brubak N 6646841.48 Ø 604959.57	28.7 13:00 - 29.7 05:10	4-1	Time-integrated composite of river water	Wet (11.2 mm; 9.2 mm in 11 h)	100-1000 L/s
		29.8 23:57 - 30.8 10:00	4-2		Wet (6.0 mm in 5 h)	-
		8.9 08:00	4-3	Grab sample	Wet (12.6 mm in 4 h)	-
5	In river Alna in Kværnerbyen N 6642145.67 Ø 600215.49	29.6 10:20 - 30.6 10:20	5-1	Time-integrated composite of river water	Dry (0 mm)	333 L/s
		1.7 10:00 - 2.7 9:40	5-2		Dry (0 mm)	323 L/s
		28.7 13:00 - 28.7 23:20	5-3		Wet (11.2 mm; 9.2 mm in 11 h)	441 L/s
		30.8 00:06 - 30.8 10:00	5-4		Wet (6.0 mm in 5 h)	-
		8.9 07:30	5-5	Grab sample	Wet (12.6 mm in 4 h)	-

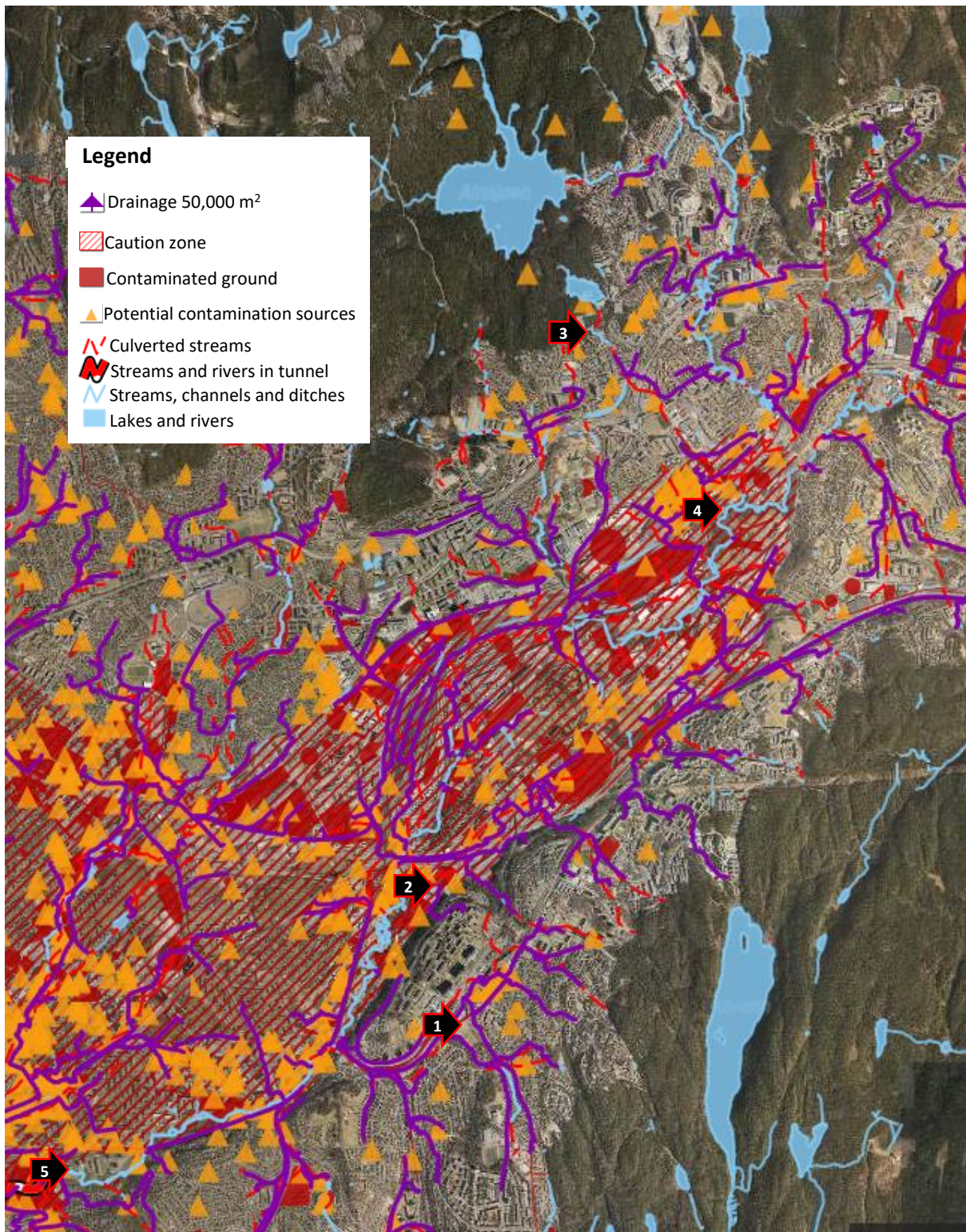


Figure 3: Overview of sampling locations for wastewater (1 and 2), bathing water downstream of Vesletjern (3), and water from the river Alna (4 and 5). "Caution zones" include contaminated ground sites and were the ground could potentially be contaminated. Map from Oslo municipality PLANINNSYN (<https://od2.pbe.oslo.kommune.no/kart>).

### **2.1.2.5 Acknowledgements**

We acknowledge Alexander Pham and colleagues at the Water and Sanitation Agency (VAV) in Oslo Municipality for much appreciated technical support and assistance during identification of appropriate manholes and for first time mounting of the equipment in manholes. Acknowledgments also to Terje Vold for providing access to VAV's monitoring station at Kværnerbyen and associated flow data. We thank Tommy at Veflen Entreprenør AS for letting us use their premises and electrical power during sampling at Brubak.

## **2.1.3 Marine samples**

### **2.1.3.1 Sediment**

Sediment was collected at two stations, one sample at Hovedøya and two samples at Storøyodden by means of a van Veen grab (0.15 m<sup>2</sup>) from RV Trygve Braarud. Three samples of the top layer (0-2 cm with undisturbed surface) were prepared in grab samples of four individual grabs each.

### **2.1.3.2 Blue mussels**

Samples of blue mussels (*Mytilus edulis*) were collected at Hovedøya (two samples) and Storøyodden (three samples) by standard procedures (Green et al., 2018) handpicked, using rake, or snorkelling. Five pooled samples (each of 20-21 shells; shell length 60 to 72 mm) were prepared.

### **2.1.3.3 Gull eggs**

Herring Gull (*Larus argentatus*) eggs (10 egg samples) were collected by Morten Helberg (University of Oslo). Biometric data for the birds will be given in a separate report (Ruus, In Press). The eggs were sampled at Søndre Skjælholmen (Nesodden municipality; 59.85317° N, 10.7281° E).

## **2.2 Chemical analysis**

All described methods are based on NILU's and NIVA's in-house methods, which were adapted and optimized for the selected compounds. None of the used methods are accredited, but all analytical work was done according to accreditation requirements given in EN17025.

### **2.2.1 Rare earth elements including gadolinium**

#### **2.2.1.1 Aqueous samples**

All samples were acidified with HNO<sub>3</sub> to a total concentration of 1% (v/v).

#### **2.2.1.2 Solid samples**

Samples were digested in a closed-vessel microwave technique system (UltraClave, Milsetone, Italy). Approximately 0,5 g of the household dust and 0,1 g of the sediments were weighed accurately on a Mettler PG503 balance and 5 ml HNO<sub>3</sub> (s.p.) and 3 ml deionized water was added. The samples were digested according to a 65 min. temperature programme, with stepwise heating to 250°C and a holding time of 30 minutes at 250°C. After cooling, the digests were quantitatively transferred to polypropylene tubes and diluted to a total volume of 50 ml with deionized water.

#### **2.2.1.3 Biota**

Samples were digested in a closed-vessel microwave technique system (UltraClave, Milsetone, Italy). Approximately 0,6 g of the common mussel and gull egg samples were weighed accurately on a Mettler PG503 balance and 5 ml HNO<sub>3</sub> (s.p.) and 3 ml deionized water was added. The samples were digested according to a 65 min. temperature programme, with stepwise heating to 250°C and a holding time of 30 minutes at 250°C. After cooling, the digests were quantitatively transferred to polypropylene tubes and diluted to a total volume of 50 ml with deionized water.

#### **2.2.1.4 Instrumental analysis**

Determination of REEs were performed on an Agilent 7700x series ICP-MS octopole reaction system. Indium was added to the sample line as an internal standard at a constant rate of approximately 1 µg.ml<sup>-1</sup>. Quantification was performed by external calibration using multi element mixtures delivered by Teknolab AS and Spectrascan all made from high purity NIST traceable primary element solutions of 99,99% or better. All calibration solutions were prepared in nitric acid solutions free of chloride to avoid common Cl molecular ions in the ICP-MS, at a nitric acid concentration of 1% or 10% to match the matrix of the samples. An analysis program containing the target elements was designed to avoid expected interferences such as polyatomic ions and doubly charged species. The strength of collision cell-ICP-MS is that most of the serious molecular ion problems encountered in classical quadrupole ICP-MS are removed when appropriate instrument settings are used.

### **2.2.2 Volatile compounds**

Samples were processed in the same manner as for volatile cyclic siloxane analysis. All operations were performed in a clean cabinet to avoid contamination from lab air. All samples were first spiked with an isotopically labelled internal standard mixture containing <sup>13</sup>C-labeled cyclic siloxanes D4, D5 and D6 and perdeuterated diisopropylbenzene (C<sub>12</sub>D<sub>18</sub>) and <sup>13</sup>C<sub>6</sub>-sH12pTP, synthesized at NILU as part of an option to the project.

### 2.2.2.1 Syntheses of $^{13}\text{C}$ -labeled surrogates for use as internal standards

One of the options to the project was synthesis of commercially unavailable substances for use as internal standards to assure reliable identification and accurate account for losses of analyte during extraction and work-up.

In scarcity of any available standards (except a specimen of technical mixture) for the broad group of congeners of Hydrogenated Terphenyls (HTPs), a synthesis of  $^{13}\text{C}_6$ -dicyclohexylbenzene was undertaken. The substance was prepared (among other congeners) by alkylation of  $^{13}\text{C}_6$ -benzene with cyclohexanol and sulfuric acid as catalyst. The major congener,  $^{13}\text{C}_6$ -sH12pTP was extracted and purified by crystallization. The standard solution made thereof was used for spiking air, water, sediment and biota samples prior to extraction. All HTP congeners were quantified against this ISTD.

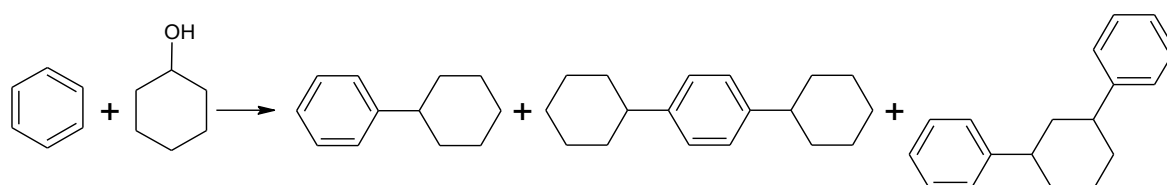


Figure 4: Synthesis route for the synthesis of  $^{13}\text{C}_6$ -sH12pTP and its by-products.

### 2.2.2.2 Aqueous samples

Water samples (200 mL) were extracted with dichloromethane. The solvent extract was then collected for analysis.

### 2.2.2.3 Air samples

Sorbents from the air-sampling devices were extracted with hexane, and the solvent was collected for analysis.

### 2.2.2.4 Solid samples

Sediment, sludge and dust samples (approximately 1 g) were extracted with 4ml of acetonitrile-hexane mixture (1:1), and the hexane layer collected for analysis via GC-MS.

### 2.2.2.5 Biota

Biota samples (approximately 1g) were extracted with 4ml of acetonitrile-hexane mixture (1:1), and the hexane layer was collected for analysis via GC-MS.

### 2.2.2.6 Instrumental analysis

All the solvent extracts were dried with Sodium Sulfate and injected onto GC-MS (Q Exactive GC-HRMS, Agilent GCMS or QuattroMicro GC-MS) without further purification or concentration. Specialty 30m RTX-200ms GC column (partially fluorinated siloxane polymer phase) was used for analysis to provide sufficient retention of the very volatile perfluorinated substances.

### **2.2.3 Alkyl phenols**

#### **2.2.3.1 Aqueous samples**

Water samples (150 ml) were spiked with isotopically labelled internal standards and extracted by solid phase extraction (SPE). SPE columns were conditioned with ethyl acetate, acetonitrile and with MilliQ water, the samples were then extracted and analytes eluted with ethyl acetate. A final solvent-exchange to either toluene or methanol was then carried out ahead of analysis.

#### **2.2.3.2 Sediment and dust samples**

Samples were extracted with accelerated solvent extraction and further cleaned with SPE.

#### **2.2.3.3 Biological samples**

Biological samples were extracted using ultrasonic assisted liquid extraction, and cleaned on a Florisil column and with dSPE (C18). Remaining interferences were removed with SPE.

#### **2.2.3.4 Instrumental analysis**

The alkylphenols were analysed with the ThermoScientific Vanquish UPLC coupled to ThermoScientific Q Exactive Plus Orbitrap system operated in a negative electrospray ionisation mode ( $R=70.000$  FWHM). Separation of alkylphenols were achieved with the use of Waters HSS T3 column ( $1.8 \mu\text{m}$ ,  $150 \times 3.0 \text{ mm}$ ) with a gradient of water and methanol used as a mobile phase.

### **2.2.4 BADGE- and BFDGE-related compounds**

#### **2.2.4.1 Aqueous samples**

Water samples (150 ml) were spiked with isotopically labelled internal standards and extracted by solid phase extraction. SPE columns were conditioned with ethyl acetate, acetonitrile and with MilliQ water, the samples were then extracted and analytes eluted with ethyl acetate. Afterwards solvent was exchanged either to toluene or methanol.

#### **2.2.4.2 Sediment, and dust samples**

Sludge, sediment, and dust samples were extracted with accelerated solvent extraction and further cleaned with SPE.

#### **2.2.4.3 Biological samples**

Biological samples were extracted using ultrasonic assisted liquid extraction, cleaned on a Florisil column and with dSPE (C18). Remaining interferences were removed with SPE.

#### **2.2.4.4 Instrumental analysis**

The BADGE- and BFDGE-related compounds were analysed with Waters Acquity UPLC coupled to Waters LCT HR-TOF system operated in a positive electrospray ionisation mode. Separation of BADGE- and BFDGE-related compounds was achieved with the use of Agilent Zorbax SB-C18 column ( $1.8 \mu\text{m}$ ,  $50 \times 2.1 \text{ mm}$ ) with a gradient of 5mM ammonium acetate in water and 5mM ammonium acetate in methanol used as a mobile phase.

## **2.2.5 UV filters**

### **2.2.5.1 Biota, water and dust samples.**

Samples were spiked with isotopically labelled internal standards before extraction. Biota samples were also spiked with a volume of zinc chloride solution to improve extraction efficiency. Biota were then extracted with organic solvents in an ultrasonic bath. Water samples were extracted with organic solvents with a magnetic stirrer. The organic-solvent extracts were removed and concentrated with vacuum under nitrogen flow before undergoing a final clean-up step with PSA sorbent to remove interferences. The final extracts were filtered using spinex 0.2µm and concentrated to approximately 0.2ml prior to the analysis.

### **2.2.5.2 Air samples (PUF)**

Sorbents from the air-sampling devices were extracted with hexane, and the solvent was collected and concentrated under nitrogen flow to approximately 0.2ml prior to analysis.

### **2.2.5.3 Instrumental Analysis**

Samples from water and air were analysed with Agilent 6890N GC system equipped with 30-meter DB-5MS column and coupled to Agilent 5973N MSD operated in EI mode.

Samples from biota were analysed with Agilent 7890B GC system equipped with two 15 meter HP-5MS-UI columns coupled to an Agilent 7010B GC/MS Triple Quad operated in EI mode.

## **2.2.6 Other additives (GC-MS)**

### **2.2.6.1 Solid samples (sediments and biota)**

The DCM-extracts were transferred to 2 ml cyclohexane, and 1ml 0,1M sodium acetate and 1 ml 2% tetraethylborate was added. The samples were vortexed for 1 minute and centrifuged. The cyclohexane extracts were washed with 2 ml 0.1M sulphuric acid. The cyclohexane extracts were cleaned by GPC and PSA.

### **2.2.6.2 Dust and air (PUF) samples**

The methanol extracts from the dust samples were diluted in 0.1 M sodium acetate, added 2% tetraethylborate and iso-hexane and then vigorously shaken. The iso-hexane extracts were added PSA as a clean-up prior to the instrumental analysis. The PUF extracts were transferred to cyclohexane and added PSA as a clean-up.

### **2.2.6.3 Water samples**

Internal standards (tripentyl tinchloride, d12-chrysene and 13C18-triphenylphosphate) and sodium acetate (0,1M) was added to the water samples (0.9 liter) and the pH was adjusted to pH=4 with acetic acid. The samples were then derivatized with tetraethyl borate and extracted with iso-hexane. The extracts were evaporated to 1ml and cleaned by using GPC and PSA prior to the analysis.

### **2.2.6.4 Instrumental analysis**

The analysis was performed by using a gas chromatograph (Agilent 6990N) coupled to a mass selective detector (Agilent 5730 Network) operated in SIM mode.

The quantification was done by using addition standard curves where the different matrices were spiked with the target compounds at 20-250ng/g (20-250 ng/l).

## **2.2.7 Pharmaceuticals**

### **2.2.7.1 Solid samples (sediments and biota)**

Biota (approx. 1 g wet weight), and sediment (exactly 0.5 g dry weight) aliquots were taken. Deuterated internal standard was added to each aliquot before the addition of 1 ml 0.1 M zinc sulfate. 1 min of vortex mixing resulting in cell lysis. 4 ml ACN added to further precipitate proteins and extract the pharmaceuticals by further vortexing. 1 g QuECHERS (80-85% Magnesium Sulfate and 15-20 % Sodium Acetate; Waters, Sweden) extraction powder was added to each extract and mixed by vortex for 1 min. The samples were centrifuged at 2500 rpm for 6 minutes and the supernatant (300 µL) transferred to deep-well 96-well plate (2 ml). 600 µL of ultrapure water was added to each well. The well plates were centrifuged at 3500 g for 10 minutes. The calibration standard were also transferred to 96-well plate and diluted as per samples.

### **2.2.7.2 Instrumental analysis**

The samples were then analyzed on an ultra performance liquid chromatograph coupled to a high resolution mass spectrometer.

## **2.3 Uncertainties**

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

Measurement uncertainties for REEs are within 20% for all sample matrixes in this study.



### 3 Results and discussion

In this study over 100 different compounds with an array of physiochemical properties were measured in environmental samples. These samples included indoor air and dust samples, surface water, municipal wastewater, and marine sediments and biota. A complete data table is included in the appendix and a detailed presentation of selected results is given in the subsequent chapters. Table 10 present the frequency of detection of all compounds in all sample types. Detection frequency is the percentage of samples in which a substance was detected relative to the total number of analysed samples. It should be noted that, as always, the results are dependent on detection limits for each compound. A non-detect or zero in this table is not a guarantee that the compound was not present, but instead that the compound was not detectable with the analytical methods applied.

*Table 10: Detection frequency of the different compounds in all measured samples. Detection frequency is given by the number of detects divided by the total number of measured samples given in percent (na = not analysed).*

Matrix	Sewage water	Surface water	Sediment	Common mussel	Gull egg	Settled floor dust	Indoor air XAD	Indoor air PUF
Gd	100	89	100	100	100	100	na	na
L3	71	0	20	0	0	na	100	na
L4	100	0	40	20	10	na	100	na
L5	100	67	100	100	40	na	100	na
Sum Lin Sil	100	67	100	100	40	na	100	na
oDiPB	0	0	0	0	0	na	0	na
mDiPB	57	0	0	0	0	na	100	na
pDiPB	43	0	0	0	0	na	100	na
Sum DiBP	57	0	0	0	0	na	100	na
iPbP	0	0	0	0	0	na	96	na
H18pT	14	0	40	0	0	na	0	na
sH12mT	0	0	20	0	0	na	100	na
uH12mT	0	0	20	0	0	na	38	na
uH12pT	0	0	20	0	0	na	4	na
sH12pT	71	0	100	0	0	na	100	na
uH6mT	14	0	40	0	0	na	54	na
csH6mT	86	0	80	0	0	na	96	na
tsH6pT	43	0	20	0	0	na	71	na
Sum HT	100	0	100	0	0	na	100	na
oT	86	11	80	0	0	na	100	na
mT	43	22	100	40	0	na	50	na
pT	0	22	100	40	0	na	13	na
Sum T	100	22	100	40	0	na	100	na
Vinyl-D4	0	0	0	0	0	na	13	na
F-D3	0	0	0	0	0	na	0	na
F-D3b	0	0	0	0	0	na	0	na
F-D3c	0	0	0	0	0	na	0	na
F-D4a	0	0	0	0	0	na	0	na
F-D4b	0	0	0	0	0	na	0	na

Matrix	Sewage water	Surface water	Sediment	Common mussel	Gull egg	Settled floor dust	Indoor air XAD	Indoor air PUF
F-D4c	0	0	0	0	0	na	0	na
F-D4d	0	0	0	0	0	na	0	na
F-D4	0	0	0	0	0	na	0	na
4tOP	0	0	0	0	0	46	na	na
4nOP	0	0	0	0	0	0	na	na
4nHP	0	0	0	0	0	0	na	na
4HP(br)	0	0	0	0	0	0	na	na
4nNP	0	0	0	0	0	0	na	na
4nDDP	0	0	0	0	90	8	na	na
BADGE	0	0	0	0	0	81	na	na
BADGE-HCl	0	0	0	0	0	8	na	na
BADGE-2HCl	0	0	0	0	0	0	na	na
BADGE-H2O	0	0	0	0	0	77	na	na
BADGE-2H2O	100	0	0	0	0	100	na	na
BADGE-HCl-H2O	0	0	0	0	0	92	na	na
BFDGE	0	0	0	0	0	0	na	na
BFDGE-2HCl	0	0	0	0	0	0	na	na
BFDGE-2H2O	0	0	0	0	0	0	na	na
Enzacamene	100	0	0	0	0	100	na	92
3-BC	0	0	0	0	0	0	na	13
2-EHMC(E)	100	89	0	0	0	100	na	100
2-EHMC	100	89	0	0	0	100	na	100
Homosalate	100	56	40	0	0	100	na	96
Tinuvin 622	0	0	0	0	0	0	na	0
ODPABA	100	11	0	0	0	100	na	100
OC	100	56	100	0	20	100	na	100
UV-320	100	22	20	0	10	96	na	100
UV-326	100	78	40	0	10	100	na	100
UV-327	100	89	20	0	70	96	na	100
UV-328	100	100	60	20	100	100	na	100
UV-329	100	67	0	0	0	100	na	100
Ensulizole	100	100	0	0	0	32	na	4
BP1	0	0	0	0	0	44	na	0
BP2	0	0	0	0	0	0	na	0
BP3	100	22	0	0	0	100	na	100
BP8	0	0	0	0	0	12	na	13
BTA	100	78	0	0	0	0	na	0
TTA	43	78	60	0	0	0	na	0
NBBs	0	0	0	0	0	0	na	0
DOTO	100	67	20	0	0	100	na	100
Acetylcedrene	43	0	0	0	0	64	na	88
Benzocaine	0	0	0	0	0	0	na	0
Climbazole	71	0	0	0	0	4	na	0
Dapsone	0	0	0	0	0	0	na	0

### **3.1 Rare earth elements**

Originally, only Gadolinium, Gd, was selected for this screening study. Gd was detected in all selected matrices and in 61 out of the 62 measured samples, including sewage and surface water, sediment, common mussel, gull eggs and indoor settled floor dust. However, Gd originating from natural sources is normally found in detectable concentrations in nearly all environmental samples and any additional anthropogenic source is difficult to identify. Rare earth metals, including Gd, are chemically alike and consequently occur together in minerals and their relative distribution is normally quite similar. This invariable and coherent rare earth metal pattern is very useful in detecting anomalies due to anthropogenic influence, and the other rare earth elements were on a later stage also quantified and discussed in this study.

### 3.1.1 Settled floor dust

The majority of the samples collected were indoor household dust (25 samples) and sum REE and Gd concentrations in these samples spanned several orders of magnitude, from 1171 to 173361 ng/sample (average 17172 ng/sample) and from 29 to 3249 ng/sample (average 407 ng/sample), respectively. One sample, House 14, exceeded all other samples approximately 10 times for all REEs. This house/location was re-sampled early summer 2019, and the concentration levels for all REEs, including Gd, were much lower and comparable to the lowest values amongst the other samples. No other study of Gd or other REE in settled floor dust have been found, so a direct comparison cannot be made. Box and whisker plots of shale normalized REE distributions are presented in Figure 5. For convenience, samples were divided into two categories; residential and non-residential houses. Generally, samples from non-residential houses were higher compared to residential houses. The normalized REE distribution from residential houses are similar to natural background, indicating that the source of REEs in household dust originated from outdoors most likely from soil and clay particles. Non-residential houses show a positive Eu anomaly. The reason for this is not clear, but may be due to the application of Eu in low-energy light bulbs (Resende & Morais, 2015). In the particular case of Gd; Gd anomaly ( $Gd/Gd^*$ ) is close to 1 (average 1.2 in both residential and non-residential houses) indicating no particular anthropogenic influence.

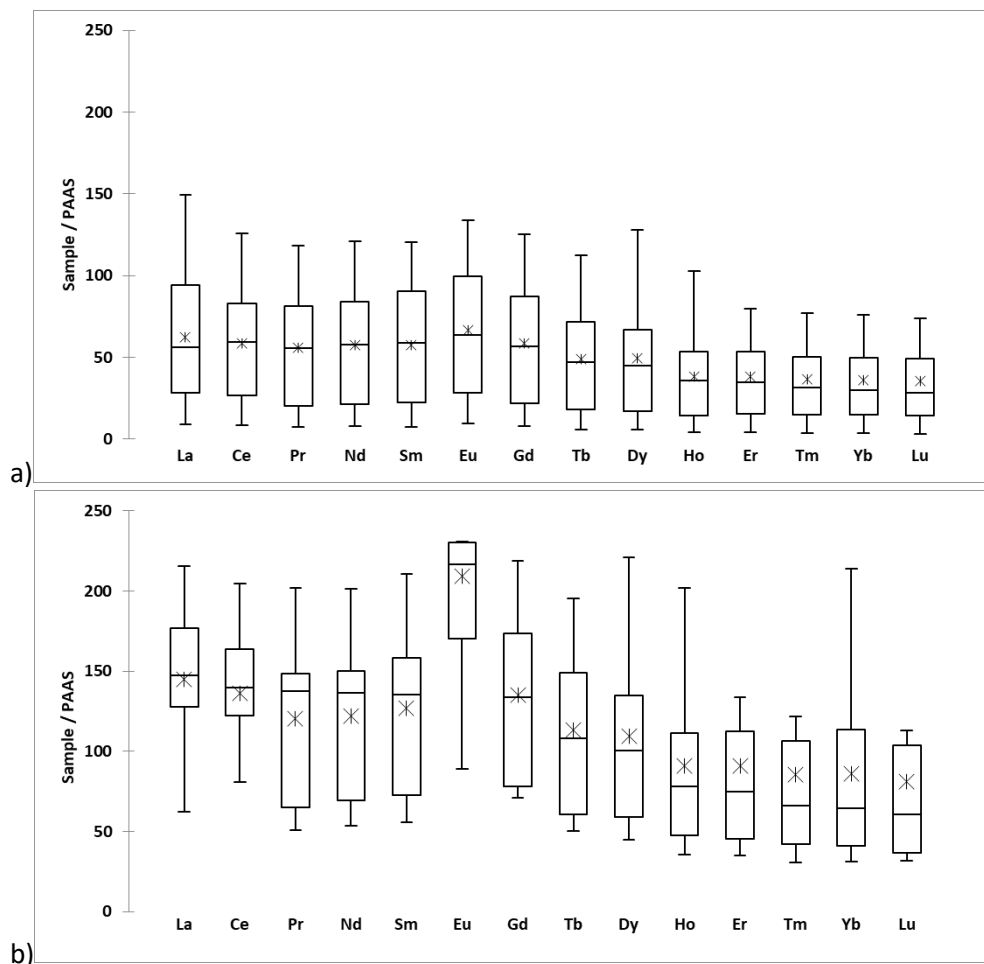


Figure 5: Box and whisker plots of PAAS normalized REE pattern from a) residential houses b) non-residential.

### 3.1.2 Sewage water

Sum REEs in municipal wastewater ranged from 36 to 336 ng/L (average 129 ng/L), whereas concentrations of Gd ranged from 3.1 to 232 ng/L (average 91 ng/L). Gd concentrations in wastewater in published literature range from 13 to 1174 ng/L (Ebrahimi & Barbieri, 2019). Box and whisker plots of shale normalized REE distributions for sewage water are shown in Figure 6. The general trend is a small negative anomaly for Ce, a consistent positive anomaly for Eu and a slight increase from light to heavy REE. The negative Ce anomaly may be linked to oxidation of  $Ce^{3+}$  to  $Ce^{4+}$  form insoluble  $CeO_2$ , whereas the positive Eu anomaly may be linked to the reduction of  $Eu^{3+}$  to  $Eu^{2+}$  that increases mobility (Weltje et al., 2002). The pattern of higher relative concentration for the heavy REEs compared to light REEs is typical for natural uncontaminated water (Bau & Dulski, 1996). Gd is strongly enriched in more than 50% sewage water samples. Gd anomaly ( $Gd/Gd^*$ ) confirms this finding with the highest above 50 (the anthropogenic load is 50 times higher than the geogenic background). Gd anomaly in the remainder of the waste water samples is 1.9 indicating these waters are moderately impacted by human activity. It should be noted that the temporal variability of Gd concentrations in waste water is large, the Gd concentration at one sampling point on consecutive days varied between 10 and 232 ng/l. The main application of Gd is as contrast agent used in MRI (magnetic resonance imaging) exams. The concentration of Gd in river water is expected to increase considerably in the future with the increasing number of MRI exams because the Gd containing contrast agent is excreted un-metabolized from the human body and are insufficiently removed in wastewater treatment plants (Rogowska, Olkowska, Ratajczyk, & Wolska, 2018).

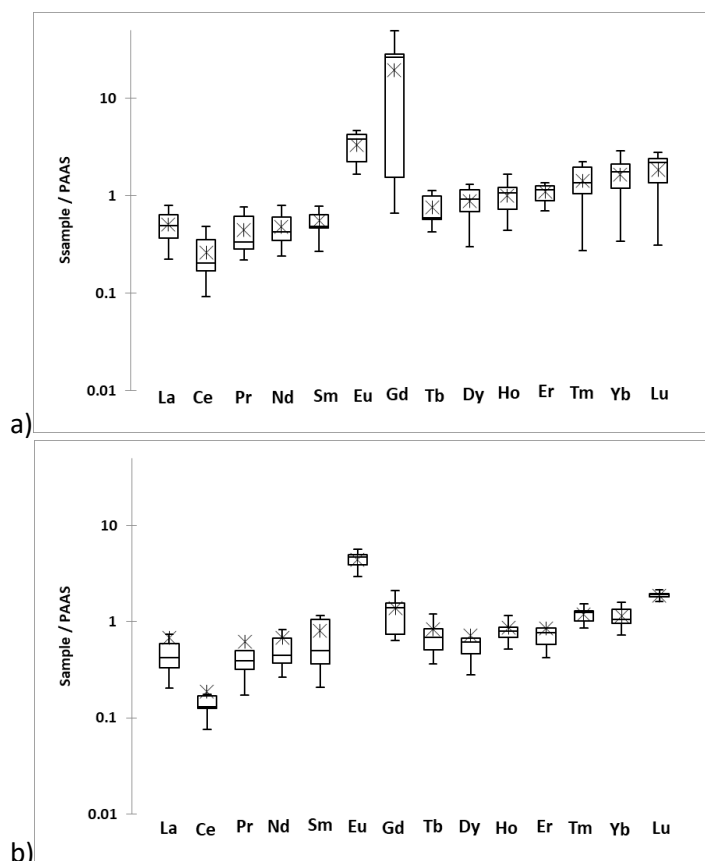


Figure 6: Box and whisker plots of PAAS normalized REE pattern of a) sewage water and b) surface water.

### **3.1.3 Surface water**

Surface water samples collected in this study consist of river water, and sum REE concentrations range from 41 to 303 ng/l (average 96 ng/L) whereas Gd concentrations range from <0.3 to 99 ng/L (average 6.2 ng/L). REEs are ubiquitous in water where they originate from the rocks or sediments with which water interacts. Surface waters are an important pathway of transporting and distributing REEs among different environmental compartments. Most lake and river waters exhibit REE concentrations in the lower ng/l, but can show substantial variation in different streams and rivers. The concentrations found in this study are comparable to those of uncontaminated river water samples collected in Germany, Sweden, USA, Japan and South Korea ranging from 1.4 – 41 ng/ L (Ebrahimi & Barbieri, 2019). Shale normalized REE distribution for surface water is similar to sewage water; a general increasing trend from light the heavy REE, a small negative Ce anomaly and a significant positive Eu anomaly, which is due to the slightly different mobility of these elements compared to the rest of REEs. A general feature of the shale normalized REE pattern in natural water is an upward trend from La to Lu; a slight enrichment of the heavier REE over the lighter REE (Bau & Dulski, 1996). Gd is only moderately enriched, with an average Gd anomaly of 1.9 (min = 1.2, max = 3.4). Gd anomalies in surface waters in this study are similar to Gd anomalies reported elsewhere (Ebrahimi & Barbieri, 2019), and the authors of those studies considered the river waters uncontaminated, though they concluded that the rivers were slightly enriched compared to natural background due to the Gd-based MRI agent.

### **3.1.4 Sediments**

Five sediment samples of different origin were collected in this study and the sum REE concentration ranged from 195 to 296 µg/g d.w. (average 250 µg/g d.w.), whereas Gd concentration ranged from 6240 to 9300 ng/g d.w. (average 7865). The median Gd concentration in 848 stream sediment samples and 743 floodplain samples were 5060 and 3920 ng/g respectively (FOREGS, 2019). Shale normalized REE distribution reveals that though the concentration levels vary between sampling locations (river sediments vs marine sediments), the distribution pattern is similar for all sediments samples, expect a small negative Ce anomaly in the marine sediments.

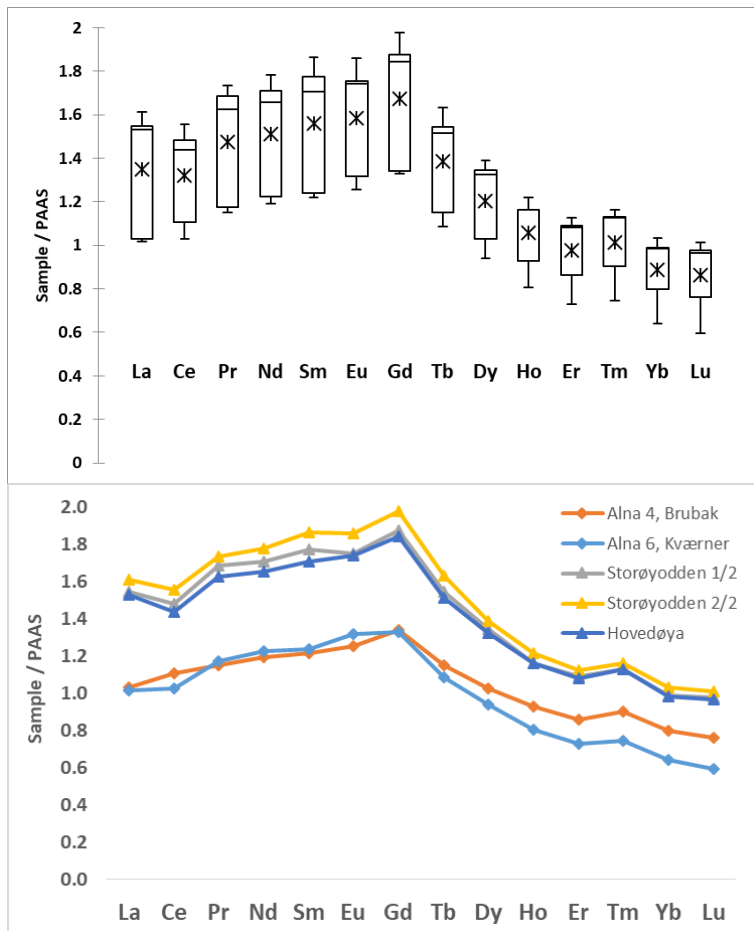


Figure 7: Box and whisker plots of PAAS normalized REE pattern of marine and river sediments.

### 3.1.5 Biota

The sum REE concentrations in gull eggs and common mussel ranged from 0.24 to 2.9 ng/g w.w. (average 1.6 ng/g w.w.) and 430 to 747 ng/g w.w. (average 573 ng/g w.w.) respectively, whereas Gd concentration in gull eggs and common mussel ranged from 0.03 to 0.157 ng/g w.w. (average 0.08 ng/g w.w.) and 13 to 26 ng/g w.w. (average 20 ng/g w.w.), respectively. No other study of REEs in either gull eggs or common mussel have been found. However, a recent study including bivalves from the Mediterranean Sea found a total REE concentration of 160 ng/g w.w. (Squadron et al., 2019). The same study confirmed that REEs have low potential for biomagnification, but are instead subject to trophic dilution as the highest concentrations of REE were measured at low trophic levels in both marine and terrestrial environments. This hypothesis seem applicable to the presented study as gull eggs contained lower concentration of Gd compared to common mussel. Additionally, (MacMillan, Chélat, Heath, Mickpegak, & Amyot, 2017) found that REE accumulation in biota is age- and length dependent, suggesting that REE uptake is faster than elimination for some species. They also found that normalized REE distribution pattern reveal species and tissue specific anomalies for individual elements, which also seem relevant for the findings in this study.

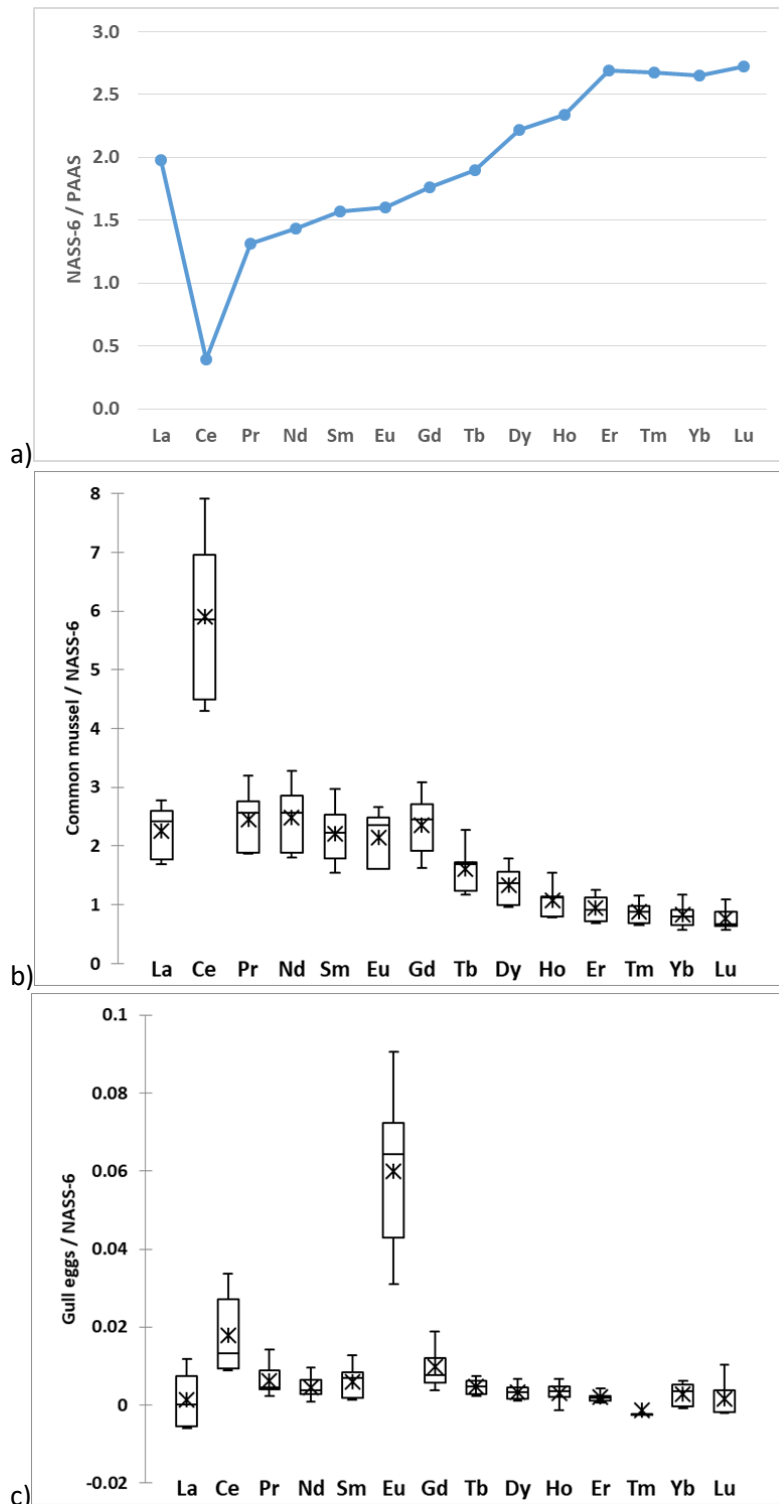


Figure 8: a) PAAS normalized NASS-6 used as proxy environment for the common mussel and gull egg samples. Box and whisker plots of NASS-6 normalized REE pattern of b) common mussel and c) gull eggs.

Shale-normalized lanthanide patterns of biota provide no insight into availability and bioconcentration of lanthanides by organisms, but instead give information on the degree of similarity between lanthanide concentrations in organisms and shale. To obtain information on availability and bioconcentration of lanthanides, it is crucial to relate or normalize concentrations in organisms to those in the environmental phase they take up lanthanides from, e.g. water phases for plants and food



and water for animals (Weltje et al., 2002). No seawater was collected in this study, therefore as an environmental proxy for the common mussel and gull eggs we have used REE concentrations from a reference seawater sample from the GEOTRACES intercalibration seawater; NRC NASS-6 coastal water (Crocket et al., 2018). Normalized to PAAS, this seawater displays a characteristic REE distribution pattern with enrichments of the heavier REEs over the lighter, because the heavier REEs are almost entirely bound to stable carbonate complexes while the lighter are present with a greater proportion as free metal ion which makes them more susceptible to removal from solution through adsorption processes (Cantrell and Byrne, 1987; Byrne and Kim, 1990; Sholkovitz et al., 1994). The exception is Ce whose microbially mediated redox chemistry results in substantially lower relative concentrations to neighboring REE. Normalizing common mussel samples to NASS-6, the lighter REEs are enriched compared to the heavier, with the exception of Ce showing a strong positive Ce anomaly, probably compensating for the negative anomaly in the seawater, which makes it tempting to speculate that either the reference seawater is much more depleted in Ce compared to the seawater where the common mussel grow or that the common mussel biomagnifies Ce to a large extent. Further, a small positive Gd anomaly can be seen in the normalized distribution plot, however considering the calculated Gd anomalies ( $Gd/Gd^*$ ) there is no evidence of human impact of significance (average Gd anomaly = 1.3). The gull eggs collected in this study show a positive Eu anomaly compared to the other REEs, which may be related to the increased mobility and probably increased uptake mechanisms for Eu due to the different chemical behavior. Additionally, the gull eggs show a slightly higher Gd anomaly compared to the common mussel with an average Gd anomaly ( $Gd/Gd^*$ ) of 2.2 (ranging from 1.1 to 4.5).

### **3.1.6 Conclusions for rare earth elements**

The concentrations of REEs in general and Gd in particular determined in this study is in good agreement with previously published investigations of similar samples from around the world. The PAAS normalized REE patterns are different between matrixes, however, within one matrix the pattern is very similar between samples. Considering the Gd anomalies, more than half of the waste water samples were significantly impacted by anthropogenic influence, and approximately 50% of the surface waters samples were moderately impacted. However, the temporal variability of the Gd concentration was large. All other samples and matrixes collected seems not influenced by human activity.

For biota, results show that REEs generally follow a coherent bioaccumulation pattern for sample tissues, with some anomalies for redox-sensitive elements (Ce and Eu). The highest REE concentrations were found at lowest trophic levels.

The widespread and growing relevance of REE in a number of industrial, agricultural and medical technologies has become evident in the last decades. Recent studies show that REEs of anthropogenic origin occur in the environment, suggesting REEs are contaminants of emerging concern. Out of the 17 REEs, La, Gd, Ce and Eu are the most studied. Adverse outcomes of REE exposures include a number of endpoints, such as growth inhibition, cytogenetic effects, and organ-specific toxicity. An apparent controversy regarding REE-associated health effects relates to opposed data pointing to either favorable or adverse effects of REE exposures (Pagano, Thomas, Di Nunzio, & Trifuoggi, 2019). Human exposure to REEs occurs via ingestion of contaminated water and food, inhalation, and direct intake during medical administration. Considering REEs in medical devices, epidemiological evidence directly linking REEs in the environment to human health conditions remains weak (Gwenzi et al., 2018).

## 3.2 Volatile compounds

### 3.2.1 Indoor air

Due to their volatile nature the most relevant indoor matrix for monitoring of the volatile compounds is air. With the exception of the fluorinated siloxanes most of the selected volatiles were found in indoor air. In fact, air is the matrix with highest number of positive findings of the selected volatiles as clearly visible in Table 10. Low or no detection in indoor air was however found for o-DiBP, H18pT, uH12pT and pT. A complete table with all monitoring results is given in the Appendix to this report. The most relevant findings are summarized in Table 11.

Table 11: Average and range of concentrations of volatile compounds in indoor air (ng/m<sup>3</sup>) measured with XAD-2 passive air sampler. For explanation of acronyms and sums see Table 2.

Sample type	Sum LinSil	Sum DiPB	iPbP	Sum HT	Sum T
	(Min - max) Average* Detection frequency				
	ng/m <sup>3</sup>				
Air	(4.8 - 1215) <b>186</b> 100 %	(0.61 - 38) <b>7.3</b> 100 %	(<0.25 - 1.5) <b>0.56</b> 96 %	(1.0 - 13) <b>3.8</b> 100 %	(0.10 - 0.79) <b>0.28</b> 100 %

\*): For the non-detects LoD/2 was used, when calculating the average.

Both linear siloxanes and isopropylbenzenes were measured earlier in Norwegian indoor air samples (Schlabach et al., 2017) and concentrations were in the same order of magnitude

The total tonnage registered by ECHA is 100-1000 tpa for L3 and L4, and 1000+ tpa for L5, which is supported both by this study and the former screening study of 2016 (Schlabach et al., 2017).

In a recent American study based on 60 houses (mixture of homes, schools, laboratories and other work places) and looking for five cyclic and nine linear siloxanes, similar air concentrations for linear siloxanes in homes were found (Tran & Kannan, 2015). This group estimated also a mean daily exposure to total siloxanes measured for all locations of the study of around 19,1 µg/day. However, the daily exposure rate from personal care products via inhalation, ingestion, and dermal absorption are probably much higher and was estimated to 307 mg/day for the US women (Horii & Kannan, 2008).

Hydrogenated terphenyls (HT) are classified as substances of very high concern and are included into ECHAs candidate list (Kennedy & Mackie, 2018). To our best knowledge this compound has previously not been measured in indoor environments or other environmental samples in Norway. Only a few international measurements of HTs are previously reported as accidental contamination of food items with Therminol 66, which contains HT as major ingredients (Moh, Tang, & Tan, 2002).

ECHA has registered a derived no effect level (DNEL) of 25 mg/m<sup>3</sup> for L5, and the measured values are more than 3 orders below that level (REACH registered substance factsheets, 2019) and it is assumed that other uptake routes are more relevant than inhalation.

### 3.2.2 Wastewater

With exception of the fluorinated siloxanes and 4-Isopropylbiphenyl (iPbP) most of the selected volatiles were found in wastewater. A complete table with all monitoring results is given in the Appendix to this report. The most relevant findings are summarized in Table 12.

Table 12: Concentration of volatile compounds in sewage water from Hellerud residential area and Grorud industrial area (ng/L). For explanation of acronyms and sums see Table 2.

Sample type	Sum LinSil	Sum DiPB	iPbP	Sum HT	Sum T
	(Min - max) Average* Detection frequency				
	ng/L				
Sewage water	(38 - 690) <b>274</b> 100 %	(<12 - 9.3) <b>6.5</b> 57 %	(<4 - <16) -- 0 %	(3 - 510) <b>119</b> 100 %	(2.3 - 7.5) <b>4.7</b> 100 %

\*): For the non-detects LoD/2 was used, when calculating the average.

An attempt was made to correlate the measured waste water concentration pattern with the two source categories: Household and industrial waste water. Unfortunately, the internal variation for each source category is higher than the difference between this two categories.

ECHA has registered a Predicted No Effect Level (PNEC) for all three linear siloxanes of 1 mg/L in waste water sediments (REACH registered substance factsheets, 2019), which is more than three orders of magnitude higher than the concentrations measured in this study.

### 3.2.3 Surface water

In surface water the detection frequency of all selected volatiles are low, reflecting the low water solubility and high volatility of these substances. Only dodecamethylpentasiloxane (L5) and m- and p-terphenyl were found in some samples. A complete table with all monitoring results is given in the Appendix to this report. The most relevant findings are summarized in Table 13.

Table 13: Concentration of volatile compounds in samples of surface water from river Alna (ng/L). For explanation of acronyms and sums see Table 2.

Sample type	Sum LinSil	Sum DiPB	iPbP	Sum HT	Sum T
	(Min - max) Average* Detection frequency				
	ng/L				
Surface water	(<1.4 - 17) <b>8.3</b> 67 %	(<2.5 - <25) -- 0 %	(<0.6 - <26) -- 0 %	(<7 - <25) -- 0 %	(<0.9 - 1.8) <b>1.4</b> 22 %

\*): For the non-detects LoD/2 was used, when calculating the average.

ECHA has not registered PNECs for the linear siloxanes in fresh water environment. It is therefore difficult to conclude on the environmental risk of this compound group to this environment.

### 3.2.4 Sediment samples

Compared to surface water the detection frequency for the selected volatiles was slightly higher. Dodecamethylpentasiloxane (L5) and both terphenyls and hydrogenated terphenyls were found in all samples. A complete table with all monitoring results is given in the Appendix to this report. The most relevant findings are summarized in Table 14.

Table 14: Concentration of volatile compounds in sediment samples (ng/g). For explanation of acronyms and sums see Table 2.

Sample type	Sum LinSil	Sum DiPB	iPbP	Sum HT	Sum T
	(Min - max) Average* Detection frequency				
	ng/g				
Sediment	(<1.4 - 4.1) <b>1.7</b> 100 %	(<0.3 - <0.7) -- 0 %	(<0.1 - <0.8) -- 0 %	(1 - 430) <b>113</b> 100 %	(0.3 - 24) <b>5.6</b> 100 %

\*) For the non-detects LoD/2 was used, when calculating the average.

For HT ECHA has registered a PNEC 6.32 µg/g in marine sediments (REACH registered substance factsheets, 2019), about a factor of 60 higher than the measured average concentration in this study. However, the high concentrations of HTs in sediment make it relevant to have a closer look into these results.

### 3.2.5 Biota

Only dodecamethylpentasiloxane (L5) was found in all samples of blue mussels. In addition decamethyltetrasiloxane (L4) and terphenyls were found in some samples of blue mussel. In Herring gull eggs only dodecamethylpentasiloxane (L5) could be found and only in two samples. A complete table with all monitoring results is given in the Appendix to this report. The most relevant findings are summarized in Table 11.

Table 15: Concentration of volatile compounds in biota samples (ng/g). For explanation of acronyms and sums see Table 2.

Sample type	Sum LinSil	Sum DiPB	iPbP	Sum HT	Sum T
	(Min - max) Average* Detection frequency				
	ng/g				
Common mussel	(0.64 - 1.9) <b>1.2</b> 100 %	(<1.2 - <2.0) -- 0 %	(<0.2 - <0.3) -- 0 %	(<5 - <10) -- 0 %	(<0.6 - 1.3) <b>1.0</b> 40 %
Herring gull egg	(<1.5 - 76) <b>21</b> 40 %	(<3 - <4) -- 0 %	(<0.6 - <0.8) -- 0 %	(<15) -- 0 %	(<0.6 - <0.8) -- 0 %

\*) For the non-detects LoD/2 was used, when calculating the average.

### 3.2.6 Possible degradation products

As shown above, most of the selected volatile compounds were frequently detected in both indoor and outdoor environmental samples. However, vinyl-D4, F-D3, and F-D4 were rarely or never detected in the samples selected for this study. These compounds are susceptible for reaction with water and not very persistent under normal environmental conditions. Unfortunately, it was not possible to search for the possible degradation/hydrolyzation products as these are much more polar and less volatile compared to the parent compounds and would require a completely different analytical method. On the other hand there are recent developments under the umbrella of the NORMAN-network addressing this difficulty. The most effective non-target screening method is based on the data-filtration of raw data by using list of suspected compounds (suspect screening). The existing suspect lists can be extended by the theoretical calculation (in silico) of mass spectra and retention time of potential degradation products (Aalizadeh, Nika, & Thomaidis, 2019; Bletsou, Jeon, Hollender, Archontaki, & Thomaidis, 2015). There is no guarantee, but a good chance that the application of this

method would have detected those degradation products and we strongly advice to include such methods in future screening studies.

### 3.3 Alkylphenols

#### 3.3.1 Settled floor dust

Of the six targeted alkylphenols only 4-tert-octylphenol (4-tOP) and 4-n-dodecylphenol (4-n-DDP) were detected in settled floor dust samples (Table 16).

Table 16: Concentration of selected alkylphenols in samples settled floor dust.

Sample type	4-tOP	4-nDDP
	(Min - max) Average* Detection frequency	ng/g
Settled floor dust	(<25 - 203) <b>41</b> 46 %	(<40 - 174) <b>28</b> 8 %

\*) : For the non-detects LoD/2 was used, when calculating the average.

#### 3.3.2 Biota

Of the six targeted alkylphenols only 4-n-dodecylphenol (4-n-DDP) was found in gull eggs in concentrations ranging from <15 to 68 ng/g w.w. The average concentration was 29 ng/g w.w. and detection frequency 90 %. In blue mussels the alkylphenols could not be detected.

#### 3.3.3 Other sample types

None of the selected alkylphenols were found in the other selected sample matrices like water and sediments.

### 3.4 BADGE and BFDGE and their derivatives

#### 3.4.1 Settled floor dust

BADGE or its derivatives were detected in all settled floor dust samples. A complete table with all monitoring results are given in the Appendix to this report. The most relevant findings are summarized in Table 17 Highest concentrations and detection frequency was found for BADGE-2H<sub>2</sub>O followed by BADGE-HCl-H<sub>2</sub>O. Sample 1 and 2 are sampled at the same time at house 1 showing a Sum BADGE of 2540 ng/g and 913 ng/g respectively. Sample 9 and 10 at two different days at house 8 showing a Sum BADGE of 9 400 and 5 040 ng/ respectively.

Table 17: Concentration of BADGE and its derivatives in samples of settled floor dust (ng/g dust).

Sample type	BADGE	BADGE-HCl	BADGE-H <sub>2</sub> O	BADGE-2H <sub>2</sub> O	BADGE-HCl-H <sub>2</sub> O	Sum BADGE
	(Min - max) Average* Detection frequency					ng/g
House dust 2018	(<15 - 197) <b>66</b> 81 %	(<30 - 119) <b>20</b> 8 %	(<2 - 667) <b>128</b> 77 %	(437 - 13 000) <b>4 450</b> 100 %	(<40 - 1 470) <b>368</b> 92 %	(512 - 14 600) <b>5 010</b> 100 %

Sample type	BADGE	BADGE-HCl (Min - max) Average* Detection frequency	BADGE-H <sub>2</sub> O	BADGE-2H <sub>2</sub> O	BADGE-HCl-H <sub>2</sub> O ng/g	Sum BADGE
Settled floor dust 2016		(<15 - 375 ) <b>92</b> 55 %	(<5 - 145 ) <b>31</b> 44 %	(<170 - 2 600) <b>1 271</b> 89 %	( 35 - 280 ) <b>147</b> 100 %	

\*): For the non-detects LoD/2 was used, when calculating the average.

The concentrations are in the same range as what was measured by an earlier Norwegian screening study (Schlabach et al., 2017) and in settled floor dust samples from other countries like US, China, Korea and Japan (L. Wang et al., 2012).

According to the EPA approach for estimating dust ingestion (US-EPA, 2011, 2017), we can estimate an dust ingestion rate (DIR) of 0,02 to 0,1 g/day. With an average body weight for infants of 5 kg and adults of 80 kg the estimated daily intake (EDI) can be calculated as following:

$$EDI = \frac{c * DIR}{b. w.}$$

For sum BADGE the EDI is ranging from roughly 1,25 to 100 ng/kg b.w./day. This intake rate is more than a factor of 1000 below the Derived No Effect Level (DNEL) for the oral uptake of BADGE of 0.5 mg/kg bw/day, registered by ECHA (REACH registered substance factsheets, 2019). However, these numbers are only reflecting the oral uptake of dust and not taking into account other routes like dietary uptake or dermal uptake. One of the major application of BADGE is the coating of food cans. Migration or leakage from canned food packages to food is possible and it is assumed that the dietary uptake is a very important pathway. However, no recent dietary uptake study, which could be used for comparison, were found.

### 3.4.2 Sewage water

In sewage water BADGE-2H<sub>2</sub>O was found with an average concentration of 1 090 ng/L (367 – 2 230 ng/L) in all measured samples. None of the other BADGE or BFDGE derivatives were found in this sample type. This is reflecting the same pattern as in settled floor dust samples of this study. A complete table with all monitoring results are given in the Appendix to this report. It was not possible to identify a correlation of the measured waste water concentration pattern with the two source categories: Household and industrial waste water, since the internal variation for each source category is higher than the difference between this two categories.

ECHA has registered a PNEC for BADGE for the hazard to aquatic organisms through waste water emissions of 10 mg/L (REACH registered substance factsheets, 2019). This is about four orders of magnitude higher than the concentrations measured in sewage water in this study.

### 3.4.3 Other sample types

Neither BADGE, BFDGE or their derivatives were found in the other selected sample matrices like fresh water, sediments, or biota.

## 3.5 UV Filters

A first screening of UV filter compounds was performed in the 2017 screening projects part 1 (Schlabach et al., 2017) and part 2 (Konieczny et al., 2017). However, in both projects there were only

very few UV filter compounds selected, and so this present investigation is the first comprehensive study of UV filters in indoor environment in Norway.

### 3.5.1 Indoor air

With exception of Tinuvin622 all selected UV filters were found in indoor air samples (Table 18 and Table 19). The highest concentrations were found for Homosalate, 100 times higher than ODPABA, UV-320-328 and ensulizole. A complete table with all monitoring results are given in the Appendix to this report.

Table 18: Concentration of UV Filters in indoor air samples (ng/m<sup>3</sup>).

Sample type	Enza-Camene	3-BC	2-EHMC(E)	2-EHMC	Homo-salate	ODPABA	OC
	(Min - max) Average* Detection frequency						
	ng/m <sup>3</sup>						
Indoor Air	(<0.25 - 7.9) <b>1.5</b> 92 %	(<0.2 - 0.65) <b>0.27</b> 13 %	(0.22 - 6.7) <b>1.6</b> 100 %	(0.11 - 8.5) <b>2.4</b> 100 %	(0.78 - 72) <b>15</b> 96 %	(0.001-0.05) <b>0.013</b> 100 %	(0.76 - 7.4) <b>3.3</b> 100 %

Table 19: Concentration of UV Filters in indoor air samples (ng/m<sup>3</sup>).

Sample type	UV-320	UV-326	UV-327	UV-328	UV-329	Ensulizole	BP3	BP8
	(Min - max) Average* Detection frequency							
	ng/m <sup>3</sup>							
Indoor air	(0.001-0.3) <b>0.031</b> 100 %	(0.03-0.21) <b>0.081</b> 100 %	(0.001-0.04) <b>0.018</b> 100 %	(0.02-5.3) <b>0.50</b> 100 %	(0.06-2.2) <b>0.55</b> 100 %	(<0.03-0.04) <b>0.02</b> 4 %	(0.69-10) <b>3.1</b> 100 %	(<0.04-0.59) <b>0.06</b> 8 %

Most of the cited indoor environment studies of UV filters are done on dust samples. There is one recent study from Albany, NY (Wan, Xue, & Kannan, 2015), which reported comparable air concentrations of BP-3 (0.19 to 72.0 ng/m<sup>3</sup>). This group estimated a contribution of indoor air to total BP-3 intake to be around 5% of the total BP-3 intake in humans with dermal uptake is the major pathway for exposure.

The UV-filter measured with the highest average indoor air concentration is OC with 3.3 ng/m<sup>3</sup>. ECHA has registered a derived no effect level (DNEL) for the hazard via inhalation route for the general population of 1.3 mg/m<sup>3</sup> (REACH registered substance factsheets, 2019), which is more than 5 orders of magnitude higher than measured in this study.

### 3.5.2 Settled floor dust

With only the exception of 3-BC and Tinuvin622, all selected UV filters were found in the settled floor dust samples of this study (Table 20 to Table 22). In contrast to indoor air, UV-328, 2-EHMC€, 2-EHMC and UV-329 were found at highest concentrations in indoor dust. A complete table with all monitoring results are given in the Appendix to this report.

Table 20: Concentration of UV Filters in samples of settled floor dust (ng/g).

Sample type	Enzacamene	2-EHMC(E)	2-EHMC	Homosalate	ODPABA
	(Min - max) Average* Detection frequency				
	ng/g				
Settled floor dust	(3.8 - 120) 31 100 %	(6.1 - 2 700) 1 060 100 %	(7.0 - 3 300) 1 370 100 %	(5.2 - 1 050) 192 100 %	(2.7 - 84) 23 100 %

Table 21: Concentration of UV Filters in samples of settled floor dust (ng/g).

Sample type	OC	UV-320	UV-326	UV-327	UV-328	UV-329
	(Min - max) Average* Detection frequency					
	ng/g					
Settled floor dust	(11 - >6 600) 2 490 100 %	(<1 - 475) 58 96 %	(24 - 1 600) 420 100 %	(<1 - 800) 143 96 %	(1 - 18 000) 2 371 100 %	(7.8 - 8 250) 910 100 %

Table 22: Concentration of UV Filters in samples of settled floor dust (ng/g).

Sample type	Ensulizole	BP1	BP3	BP8
	(Min - max) Average* Detection frequency			
	ng/g			
Settled floor dust	(<10 - 262) 35 32 %	(<20 - 660) 80 44 %	(6.0 -800) 350 100 %	(<50 - 94) 49 12 %

Enzacamene, homosalate, and BP3 were targeted in settled floor dust samples from Shanghai, China with average concentrations of 254, 368, and 428 ng/g, respectively (Ao et al., 2017). The benzophenone-type UV filters BP1, BP3, and BP8 were detected in comparable amounts in dust samples from the U.S. (Median Sum BP: 612 ng/g), whereas Asian settled floor dust samples (China, Japan, and Korea) showed slightly lower levels (Median Sum BP: 79 – 176 ng/g) (Lei Wang, Asimakopoulos, Moon, Nakata, & Kannan, 2013).

According to the EPA approach for estimating dust ingestion (US-EPA, 2011, 2017), we can estimate a dust ingestion rate (DIR) of 0,02 to 0,1 g/day. With an average body weight for infants of 5 kg and adults of 80 kg the estimated daily intake (EDI) can be calculated as following:

$$EDI = \frac{c * DIR}{b.w.}$$

For OC the UV-filter measured with the highest concentration in this study the EDI is ranging from roughly 0,6 to 50 ng/kg b.w./day and even lower for the other UV-filters with lower dust concentrations. This intake rate is more than a factor of 1000 below the Derived No Effect Level (DNEL) for the oral uptake of BADGE of 0.8 mg/kg bw/day, registered by ECHA (REACH registered substance factsheets, 2019). The same is true for the other UV-filters, which have a DNEL in the same range as OC as shown in Table 1Table 23.



Table 23: Derived no effect level (DNEL) for the hazard of some UV filters via oral route registered by ECHA (REACH registered substance factsheets, 2019).

	2-EHMC(E)	Homosalate	OC	UV-328	UV-329	BP3
	mg/kg b.w./day					
<b>DNEL</b>	<b>2.25</b>	<b>0.86</b>	<b>0.8</b>	<b>0.14</b>	<b>0.05</b>	<b>2.0</b>

However, these numbers are only reflecting the oral uptake of dust and not taking into account other routes like dietary uptake or dermal uptake. One of the major application of UV-filters are the use in sunscreens, which points to the dermal uptake as major human exposure pathway.

### 3.5.3 Sewage water

With exception of BC-3 all selected UV filters were detected in sewage water samples (Table 24 and Table 25). A complete table with all monitoring results are given in the Appendix to this report.

Table 24: Concentration of UV Filters in samples of sewage water (ng/L).

Sample Type	Enza-Camene	2-EHMC(E)	2-EHMC	Homo-salate	ODPABA	OC
	(Min - max) Average* Detection frequency ng/L					
<b>Sewage Water</b>	(19 - 74) <b>45</b> 100 %	(88 - 550) <b>298</b> 100 %	(278 - 1750) <b>1 150</b> 100 %	(28 - 440) <b>226</b> 100 %	(2.2 - 17) <b>8.9</b> 100 %	(312 - 13 000) <b>7 360</b> 100 %

Table 25: Concentration of UV Filters in samples of sewage water (ng/L).

Sample type	UV-320	UV-326	UV-327	UV-328	UV-329	Ensulizole	BP3
	(Min - max) Average* Detection frequency ng/L						
<b>Sewage Water</b>	(0.45 - 2.6) <b>1.5</b> 100 %	(31 - 115) <b>65</b> 100 %	(3.4 - 8.1) <b>6.4</b> 100 %	(22 - 68) <b>48</b> 100 %	(14 - 34) <b>26</b> 100 %	(55 - 1 310) <b>515</b> 100 %	(180 - 1 400) <b>783</b> 100 %

In earlier Norwegian studies mostly effluent from WWTPs and not influent samples were studied and therefore the concentrations reported at that time are lower and not directly comparable (K. H. Langford et al., 2015; Thomas et al., 2014). However, effluent samples taken in Tromsø as a part of the screening program 2017 could, in fact, be regarded as untreated waste water and are close to what are measured in this study (Schlabach et al., 2018). In the screening 2016 program OC was measured in both influent and effluent samples and the influents samples showed the same concentrations in 2016 and 2018 (Schlabach et al., 2017).

ECHA has registered PNECs for the UV-filters for the hazard to aquatic organisms through waste water emissions of between 1 to 100 mg/L (REACH registered substance factsheets, 2019). These values are more than three orders of magnitude higher than the concentrations measured in sewage water in this study.

### 3.5.4 Surface water

With exception of Enzamene, BC-3, and Tinuvin622 all other selected UV filters were detected in surface water samples (Table 26 and Table 27). A complete table with all monitoring results are given in the Appendix to this report.

Table 26: Concentration of UV Filters in samples of surface water (ng/L).

Sample Type	2-EHMC(E)	2-EHMC	Homo-salate	ODPABA	OC
	(Min - max) Average* Detection frequency ng/L				
Surface Water	(<0.4 - 4.6) <b>1.2</b> 89 %	(<3 - 16) <b>3.6</b> 89 %	(<1 - 50) <b>7.5</b> 56 %	(<1 - 5.1) <b>1.0</b> 11 %	(<30 - 800) <b>126</b> 56 %

Table 27: Concentration of UV Filters in samples of surface water (ng/L).

Sample type	UV-320	UV-326	UV-327	UV-328	UV-329	Ensulizole	BP3
	(Min - max) Average* Detection frequency ng/L						
Surface Water	(<0.2 - 0.94) <b>0.21</b> 22 %	(<0.5 - 10.0) <b>2.2</b> 78 %	(<0.2 - 5.5) <b>1.3</b> 89 %	(0.71 - 17) <b>4.4</b> 100 %	(<1 - 5.2) <b>1.8</b> 67 %	(9.8 - 310) <b>68</b> 100 %	(<10 - 13) <b>6.7</b> 22 %

In the screening 2016 program OC was measured in surface water samples from lake Mjøsa, which showed the slightly lower concentrations than in the 2018 samples from river Alna (Schlabach et al., 2017). The concentrations measured in surface water from the river Alna are in the same order of magnitude as screening measurements from urban areas in Sweden (Remberger, Lilja, Kaj, Viktor, & Brorström-Lundén, 2011). In addition, the NORMAN database EMPODAT has registered the surface water concentrations of several UV filters from different European countries (NORMAN, 2019). It seems that most of the results are in the same order of magnitude, however, since data are not aggregated as average or median, this analysis was not possible to perform for this report, but should be performed as a separate task.

ECHA has registered a PNEC for the cosmetic UV-filter octocrylene (OC) for the hazard to aquatic organisms living in fresh water of 0.266 µg/L (REACH registered substance factsheets, 2019). This value is only a factor of two above the average measured in river Alna in this study. The PNEC is exceeded by a factor of three in one sample taken at Brubak during a storm water event showing a potential environmental risk for this compound, which should be examined in dedicated studies. For BP3 a UV-filter used both in cosmetics and technical application a fresh water PNEC of 0.67 µg/L is registered by ECHA. This is only a factor of 100 above the average concentrations measured in river Alna in this study. Also Ensulizole is found in elevated concentrations in river Alna. The highest concentration with 310 ng/L was found downstream the bathing lake Vesletjern. ECHA has registered “no hazard identified” both under the categories ecotoxicological and toxicological information (REACH registered substance factsheets, 2019).

### 3.5.5 Sediments

Compared to indoor and water samples there are fewer UV filters detected in sediments (6 of 14 selected compounds). The summarized concentrations of the detected compounds are given in Table 28. A complete table with all monitoring results are given in the Appendix to this report.

Table 28: Concentration of UV Filters in samples of sediment (ng/g).

Sample type	Homo-salate	OC	UV-320	UV-326	UV-327	UV-328
	(Min - max) Average* Detection frequency					ng/g
Sediment	(<0.4 - 4.6) <b>1.6</b> 40 %	(51 - 260) <b>141</b> 100 %	(<1 - 4.3) <b>1.5</b> 20 %	(<1 -5.5) <b>2.0</b> 40 %	(<0.8 - 7.1) <b>2.0</b> 20 %	(<2.5 - 21) <b>6.2</b> 60 %

UV filters were earlier detected with similar concentrations in sediments from Oslofjord (Katherine H. Langford, Reid, & Thomas, 2011).

### 3.5.6 Biota

In biota samples 5 of the 14 selected UV filters were detected in gull egg samples (OC, UV-320, UV-326, UV-327 and UV-328). UV-328 was detected in all gull egg samples and also in one of five common mussel samples. A complete table with all monitoring results are given in the Appendix to this report.

Table 29: Concentration of UV Filters in biota samples.

Sample type	OC	UV-320	UV-326	UV-327	UV-328
	(Min - max) Average* Detection frequency				ng/g
Common mussels	(<2) 0 %	(<0.5) 0 %	(<0.4) 0 %	(<0.5) 0 %	(<0.6 - 0.66) <b>0.34</b> 20 %
Gull egg	(<4 - 7.4) <b>2.8</b> 20 %	(<0.3 - 0.32) <b>0.17</b> 10 %	(<0.3 - 0.35) <b>0.17</b> 10 %	(<0.3 - 0.57) <b>0.35</b> 70 %	(0.40 - 60) <b>10</b> 100 %

In the Norwegian screening study of 2017 a selection of UV filters were detected in Arctic bird eggs. However, the UV-328 concentration in gull egg from Oslo (this study) is much higher than what was found in the Arctic study and even higher than in common gull eggs from Tromsø (Schlabach et al., 2018).

### 3.6 Other additives

#### 3.6.1 Indoor air

In indoor air it was possible to detect two of total five of the selected additives (Table 30). A complete table with all monitoring results are given in the Appendix to this report.

Table 30: Concentration of other selected additives in indoor air samples (ng/m<sup>3</sup>).

Sample type	Di-n-octyltin oxide	Acetyl cedrene
	(Min - max) Average* Detection frequency	ng/m <sup>3</sup>
Indoor air	(0.005 - 0.034) <b>0.011</b> 100 %	(0.93 - 49) <b>17</b> 88 %

Di-n-octyltin oxide has been part of earlier screening studies, however not in air. It was not possible to find other studies reporting indoor air concentrations of this compound. Acetyl cedrene has never been measured in indoor air in Norway and it was not possible to find measurements from other countries.

ECHA has registered a DNEL for hazard via inhalation route (general population) of 289 µg/m<sup>3</sup> (REACH registered substance factsheets, 2019). This is more than four orders of magnitude above the measured average of 17 ng/m<sup>3</sup> in this study.

#### 3.6.2 Settled floor dust

In settled floor dust it was possible to detect two of total five of the selected additives (Table 31). A complete table with all monitoring results are given in the Appendix to this report.

Table 31: Concentration of other selected additives in samples of settled floor dust (ng/g).

Sample type	Di-n-octyltin oxide	Acetyl cedrene
	(Min - max) Average* Detection frequency	ng/g
Settled floor dust	(38 - 23 800) <b>2 070</b> 100 %	(93 - 3 140) <b>305</b> 64 %

Di-n-octyltin oxide was also measured in settled floor dust at concentrations of 7 to 165 ng/g in the 2016 screening program, which is significantly lower than what was found in this study (38-23 800 ng/g dust). Also when comparing only residential buildings from this dust (38-4000 ng/g dust) there is a difference between 2016 and 2018. Since the selection of buildings differ between the two studies, it is not possible to state whether this observation is due to a general increase of di-n-octyltin oxide in the indoor environment or due to large variabilities in indoor concentrations. However, the fact that this compound has the potential to disrupt the endocrine systems (AT-EE, 2015), and that it shows high indoor concentrations, are strong reasons for a more thorough observation and evaluation of this compound.

Acetyl cedrene has never been measured in settled floor dust in indoor environments in Norway and it was not possible to find measurements from other countries.

According to the EPA approach for estimating dust ingestion (US-EPA, 2011, 2017), we can estimate a dust ingestion rate (DIR) of 0,02 to 0,1 g/day. For acetyl cedrene the EDI is ranging from roughly 0.075 to 6 ng/kg b.w./day. This intake rate is more than a factor of 1000 below the Derived No Effect Level (DNEL) for the oral uptake of 0.166 mg/kg bw/day, registered by ECHA (REACH registered substance factsheets, 2019). For Di-n-octyltin oxide ECHA has registered “no hazard identified” for this exposure route.

### 3.6.3 Sewage water

Four of the five selected additives were found in sewage water (Table 32). A complete table with all monitoring results are given in the Appendix to this report.

Table 32: Concentration of other selected additives in samples of sewage water (ng/L).

Sample type	BTA	TTA	Di-n-octyltin oxide	Acetyl cedrene
	ng/L			
	(Min - max) Average* Detection frequency			
Sewage water	(49 - 292) <b>177</b> 100 %	(<40 - 198) <b>79</b> 43 %	(5.4 - 16) <b>10</b> 100 %	(<20 - 61) <b>26</b> 43 %

In the 2016 screening program both BTA and TTA were found in similar concentrations in WWTP effluent (Koniczny et al., 2017). Earlier this year a review article summarized the findings on both BTA and TTA (Shi, Liu, Xiong, Cai, & Ying, 2019). For WWTP influent concentrations ranged from 30 to 75 000 ng/L for BTA and 25 to 16 000 ng/L, with highest values reported from Western countries. Di-n-octyltin oxide could not be detected above LoD in the screening program 2016, but was detected in all 2018 samples. As the LoD is lower in this study, this difference can be due to the lower LoD or due to increase in the general concentration levels.

Acetyl cedrene was measured for the first time in Norwegian sewage water samples. In a recent German study a mean concentration of 1 530 ng/L acetyl cedrene were found in WWTP influent (Klaschka et al., 2013).

For the selected additives Table 33 shows the PNECs for the hazard to aquatic organisms via waste water registered by ECHA (REACH registered substance factsheets, 2019). All PNECs are at least more than two orders of magnitude above the measured average in waste water from the Alna area.

Table 33: PNECs of other selected additives for the hazard to aquatic organisms via waste water.

	BTA	TTA	Di-n-octyltin oxide	Acetyl cedrene
	mg/L			
PNEC	0.1	39.4	No hazard identified	10

### 3.6.4 Surface water

Three of the five selected additives were found in surface water (Table 34). A complete table with all monitoring results are given in the Appendix to this report.

Table 34: Concentration of other selected additives in samples of surface water.

Sample type	BTA (Min - max) Average* Detection frequency	TTA	Di-n-octyltin ng/L
Surface water	(12 - 105) <b>32</b> 78 %	(<40 - 218) <b>126</b> 78 %	(<0.5 - 6.0) <b>1.6</b> 67 %

In the review of Shi et al. the following surface water concentrations for BTA and TTA were summarized, BTA: ND – 8 500 ng/L and TTA: ND – 7 200 ng/L (Shi et al., 2019). Highest values were reported from Spain and Switzerland. In our study BTA show a generally higher concentration than TTA in sewage water, however, TTA is dominating in surface water, and has a higher concentration in surface water than sewage water. The Hazardous Substances Data Bank summarized recently the environmental fate of benzotriazole and tolyltriazole (Benzotriazole, 2018; Tolyltriazole, 2018). Both benzotriazole and tolyltriazole are used as a corrosion inhibitor in lubricants and greases, in deicing fluids for aircrafts, automotive antifreeze formulations, brake fluids, metal-cutting fluids, in washing and cleaning products and industrial cooling systems. From these applications it can be released to the environment through several waste streams. The most obvious difference in the use of these two compounds might be that benzotriazole can be an ingredient in dishwasher detergents. This use will have direct emission to the waste water system, whereas use in cars (antifreeze formulations and brake fluids) may give rise to elevated levels in surface water receiving run-off from roads.

Di-n-octyltin oxide could not be detected above LoD in the 2016 screening program, but was detected in all 2018 samples. As the LoD is lower in this study, this difference can be due to the lower LoD or due to increase in the general concentration levels.

For the selected additives Table 33 shows the PNECs for the hazard to aquatic organisms in fresh water registered by ECHA (REACH registered substance factsheets, 2019). For TTA the registered fresh water PNEC is about a factor of 60 above the measured average in fresh water from river Alna. For BTA the PNEC is more than two orders of magnitude above the measured average concentration in river Alna.

Table 35: PNECs of other selected additives for the hazard to aquatic organisms in fresh water.

	BTA	TTA mg/L	Di-n-octyltin oxide
PNEC	0.019	0.008	No hazard identified

### 3.6.5 Sediments

Two of the five selected additives were found in sewage water (Table 36). A complete table with all monitoring results are given in the Appendix to this report.

Table 36: Concentration of other selected additives in sediment samples.

Sample type	TTA (Min - max) Average* Detection frequency	Di-n-octyltin ng/g
Sediment	(31 - 378) 131 60 %	(<3 - 9.2) 3.6 20 %

In the review of Shi et al. the following sediment concentrations for BTA and TTA were summarized, BTA: ND – 336 ng/g and TTA: ND – 165 ng/g (Shi et al., 2019). Highest values were reported from China and US.

For TTA ECHA has registered a PNEC 3 µg/g in marine sediments (REACH registered substance factsheets, 2019), about a factor of 20 higher than the measured average concentration in this study. However, the high concentrations of TTA in sediment make it relevant to have closer look into these results.

### 3.6.6 Biota

None of the selected additives could be detected in biota chosen for this study.

### 3.6.7 NBBsulfone

NBBsulfone could not be detected in any sample type since unavoidably high background levels in sampling equipment, laboratory infrastructure and instrumentation results in poor detection limits.

## 3.7 Pharmaceuticals

Only one of the three selected pharmaceuticals could be detected in this screening study and only in sewage water and settled floor dust. A complete table with all monitoring results are given in the Appendix to this report. Climbazole was found in one settled floor dust sample with a concentration of 36 ng/g. There are no references on other findings of climbazole in settled floor dust. This compound was also found in five of seven wastewater samples with an average concentration of 22 ng/l (<7 – 46 ng/L). A German research group measured this compound at two WWTPs with an average concentration of 475 and 1 350 ng/L, respectively (Wick, Fink, & Ternes, 2010). The same group performed several tests on the ecological effects of climbazole and found high toxicity to the aquatic macrophyte *Lemna* and also to terrestrial plants. In plants symptoms similar to those caused by plant growth retardants were found (Richter, Wick, Ternes, & Coors, 2013).

## 3.8 Comparison of residential and non-residential indoor environment

In order to get indications on use pattern of the different compounds the indoor environmental samples were grouped and compared. It was possible to divide the dataset into two categories: Residential (mostly single flat houses and apartment buildings) and non-residential indoor environments (office buildings, school and veterinary, but no industry). Due to the limited number,

further partitioning did not result in more information as the variation of the measured concentrations is very high also internally in the different categories.

For rare earth elements (REE) samples from non-residential houses were higher compared to residential houses (see chapter 3.1.1). The normalized REE distribution from residential houses are similar to natural background, indicating that the source of REEs in household dust originated from outdoors, most likely from soil and clay particles. Non-residential houses show a positive Eu anomaly. The reason for this is not clear, but may be due to the application of Eu in low-energy light bulbs (Resende & Morais, 2015). In the particular case of Gd; Gd anomaly ( $Gd/Gd^*$ ) is close to 1 (average 1.2 in both residential and non-residential houses) indicating no particular anthropogenic influence.

Common for all measured volatile organic compounds is that higher concentrations are measured in residential indoor air compared to non-residential air Figure 9. As volatiles by their nature are normally mainly found in the gas phase, their concentrations are very dependent on ventilation. Thus it is difficult to decide if these differences can be attributed to higher emissions in residential indoor environment or to better ventilation in non-residential indoor environment. The results suggest that the stricter requirements to the ventilation rate for office buildings lead to lower concentrations in these indoor environments (Byggt teknisk forskrift (TEK17), 2019).

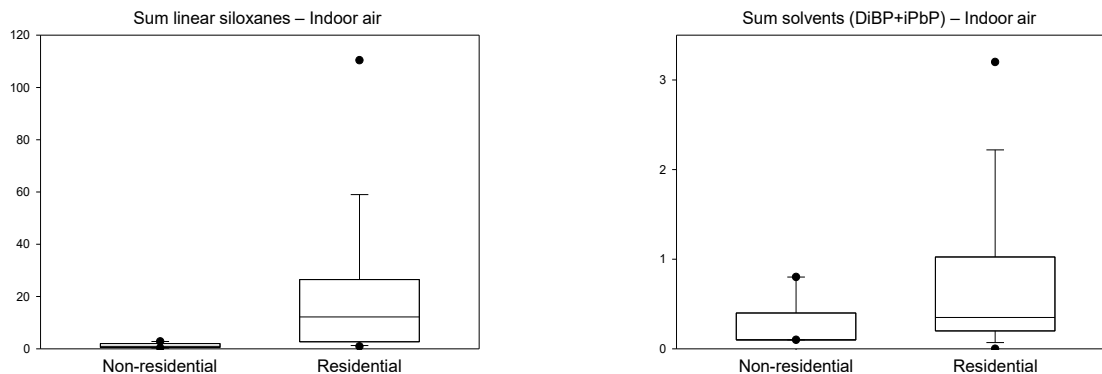


Figure 9: Comparison of air concentrations of linear siloxanes and DiBP+iPbP in residential and non-residential indoor environments.

Compounds, that are found both in the gaseous and particle phase (e.g. UV-substances), are evenly distributed in dust samples from residential and non-residential environments. But the concentrations of these compounds in air is often, like for the volatile compounds, significant higher in residential environments compared to non-residential environments (Figure 10). This is indicating that the normally better ventilation systems in office buildings generally reduce the concentration of gaseous pollutants.



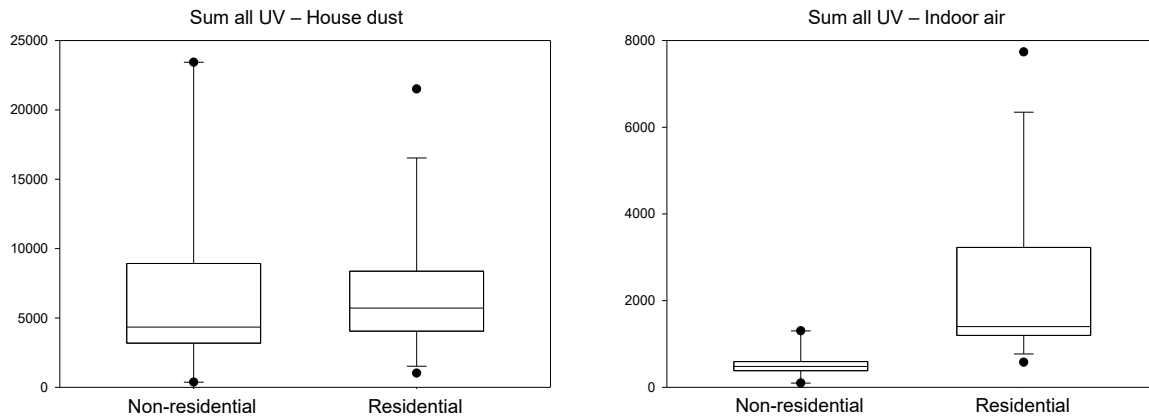


Figure 10: Comparison of dust and air concentrations of the sum of all measured UV filters in residential and non-residential indoor environments.

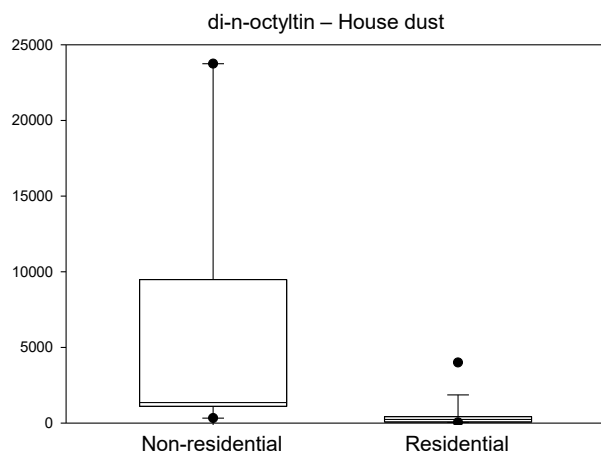
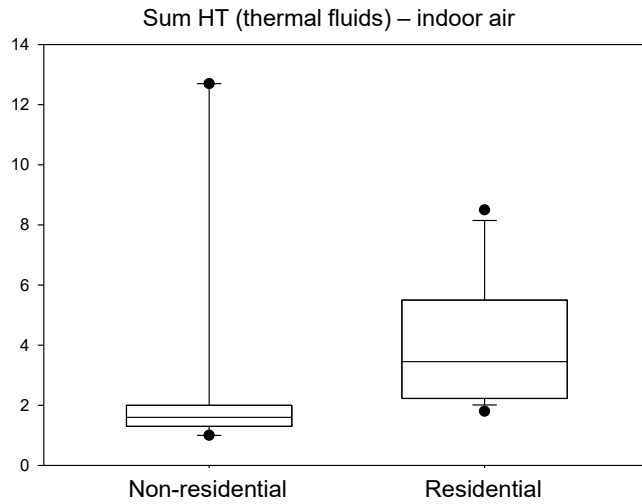


Figure 11: Comparison of dust concentrations of di-n-octyltin oxide in residential and non-residential indoor environments.

Di-n-octyltin shows an abnormal distribution with most of the values close to average and a few very extreme values (Figure 11). This might be due to breakdown particles of products, which contain significant amounts of di-n-octyltin oxide. Di-n-octyltin oxide shows in addition a generally higher concentration in non-residential buildings. However, the available information about these buildings do not allow to point out one or a few single sources.



*Figure 12: Comparison of air concentrations of the sum of all measured hydrated terphenyls (thermal fluids) in residential and non-residential indoor environments.*

As shown in Figure 12 also the hydrated terphenyls, which are used as thermal fluids, show in general a much lower concentration in non-residential buildings. However, there is one single case of extreme air concentration (house 22), which might be due to leakage from technical installations in this building.

## 4 Conclusions

For most of the selected compounds, this study was a follow-up of earlier findings. All earlier findings could be verified and supported in better detail.

Most of the compounds selected for this study, were found in at least one of the sample types selected. In most cases, the measured concentrations are much lower than the established no-effect concentration, and it might seem natural to conclude that the environmental risk posed by these compounds are low. However, several compounds were found in comparatively high concentrations in the selected sample types, and these high concentrations should be enough to look closer into the environmental and health risks of these compounds.

For the cosmetic UV-filter (octocrylene or OC), the PNEC for the hazard to fresh water organisms is exceeded by a factor of three in one sample taken at Brubak during a storm water event, showing a potential environmental risk for this compound, which should be examined in more detail in dedicated studies.

The volatile compounds vinyl-D4, F-D3, and F-D4 were rarely or never detected, since these compounds are susceptible for reaction with water and not very persistent under normal environmental conditions. It was not possible to search for the possible degradation/hydrolyzation products as these are much more polar and less volatile compared to the parent compounds and would require a completely different analytical method. Recent developments in the NORMAN-network are addressing these difficulties and there are good chances that the application of this new method, which is combining suspect screening and degradation modelling, would have detected those degradation products and we strongly advice to include such methods in future screening studies.

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**Appendix A**  
**Complete results table**  
**Rare earth elements**

Matrix/ Sampling site		La	Ce	Pr	Nd	Sm	Eu	Gd
<b>Sewage water</b>								
Alna 1, Hellerud, Pr.1	ng/L	19	16	3,0	14	2,7	4,2	124
Alna 1, Hellerud, Pr.2	ng/L	12	13	2,5	11	2,7	2,6	139
Alna 1, Hellerud, Pr.3	ng/L	28	29	5,6	20	2,5	2,4	4,5
Alna 2.Ind.omr. Pr 1	ng/L	8,5	7,3	1,9	7,7	1,5	1,8	3,1
Alna 2.Ind.omr. Pr 2	ng/L	16	15	2,6	11	2,8	4,8	127
Alna 2.Ind.omr. Pr 3	ng/L	30	38	6,8	25	5,2	5,1	10,0
Alna 2.Ind.omr. Pr 4	ng/L	21	28	5,3	18	4,4	4,6	232
<b>Surface water</b>								
Alna 3,Veslt.tj. Pr. 1	ng/L	99	51	22	77	14	5,7	14
Alna 4,Brubak, Pr. 1	ng/L	28	14	6,9	27	6,0	5,1	6,5
Alna 4,Brubak, Pr. 2	ng/L	13	10	3,5	13	2,8	3,8	4,6
Alna 4,Stikkpr, Pr. 4	ng/L	22	10	4,4	22	4,1	3,3	9,8
Alna 5,Kværner,Pr. 1	ng/L	7,7	6,1	1,5	8,5	1,2	5,4	<3
Alna 5,Kværner,Pr. 2	ng/L	22	14	3,5	12	2,0	6,2	3,5
Alna 5,Kværner,Pr. 3	ng/L	15	10,0	3,4	15	6,5	5,2	6,7
Alna 5,Kværner,Pr. 4	ng/L	9,1	9,3	2,3	8,7	2,0	4,6	7,3
Alna 5,Stikkpr.,Pr. 5	ng/L	16	10	2,9	14	2,5	4,3	3,3
<b>Sediment</b>								
Hovedøya	ng/g dw	39 180	88 659	10 226	38 170	6 822	1 381	8 659
Storøyodden 1/2	ng/g dw	38 719	82 199	10 446	39 219	6 941	1 449	8 813
Storøyodden 2/2	ng/g dw	58 868	118 503	15 018	54 667	9 927	1 928	9 299
Alna 4. Brubak	ng/g dw	61 215	124 482	15 446	57 012	10 446	2 045	6 313
Alna 5, Kværner	ng/g dw	58 219	115 036	14 473	52 996	9 557	1 915	6 240
<b>Blue mussel</b>								
Hovedøya 1	ng/g ww	133	141	22	83	14	2,8	13
Hovedøya 2	ng/g ww	127	135	22	87	16	2,8	16
Storøyodden 1	ng/g ww	182	183	30	118	20	4,2	20
Storøyodden 2	ng/g ww	209	248	38	151	26	4,7	26
Storøyodden 3	ng/g ww	195	218	32	131	22	4,4	23
<b>Gull egg</b>								
Søndre Skjælholmen	ng/g ww	-0,39	0,28	0,03	0,03	0,07	0,13	0,04
Søndre Skjælholmen	ng/g ww	0,89	1,1	0,17	0,41	0,11	0,05	0,10
Søndre Skjælholmen	ng/g ww	0,72	0,95	0,12	0,44	0,06	0,07	0,16
Søndre Skjælholmen	ng/g ww	0,41	0,36	0,07	0,15	0,09	0,10	0,07
Søndre Skjælholmen	ng/g ww	-0,45	0,33	0,05	0,04	0,02	0,10	0,06
Søndre Skjælholmen	ng/g ww	-0,39	0,29	0,03	0,13	0,01	0,12	0,05
Søndre Skjælholmen	ng/g ww	0,48	0,63	0,05	0,23	0,01	0,06	0,05
Søndre Skjælholmen	ng/g ww	-0,41	0,28	0,05	0,12	0,07	0,13	0,03
Søndre Skjælholmen	ng/g ww	0,00	0,47	0,05	0,19	0,08	0,16	0,09
Søndre Skjælholmen	ng/g ww	0,58	0,93	0,12	0,32	0,02	0,12	0,15

<b>Matrix/ Sampling site</b>		<b>La</b>	<b>Ce</b>	<b>Pr</b>	<b>Nd</b>	<b>Sm</b>	<b>Eu</b>	<b>Gd</b>
<b>House dust</b>								
House 1 a	ng/g	1 132	2 207	223	839	148	35	130
House 1 b	ng/g	1 999	4 096	443	1 650	294	58	229
House 2	ng/g	677	1 391	153	584	107	26	86
House 3	ng/g	478	928	101	383	69	18	61
House 4	ng/g	4 482	8 062	839	3 003	529	109	473
House 5	ng/g	1 360	4 415	296	1 134	199	54	194
House 6	ng/g	3 120	5 635	573	2 193	421	118	365
House 7	ng/g	3 604	7 696	784	2 961	509	115	318
House 8 a	ng/g	3 551	7 312	815	3 147	541	110	437
House 8 b	ng/g	1 844	3 489	420	1 625	279	72	475
House 9	ng/g	1 540	3 031	369	1 388	249	49	252
House 10	ng/g	2 720	5 198	592	2 172	354	80	203
House 11	ng/g	2 216	4 239	455	1 754	291	66	227
House 12	ng/g	2 368	4 754	558	2 158	403	60	321
House 13	ng/g	3 133	6 270	753	2 820	426	116	374
House 14	ng/g	906	1 830	117	441	78	20	3 249
House 15	ng/g	1 274	2 468	253	894	128	32	73
House 16	ng/g	41 156	76 721	8 954	35 196	4 434	945	111
House 17	ng/g	2 555	5 184	487	1 873	337	78	305
House 18	ng/g	5 590	10 386	363	1 398	250	196	269
House 19	ng/g	1 874	3 690	392	1 580	295	318	269
House 20	ng/g	6 460	13 107	1 434	5 234	949	203	832
House 21	ng/g	5 206	10 701	1 224	4 536	860	202	806
House 22	ng/g	4 462	8 987	995	3 642	664	154	612
House 23	ng/g	4 376	8 870	980	3 684	645	185	555
House 24	ng/g	4 267	8 686	970	3 444	573	139	460
House 14	ng/g	268	533	52	203	33	8,5	29
House 14	ng/g	423	910	97	367	62	16	56
House 14	ng/g	293	657	63	235	40	11	37

Matrix/ Sampling site		Tb	DY	Ho	Er	Tm	Yb	Lu
<b>Sewage water</b>								
Alna 1, Hellerud, Pr.1	ng/L	0,43	4,1	1,1	3,2	0,54	4,9	0,83
Alna 1, Hellerud, Pr.2	ng/L	0,46	3,2	0,84	3,3	0,51	6,0	1,1
Alna 1, Hellerud, Pr.3	ng/L	0,45	2,9	0,60	2,0	0,32	2,4	0,34
Alna 2.Ind.omr. Pr 1	ng/L	0,33	1,3	0,44	0,93	0,11	0,95	0,13
Alna 2.Ind.omr. Pr 2	ng/L	0,69	5,4	1,3	3,4	0,77	5,8	1,00
Alna 2.Ind.omr. Pr 3	ng/L	0,87	5,7	1,1	4,0	0,80	4,3	0,95
Alna 2.Ind.omr. Pr 4	ng/L	0,85	4,7	1,7	5,6	0,89	8,1	1,2
<b>Surface water</b>								
Alna 3,Veslt.tj. Pr. 1	ng/L	1,7	7,3	1,6	5,0	0,57	3,7	0,70
Alna 4,Brubak, Pr. 1	ng/L	0,92	5,3	1,2	4,0	0,61	4,4	0,82
Alna 4,Brubak, Pr. 2	ng/L	0,53	2,2	0,65	1,6	0,36	2,7	0,64
Alna 4,Stikkpr, Pr. 4	ng/L	0,65	3,0	0,79	2,5	0,52	3,7	0,93
Alna 5,Kværner,Pr. 1	ng/L	0,28	1,2	0,70	1,7	0,41	3,0	0,84
Alna 5,Kværner,Pr. 2	ng/L	0,29	1,8	0,52	1,2	0,48	2,8	0,77
Alna 5,Kværner,Pr. 3	ng/L	0,57	2,7	0,88	2,2	0,52	3,8	0,83
Alna 5,Kværner,Pr. 4	ng/L	0,39	2,0	0,83	2,3	0,35	2,7	0,84
Alna 5,Stikkpr.,Pr. 5	ng/L	0,48	2,7	0,69	1,8	0,50	2,0	0,89
<b>Sediment</b>								
Hovedøya	ng/g dw	1 258	6 119	1 218	3 266	465	2 891	436
Storøyodden 1/2	ng/g dw	1 167	5 830	1 163	3 134	451	2 758	415
Storøyodden 2/2	ng/g dw	885	4 524	928	2 500	362	2 236	327
Alna 4. Brubak	ng/g dw	837	4 130	807	2 120	298	1 795	256
Alna 5, Kværner	ng/g dw	1 190	5 917	1 164	3 161	453	2 764	420
<b>Blue mussel</b>								
Hovedøya 1	ng/g ww	1,8	9,8	1,9	5,4	0,74	4,3	0,67
Hovedøya 2	ng/g ww	1,7	9,4	1,8	5,6	0,71	4,9	0,74
Storøyodden 1	ng/g ww	2,5	13	2,6	7,1	0,95	6,0	0,78
Storøyodden 2	ng/g ww	3,3	17	3,6	9,8	1,2	8,7	1,3
Storøyodden 3	ng/g ww	2,5	15	2,7	8,8	1,0	6,8	1,0
<b>Gull egg</b>								
Søndre Skjælholmen	ng/g ww	0,00	0,03	0,00	0,01	0,01	0,04	0,00
Søndre Skjælholmen	ng/g ww	0,01	0,07	0,01	0,03	0,00	-0,01	0,00
Søndre Skjælholmen	ng/g ww	0,01	0,05	0,01	0,02	0,00	0,01	0,01
Søndre Skjælholmen	ng/g ww	0,01	0,02	0,00	0,01	0,00	0,04	0,00
Søndre Skjælholmen	ng/g ww	0,00	0,02	0,01	0,02	0,00	0,04	0,01
Søndre Skjælholmen	ng/g ww	0,01	0,04	0,00	0,02	0,00	0,03	0,00
Søndre Skjælholmen	ng/g ww	0,01	0,01	0,00	0,01	0,00	0,02	0,00
Søndre Skjælholmen	ng/g ww	0,00	0,01	0,01	0,03	0,00	-0,01	0,00
Søndre Skjælholmen	ng/g ww	0,01	0,03	0,01	0,01	0,00	-0,01	0,00
Søndre Skjælholmen	ng/g ww	0,01	0,04	0,02	0,01	0,00	0,05	0,01

<b>Matrix/ Sampling site</b>		<b>Tb</b>	<b>Dy</b>	<b>Ho</b>	<b>Er</b>	<b>Tm</b>	<b>Yb</b>	<b>Lu</b>
<b>House dust</b>								
House 1 a	ng/g	18	95	17	49	6,7	41	6,2
House 1 b	ng/g	33	172	30	84	11	67	9,3
House 2	ng/g	12	59	11	30	3,9	24	3,3
House 3	ng/g	10	60	12	36	5,1	34	4,9
House 4	ng/g	72	447	82	257	39	267	40
House 5	ng/g	28	128	24	69	9,2	57	7,9
House 6	ng/g	56	427	61	183	25	167	24
House 7	ng/g	60	318	57	159	21	137	18
House 8 a	ng/g	62	332	59	169	23	143	20
House 8 b	ng/g	33	173	32	92	13	85	11
House 9	ng/g	27	146	27	75	9,7	64	8,9
House 10	ng/g	42	225	41	120	16	109	16
House 11	ng/g	32	168	31	92	13	89	14
House 12	ng/g	44	215	35	96	13	81	12
House 13	ng/g	51	261	48	133	18	111	16
House 14	ng/g	10	55	11	31	4,3	28	3,8
House 15	ng/g	16	81	15	43	5,5	51	5,0
House 16	ng/g	347	1 610	154	358	31	181	23
House 17	ng/g	39	201	36	100	13	94	12
House 18	ng/g	32	157	29	80	10	68	10
House 19	ng/g	38	208	39	106	15	92	13
House 20	ng/g	119	605	110	307	40	265	36
House 21	ng/g	125	773	162	496	71	471	67
House 22	ng/g	80	427	79	223	29	190	26
House 23	ng/g	87	426	82	242	33	245	32
House 24	ng/g	59	276	46	120	14	87	12
House 14	ng/g	3,8	20	3,4	9,0	1,2	8,2	1,1
House 14	ng/g	7,6	39	7,3	20	2,8	17	2,5
House 14	ng/g	5,0	25	4,6	12	1,8	10	1,4



## **Complete results table Volatile compounds**

Matrix/ Sampling site		L3	L4	L5	Sum Lin Sil	oDiPB	mDiPB	pDiPB	Sum DiBP	iPbP
<b>Sewage water</b>										
Alna 1, Hellerud, Pr.1	ng/L	21	27	272	320	<2	2,8	1,0	3,8	<3,3
Alna 1, Hellerud, Pr.2	ng/L	8,0	15	161	184	<2	2,2	2,9	5,1	<3
Alna 1, Hellerud, Pr.3	ng/L	<89	58	632	690	<20	<5,8	<14,6		<11
Alna 2.Ind.omr. Pr 1	ng/L	28	19	148	196	<5	<4,3	<3,2		<6
Alna 2.Ind.omr. Pr 2	ng/L	26	28	290	344	<2	4,4	4,9	9,3	<15
Alna 2.Ind.omr. Pr 3	ng/L	<1,1	3,3	35	38	<10	7,8	<8,9	7,8	<17
Alna 2.Ind.omr. Pr 4	ng/L	3,1	7,8	138	149	<2	<3	<2,3		<4,1
<b>Surface water</b>										
Alna 3,Veslt.tj. Pr. 1	ng/L	<0,3	<1,3	<2		<2	<0,5	<0,4		<0,6
Alna 4,Brubak, Pr. 1	ng/L	<1,3	<6,4	17	17	<10	<9,1	<6,9		<26
Alna 4,Brubak, Pr. 2	ng/L	<0,1	<0,7	1,5	1,5	<2	<1	<0,8		<1,5
Alna 4,Stikkpr, Pr. 4	ng/L	<0,1	<0,5	<0,8		<2	<0,4	<0,7		<4,4
Alna 5,Kvæerner, Pr. 1	ng/L	<0,3	<1,5	7,6	7,6	<2	<1,1	<0,8		<3
Alna 5,Kvæerner, Pr. 2	ng/L	<0,1	<0,7	5,9	5,9	<2	<0,5	<0,4		<0,6
Alna 5,Kvæerner, Pr. 3	ng/L	<0,1	<0,3	13	13	<2	<0,7	<0,5		<1,2
Alna 5,Kvæerner, Pr. 4	ng/L	<0,2	<1	4,6	4,6	<2	<1,5	<1,1		<0,8
Alna 5,Stikkpr., Pr. 5	ng/L	<0,1	<0,8	<1,2		<2	<0,3	<0,2		<0,8
<b>Sediment</b>										
Hovedøya	ng/g dw	<0,1	1,0	3,1	4,1	<0,2	<0,13	<0,1		<0,73
Storøyodden 1/2	ng/g dw	<0,11	<0,33	1,4	1,4	<0,2	<0,07	<0,05		<0,37
Storøyodden 2/2	ng/g dw	<0,11	<0,34	0,71	0,71	<0,2	<0,28	<0,21		<0,23
Alna 4. Brubak	ng/g dw	0,06	0,15	0,82	1,0	<0,2	<0,05	<0,04		<0,1
Alna 5, Kvæerner	ng/g dw	<0,11	<0,69	1,3	1,3	<0,2	<0,14	<0,11		<0,78
<b>Blue mussel</b>										
Hovedøya 1	ng/g ww	<0,07	<0,43	1,9	1,9	<1	<0,09	<0,07		<0,29
Hovedøya 2	ng/g ww	<0,15	0,35	1,5	1,8	<1	<0,56	<0,42		<0,31
Storøyodden 1	ng/g ww	<0,14	<0,45	0,64	0,64	<1	<0,36	<0,27		<0,2
Storøyodden 2	ng/g ww	<0,15	<0,46	0,75	0,75	<1	<0,38	<0,28		<0,21
Storøyodden 3	ng/g ww	<0,15	<0,46	0,86	0,86	<1	<0,38	<0,28		<0,31
<b>Gull egg</b>										
Søndre Skjælholmen	ng/g ww	<0,31	<0,72	<1,81		<2	<0,76	<0,57		<0,76
Søndre Skjælholmen	ng/g ww	<0,29	<0,67	<1,67		<2	<0,7	<0,53		<0,7
Søndre Skjælholmen	ng/g ww	<0,24	<0,56	<0,7		<2	<0,59	<0,44		<0,59
Søndre Skjælholmen	ng/g ww	<0,28	<0,66	<0,82		<2	<0,69	<0,52		<0,69
Søndre Skjælholmen	ng/g ww	<0,29	<0,67	<0,84		<2	<0,71	<0,53		<0,71
Søndre Skjælholmen	ng/g ww	<0,3	<1,4	3,3	3,3	<2	<0,74	<0,55		<0,74
Søndre Skjælholmen	ng/g ww	<0,8	3,1	73	76	<2	<0,79	<0,59		<0,79
Søndre Skjælholmen	ng/g ww	<0,33	<0,78	<0,97		<2	<0,82	<0,62		<0,82
Søndre Skjælholmen	ng/g ww	<0,26	<0,62	1,4	1,4	<2	<0,65	<0,49		<0,65
Søndre Skjælholmen	ng/g ww	<0,31	<1,45	4,0	4,0	<2	<0,76	<0,57		<0,76



Matrix/ Sampling site		L3	L4	L5	Sum Lin Sil	oDiPB	mDiPB	pDiPB	Sum DiBP	iPBp
<b>House dust</b>										
House 1 a	ng/m3	19	26	64	109	<0,07	5,7	4,8	10	0,51
House 2	ng/m3	5,6	2,1	12	20	<0,07	2,7	2,4	5,1	0,63
House 3	ng/m3	49	16	379	444	<0,08	21	18	38	0,55
House 4	ng/m3	10	8,0	67	85	<0,06	2,7	1,3	4,0	0,66
House 5	ng/m3	11	25	239	274	<0,07	13	13	25	1,5
House 6	ng/m3	4,9	14	23	42	<0,06	2,3	1,8	4,1	0,76
House 7	ng/m3	5,0	1,1	12	18	<0,05	0,31	0,30	0,61	0,21
House 8 a	ng/m3	3,0	7,4	559	569	<0,06	3,0	3,1	6,1	0,71
House 9	ng/m3	96	152	145	393	<0,05	0,87	0,87	1,7	0,51
House 10	ng/m3	3,9	9,2	1 201	1 215	<0,09	1,7	1,5	3,2	0,85
House 11	ng/m3	3,4	7,1	332	342	<0,06	2,3	2,6	4,9	1,0
House 12	ng/m3	8,3	4,0	242	254	<0,07	0,99	0,79	1,8	0,76
House 13	ng/m3	30	7,5	5,9	44	<0,06	2,0	1,7	3,7	<0,25
House 14	ng/m3	39	8,1	55	101	<0,07	8,7	6,7	15	0,98
House 15	ng/m3	261	7,9	97	367	<0,08	10	8,4	19	1,1
House 16	ng/m3	8,7	5,3	13	27	<0,06	1,2	0,68	1,9	0,46
House 17	ng/m3	2,1	4,3	26	32	<0,07	3,0	3,6	6,5	0,28
House 18	ng/m3	3,4	1,6	5,3	10	<0,07	3,6	2,3	5,9	0,20
House 19	ng/m3	2,3	1,8	5,0	9,0	<0,07	0,58	0,51	1,1	0,13
House 20	ng/m3	5,5	2,7	10	19	<0,07	0,85	0,70	1,5	0,17
House 21	ng/m3	2,5	1,00	1,4	4,8	<0,06	0,78	0,96	1,7	0,09
House 22	ng/m3	4,0	0,00	22	26	<0,07	5,5	5,2	11	0,68
House 23	ng/m3	3,5	2,1	4,2	9,8	<0,05	0,60	0,48	1,1	0,23
House 24	ng/m3	10	14	23	47	<0,06	0,65	0,50	1,2	0,19

Matrix/ Sampling site		H18pT	sH12mT	uH12mT	uH12pT	sH12pT	uH6mT	csH6mT	tsH6pT	Sum HT
<b>Sewage water</b>										
Alna 1, Hellerud,Pr.1	ng/L	<300	<33	<35	<30	<30	<20	<b>12</b>	<9,1	<b>16</b>
Alna 1, Hellerud,Pr.2	ng/L	<28	<5,2	<5,5	<4,5	<b>20</b>	<b>6,3</b>	<b>9,4</b>	<b>2,4</b>	<b>40</b>
Alna 1, Hellerud,Pr.3	ng/L	<580	<131	<140	<113	<b>490</b>	<21	<b>15</b>	<10	<b>510</b>
Alna 2.Ind.omr. Pr 1	ng/L	<b>148</b>	<6,2	<3,8	<3,1	<b>20</b>	<4,2	<b>10</b>	<b>6,8</b>	<b>182</b>
Alna 2.Ind.omr. Pr 2	ng/L	<120	<140	<14	<12	<b>33</b>	<7,8	<b>14</b>	<b>4,8</b>	<b>55</b>
Alna 2.Ind.omr. Pr 3	ng/L	<30	<33	<34	<28	<29	<40	<20	<18	<b>3,0</b>
Alna 2.Ind.omr. Pr 4	ng/L	<60	<8,5	<8,8	<7,4	<b>12</b>	<9,8	<b>6,6</b>	<4,7	<b>26</b>
<b>Surface water</b>										
Alna 3,Veslt.tj. Pr. 1	ng/L	<17	<3,3	<2,9	<2,7	<2,7	<2,7	<2,1	<1,9	<25
Alna 4,Brubak, Pr. 1	ng/L	<30	<5,8	<5,1	<4,7	<4,8	<4,8	<3,7	<3,4	<7
Alna 4,Brubak, Pr. 2	ng/L	<7,5	<1,4	<1,3	<1,2	<1,2	<1,2	<0,9	<0,8	<10
Alna 4,Stikkpr, Pr. 4	ng/L	<3,3	<3,1	<2,8	<2,5	<2,6	<2,6	<2	<1,8	<7
Alna 5,Kvæerner,Pr. 1	ng/L	<5	<1	<0,9	<0,8	<0,8	<0,8	<0,6	<0,6	<7
Alna 5,Kvæerner,Pr. 2	ng/L	<8,7	<1,7	<1,5	<1,3	<1,4	<1,4	<1,1	<1	<10
Alna 5,Kvæerner,Pr. 3	ng/L	<18,8	<1,8	<1,6	<1,5	<1,5	<1,5	<1,1	<1,1	<20
Alna 5,Kvæerner,Pr. 4	ng/L	<8,8	<1,7	<1,5	<1,4	<1,4	<1,4	<1,1	<1	<10
Alna 5,Stikkpr., Pr. 5	ng/L	<7,9	<1,5	<1,3	<1,2	<1,3	<1,3	<1	<0,9	<10
<b>Sediment</b>										
Hovedøya	ng/g dw	<b>112</b>	<1,22	<1,32	<1,11	<b>8,7</b>	<b>3,1</b>	<b>1,7</b>	<1,32	<b>130</b>
Storøyodden 1/2	ng/g dw	<0,41	<0,16	<0,18	<0,15	<b>1,1</b>	<0,21	<b>0,11</b>	<0,09	<b>1,1</b>
Storøyodden 2/2	ng/g dw	<0,79	<0,15	<0,17	<0,14	<b>0,99</b>	<0,2	<0,15	<0,13	<b>0,99</b>
Alna 4. Brubak	ng/g dw	<0,86	<0,17	<0,18	<0,15	<b>1,8</b>	<1,12	<b>0,21</b>	<0,46	<b>1,8</b>
Alna 5, Kvæerner	ng/g dw	<b>2,5</b>	<b>92</b>	<b>31</b>	<b>3,6</b>	<b>85</b>	<b>26</b>	<b>105</b>	<b>65</b>	<b>430</b>
<b>Blue mussel</b>										
Hovedøya 1	ng/g ww	<3,83	<1,88	<2,04	<1,71	<1,56	<2,48	<1,17	<1,02	<5
Hovedøya 2	ng/g ww	<5,43	<2,66	<2,89	<2,43	<2,22	<3,52	<1,66	<1,44	<5
Storøyodden 1	ng/g ww	<6,33	<0,41	<0,45	<0,38	<0,34	<1,37	<0,65	<0,56	<10
Storøyodden 2	ng/g ww	<7,69	<0,75	<0,82	<0,69	<0,63	<1	<0,47	<0,41	<10
Storøyodden 3	ng/g ww	<4,72	<0,46	<0,5	<0,42	<0,38	<1,02	<0,48	<0,42	<5
<b>Gull egg</b>										
Søndre Skjælholmen	ng/g ww	<6,06	<0,66	<0,67	<0,56	<0,59	<0,79	<0,44	<0,38	<15
Søndre Skjælholmen	ng/g ww	<5,6	<0,61	<0,62	<0,51	<0,54	<0,73	<0,4	<0,35	<15
Søndre Skjælholmen	ng/g ww	<4,69	<0,51	<0,52	<0,43	<0,46	<0,61	<0,34	<0,3	<15
Søndre Skjælholmen	ng/g ww	<5,5	<0,6	<0,61	<0,51	<0,53	<0,72	<0,4	<0,35	<15
Søndre Skjælholmen	ng/g ww	<5,62	<0,61	<0,62	<0,52	<0,55	<0,74	<0,41	<0,35	<15
Søndre Skjælholmen	ng/g ww	<5,86	<0,64	<0,65	<0,54	<0,57	<0,77	<0,42	<0,37	<15
Søndre Skjælholmen	ng/g ww	<6,27	<0,69	<0,69	<0,58	<0,61	<0,82	<0,45	<0,4	<15
Søndre Skjælholmen	ng/g ww	<6,54	<0,71	<0,72	<0,6	<0,63	<0,86	<0,47	<0,41	<15
Søndre Skjælholmen	ng/g ww	<5,17	<0,56	<0,57	<0,47	<0,5	<0,68	<0,37	<0,33	<15
Søndre Skjælholmen	ng/g ww	<6,08	<0,66	<0,67	<0,56	<0,59	<0,79	<0,44	<0,38	<15

Matrix/ Sampling site		H18pT	sH12mT	uH12mT	uH12pT	sH12pT	uH6mT	csH6mT	tsH6pT	Sum HT
<b>House dust</b>										
House 1 a	ng/m3	<1,74	<b>1,1</b>	<0,39	<0,36	<b>5,3</b>	<0,27	<b>0,51</b>	<b>0,24</b>	<b>7,6</b>
House 2	ng/m3	<1,24	<b>1,2</b>	<b>0,46</b>	<0,17	<b>1,8</b>	<b>0,37</b>	<b>0,79</b>	<b>0,35</b>	<b>5,7</b>
House 3	ng/m3	<1,06	<b>0,35</b>	<0,24	<0,22	<b>1,4</b>	<0,17	<b>0,15</b>	<0,10	<b>2,1</b>
House 4	ng/m3	<0,71	<b>0,57</b>	<0,21	<0,19	<b>1,1</b>	<b>0,10</b>	<b>0,18</b>	<b>0,09</b>	<b>2,2</b>
House 5	ng/m3	<2,02	<b>1,7</b>	<b>0,76</b>	<0,28	<b>2,4</b>	<b>0,51</b>	<b>1,2</b>	<b>0,54</b>	<b>8,0</b>
House 6	ng/m3	<1,30	<b>0,91</b>	<b>0,36</b>	<0,18	<b>2,1</b>	<b>0,25</b>	<b>0,41</b>	<b>0,18</b>	<b>4,5</b>
House 7	ng/m3	<0,59	<b>1,4</b>	<b>0,42</b>	<b>0,09</b>	<b>0,98</b>	<b>0,22</b>	<b>0,87</b>	<b>0,37</b>	<b>4,9</b>
House 8 a	ng/m3	<2,70	<b>0,95</b>	<0,41	<0,37	<b>0,20</b>	<0,21	<b>0,34</b>	<b>2,4</b>	<b>4,2</b>
House 9	ng/m3	<0,68	<b>0,45</b>	<0,21	<0,19	<b>2,0</b>	<b>0,11</b>	<b>0,14</b>	<b>0,07</b>	<b>2,9</b>
House 10	ng/m3	<1,31	<b>0,54</b>	<0,28	<0,25	<b>1,3</b>	<0,20	<b>0,26</b>	<0,12	<b>2,3</b>
House 11	ng/m3	<1,64	<b>0,50</b>	<0,25	<0,23	<b>1,2</b>	<0,13	<b>0,20</b>	<b>0,08</b>	<b>2,2</b>
House 12	ng/m3	<3,30	<b>0,59</b>	<0,31	<0,28	<b>1,2</b>	<b>0,26</b>	<b>0,30</b>	<b>0,12</b>	<b>2,7</b>
House 13	ng/m3	<3,29	<b>0,68</b>	<0,50	<0,45	<b>1,2</b>	<b>0,16</b>	<b>0,34</b>	<b>0,18</b>	<b>2,8</b>
House 14	ng/m3	<4,54	<b>0,74</b>	<0,34	<0,31	<b>2,6</b>	<0,21	<b>0,36</b>	<0,13	<b>4,0</b>
House 15	ng/m3	<1,58	<b>1,9</b>	<b>0,61</b>	<0,17	<b>3,5</b>	<0,49	<b>1,0</b>	<b>0,54</b>	<b>8,5</b>
House 16	ng/m3	<0,98	<b>0,29</b>	<0,11	<0,10	<b>1,1</b>	<0,11	<b>0,13</b>	<0,07	<b>1,8</b>
House 17	ng/m3	<0,98	<b>0,34</b>	<0,19	<0,14	<b>0,86</b>	<0,12	<b>0,19</b>	<b>0,07</b>	<b>1,7</b>
House 18	ng/m3	<0,37	<b>0,25</b>	<0,11	<0,10	<b>0,84</b>	<0,09	<b>0,14</b>	<0,05	<b>1,3</b>
House 19	ng/m3	<0,20	<b>0,13</b>	<0,09	<0,08	<b>0,64</b>	<0,04	<b>0,07</b>	<0,03	<b>1,0</b>
House 20	ng/m3	<1,03	<b>0,19</b>	<0,12	<0,11	<b>0,98</b>	<b>0,08</b>	<b>0,10</b>	<0,05	<b>1,7</b>
House 21	ng/m3	<0,44	<b>0,28</b>	<b>0,11</b>	<0,03	<b>0,37</b>	<b>0,06</b>	<b>0,13</b>	<b>0,06</b>	<b>1,3</b>
House 22	ng/m3	<1,24	<b>0,56</b>	<b>0,44</b>	<0,17	<b>11</b>	<b>0,21</b>	<b>0,26</b>	<b>0,13</b>	<b>13</b>
House 23	ng/m3	<0,91	<b>0,32</b>	<b>0,11</b>	<0,04	<b>0,79</b>	<b>0,11</b>	<0,47	<b>0,09</b>	<b>1,5</b>
House 24	ng/m3	<0,50	<b>0,41</b>	<b>0,16</b>	<0,05	<b>0,86</b>	<b>0,01</b>	<b>0,24</b>	<b>0,10</b>	<b>2,1</b>

Matrix/ Sampling site		oT	mT	pT	Sum T	Vinyl-D4
<b>Sewage water</b>						
Alna 1, Hellerud, Pr.1	ng/L	<b>4,7</b>	<0,6	<0,7	<b>4,7</b>	<1,7
Alna 1, Hellerud, Pr.2	ng/L	<b>2,3</b>	<0,5	<0,6	<b>2,3</b>	<1,5
Alna 1, Hellerud, Pr.3	ng/L	<11,1	<b>4,8</b>	<4,2	<b>4,8</b>	<54
Alna 2.Ind.omr. Pr 1	ng/L	<b>5,1</b>	<b>2,4</b>	<0,7	<b>7,5</b>	<6
Alna 2.Ind.omr. Pr 2	ng/L	<b>3,8</b>	<0,2	<0,2	<b>3,8</b>	<1,5
Alna 2.Ind.omr. Pr 3	ng/L	<b>2,8</b>	<0,5	<0,7	<b>2,8</b>	<3,3
Alna 2.Ind.omr. Pr 4	ng/L	<b>4,0</b>	<b>2,7</b>	<0,9	<b>6,7</b>	<3,4
<b>Surface water</b>						
Alna 3, Veslt.tj. Pr. 1	ng/L	<1,5	<0,6	<0,9		<1,5
Alna 4, Brubak, Pr. 1	ng/L	<2,6	<b>1,0</b>	<b>0,80</b>	<b>1,8</b>	<12,8
Alna 4, Brubak, Pr. 2	ng/L	<0,6	<0,3	<0,4		<1,5
Alna 4, Stikkpr, Pr. 4	ng/L	<b>0,20</b>	<b>0,50</b>	<b>0,20</b>	<b>0,90</b>	<1
Alna 5, Kværner, Pr. 1	ng/L	<0,4	<0,2	<0,3		<3
Alna 5, Kværner, Pr. 2	ng/L	<0,7	<0,3	<0,5		<1,4
Alna 5, Kværner, Pr. 3	ng/L	<0,8	<0,3	<0,5		<0,6
Alna 5, Kværner, Pr. 4	ng/L	<0,8	<0,3	<0,5		<2,1
Alna 5, Stikkpr., Pr. 5	ng/L	<0,7	<0,3	<0,4		<0,8
<b>Sediment</b>						
Hovedøya	ng/g dw	<0,37	<b>1,4</b>	<b>1,3</b>	<b>2,7</b>	<1
Storøyodden 1/2	ng/g dw	<b>0,08</b>	<b>0,16</b>	<b>0,13</b>	<b>0,37</b>	<1
Storøyodden 2/2	ng/g dw	<b>0,03</b>	<b>0,15</b>	<b>0,12</b>	<b>0,30</b>	<1
Alna 4. Brubak	ng/g dw	<b>0,09</b>	<b>0,15</b>	<b>0,11</b>	<b>0,35</b>	<1
Alna 5, Kværner	ng/g dw	<b>19</b>	<b>3,9</b>	<b>1,1</b>	<b>24</b>	<1
<b>Blue mussel</b>						
Hovedøya 1	ng/g ww	<0,28	<b>0,47</b>	<b>0,35</b>	<b>0,82</b>	<1
Hovedøya 2	ng/g ww	<0,4	<b>0,66</b>	<b>0,60</b>	<b>1,3</b>	<1
Storøyodden 1	ng/g ww	<0,31	<0,17	<0,21		<1
Storøyodden 2	ng/g ww	<0,23	<0,25	<0,31		<1
Storøyodden 3	ng/g ww	<0,23	<0,15	<0,19		<1
<b>Gull egg</b>						
Søndre Skjælholmen	ng/g ww	<0,42	<0,14	<0,18		<2,71
Søndre Skjælholmen	ng/g ww	<0,39	<0,13	<0,16		<2,5
Søndre Skjælholmen	ng/g ww	<0,33	<0,11	<0,14		<2,09
Søndre Skjælholmen	ng/g ww	<0,38	<0,13	<0,16		<2,45
Søndre Skjælholmen	ng/g ww	<0,39	<0,13	<0,16		<2,51
Søndre Skjælholmen	ng/g ww	<0,41	<0,13	<0,17		<2,61
Søndre Skjælholmen	ng/g ww	<0,44	<0,14	<0,18		<2,8
Søndre Skjælholmen	ng/g ww	<0,46	<0,15	<0,19		<2,92
Søndre Skjælholmen	ng/g ww	<0,36	<0,12	<0,15		<2,31
Søndre Skjælholmen	ng/g ww	<0,42	<0,14	<0,18		<2,71

<b>Matrix/ Sampling site</b>		<b>oT</b>	<b>mT</b>	<b>pT</b>	<b>Sum T</b>	<b>Vinyl-D4</b>
<b>House dust</b>						
House 1 a	ng/m3	<b>0,42</b>	<b>0,01</b>	<b>0,00</b>	<b>0,43</b>	<0,12
House 2	ng/m3	<b>0,46</b>	<b>0,01</b>	<0,01	<b>0,47</b>	<0,16
House 3	ng/m3	<b>0,12</b>	<0,01	<0,01	<b>0,12</b>	<b>6,5</b>
House 4	ng/m3	<b>0,12</b>	<b>0,00</b>	<0,01	<b>0,12</b>	<0,18
House 5	ng/m3	<b>0,76</b>	<b>0,03</b>	<0,01	<b>0,79</b>	<0,69
House 6	ng/m3	<b>0,31</b>	<b>0,01</b>	<0,01	<b>0,32</b>	<0,50
House 7	ng/m3	<b>0,52</b>	<b>0,01</b>	<b>0,00</b>	<b>0,53</b>	<0,07
House 8 a	ng/m3	<b>0,31</b>	<0,02	<0,02	<b>0,31</b>	<0,20
House 9	ng/m3	<b>0,18</b>	<b>0,00</b>	<0,01	<b>0,18</b>	<0,15
House 10	ng/m3	<b>0,19</b>	<0,02	<0,02	<b>0,19</b>	<b>1,1</b>
House 11	ng/m3	<b>0,16</b>	<b>0,01</b>	<0,01	<b>0,17</b>	<0,16
House 12	ng/m3	<b>0,27</b>	<b>0,01</b>	<0,01	<b>0,28</b>	<0,25
House 13	ng/m3	<b>0,26</b>	<b>0,01</b>	<b>0,01</b>	<b>0,28</b>	<0,19
House 14	ng/m3	<b>0,17</b>	<0,01	<0,02	<b>0,17</b>	<0,13
House 15	ng/m3	<b>0,67</b>	<b>0,04</b>	<0,03	<b>0,71</b>	<0,12
House 16	ng/m3	<b>0,10</b>	<0,02	<0,01	<b>0,10</b>	<0,13
House 17	ng/m3	<b>0,27</b>	<0,01	<0,01	<b>0,27</b>	<0,08
House 18	ng/m3	<b>0,13</b>	<0,01	<0,01	<b>0,13</b>	<b>0,03</b>
House 19	ng/m3	<b>0,09</b>	<0,01	<0,01	<b>0,09</b>	<0,05
House 20	ng/m3	<b>0,14</b>	<0,01	<0,01	<b>0,14</b>	<0,07
House 21	ng/m3	<b>0,16</b>	<0,01	<0,01	<b>0,16</b>	<0,06
House 22	ng/m3	<b>0,25</b>	<0,01	<0,01	<b>0,25</b>	<0,19
House 23	ng/m3	<b>0,19</b>	<0,01	<0,01	<b>0,19</b>	<0,13
House 24	ng/m3	<b>0,25</b>	<b>0,07</b>	<0,01	<b>0,32</b>	<0,09

Matrix/ Sampling site		F-D3	F-D3b	F-D3c	F-D4a	F-D4b	F-D4c	F-D4d	F-D4
<b>Sewage water</b>									
Alna 1, Hellerud, Pr.1	ng/L	<1	<1	<1	<0,6	<0,6	<0,6	<0,6	<0,6
Alna 1, Hellerud, Pr.2	ng/L	<0,9	<0,9	<0,9	<0,5	<0,5	<0,5	<0,5	<0,5
Alna 1, Hellerud, Pr.3	ng/L	<31,7	<31,7	<31,7	<18	<18	<18	<18	<18
Alna 2. Ind.omr. Pr 1	ng/L	<3,5	<3,5	<3,5	<2	<2	<2	<2	<2
Alna 2. Ind.omr. Pr 2	ng/L	<0,9	<0,9	<0,9	<0,5	<0,5	<0,5	<0,5	<0,5
Alna 2. Ind.omr. Pr 3	ng/L	<1,9	<1,9	<1,9	<1,1	<1,1	<1,1	<1,1	<1,1
Alna 2. Ind.omr. Pr 4	ng/L	<2	<2	<2	<1,1	<1,1	<1,1	<1,1	<1,1
<b>Surface water</b>									
Alna 3, Veslt.tj. Pr. 1	ng/L	<0,9	<0,9	<0,9	<0,5	<0,5	<0,5	<0,5	<0,5
Alna 4, Brubak, Pr. 1	ng/L	<7,5	<7,5	<7,5	<4,2	<4,2	<4,2	<4,2	<4,2
Alna 4, Brubak, Pr. 2	ng/L	<0,9	<0,9	<0,9	<0,5	<0,5	<0,5	<0,5	<0,5
Alna 4, Stikkpr, Pr. 4	ng/L	<0,6	<0,6	<0,6	<0,3	<0,3	<0,3	<0,3	<0,3
Alna 5, Kværner, Pr. 1	ng/L	<1,8	<1,8	<1,8	<1	<1	<1	<1	<1
Alna 5, Kværner, Pr. 2	ng/L	<0,8	<0,8	<0,8	<0,5	<0,5	<0,5	<0,5	<0,5
Alna 5, Kværner, Pr. 3	ng/L	<0,4	<0,4	<0,4	<0,2	<0,2	<0,2	<0,2	<0,2
Alna 5, Kværner, Pr. 4	ng/L	<1,2	<1,2	<1,2	<0,7	<0,7	<0,7	<0,7	<0,7
Alna 5, Stikkpr., Pr. 5	ng/L	<0,4	<0,4	<0,4	<0,3	<0,3	<0,3	<0,3	<0,3
<b>Sediment</b>									
Hovedøya	ng/g dw	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
Storøyodden 1/2	ng/g dw	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
Storøyodden 2/2	ng/g dw	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
Alna 4. Brubak	ng/g dw	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
Alna 5, Kværner	ng/g dw	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
<b>Blue mussel</b>									
Hovedøya 1	ng/g ww	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
Hovedøya 2	ng/g ww	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
Storøyodden 1	ng/g ww	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
Storøyodden 2	ng/g ww	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
Storøyodden 3	ng/g ww	<1	<1	<1	<0,5	<0,5	<0,5	<0,5	<0,5
<b>Gull egg</b>									
Søndre Skjælholmen	ng/g ww	<2,35	<2,35	<2,35	<2,86	<2,86	<2,86	<2,86	<2,86
Søndre Skjælholmen	ng/g ww	<2,17	<2,17	<2,17	<2,64	<2,64	<2,64	<2,64	<2,64
Søndre Skjælholmen	ng/g ww	<1,82	<1,82	<1,82	<2,21	<2,21	<2,21	<2,21	<2,21
Søndre Skjælholmen	ng/g ww	<2,13	<2,13	<2,13	<2,59	<2,59	<2,59	<2,59	<2,59
Søndre Skjælholmen	ng/g ww	<2,18	<2,18	<2,18	<2,65	<2,65	<2,65	<2,65	<2,65
Søndre Skjælholmen	ng/g ww	<2,27	<2,27	<2,27	<2,76	<2,76	<2,76	<2,76	<2,76
Søndre Skjælholmen	ng/g ww	<2,44	<2,44	<2,44	<2,95	<2,95	<2,95	<2,95	<2,95
Søndre Skjælholmen	ng/g ww	<2,54	<2,54	<2,54	<3,08	<3,08	<3,08	<3,08	<3,08
Søndre Skjælholmen	ng/g ww	<2,01	<2,01	<2,01	<2,43	<2,43	<2,43	<2,43	<2,43
Søndre Skjælholmen	ng/g ww	<2,36	<2,36	<2,36	<2,86	<2,86	<2,86	<2,86	<2,86

Matrix/ Sampling site		F-D3	F-D3b	F-D3c	F-D4a	F-D4b	F-D4c	F-D4d	F-D4
<b>House dust</b>									
House 1 a	ng/m3	<0,10	<0,10	<0,10	<0,06	<0,06	<0,06	<0,06	<0,06
House 2	ng/m3	<0,09	<0,09	<0,09	<0,05	<0,05	<0,05	<0,05	<0,05
House 3	ng/m3	<0,12	<0,12	<0,12	<0,07	<0,07	<0,07	<0,07	<0,07
House 4	ng/m3	<0,11	<0,11	<0,11	<0,06	<0,06	<0,06	<0,06	<0,06
House 5	ng/m3	<0,41	<0,41	<0,41	<0,23	<0,23	<0,23	<0,23	<0,23
House 6	ng/m3	<0,12	<0,12	<0,12	<0,06	<0,06	<0,06	<0,06	<0,06
House 7	ng/m3	<0,08	<0,08	<0,08	<0,04	<0,04	<0,04	<0,04	<0,04
House 8 a	ng/m3	<0,24	<0,24	<0,24	<0,14	<0,14	<0,14	<0,14	<0,14
House 9	ng/m3	<0,23	<0,23	<0,23	<0,13	<0,13	<0,13	<0,13	<0,13
House 10	ng/m3	<0,24	<0,24	<0,24	<0,14	<0,14	<0,14	<0,14	<0,14
House 11	ng/m3	<0,31	<0,31	<0,31	<0,18	<0,18	<0,18	<0,18	<0,18
House 12	ng/m3	<0,15	<0,15	<0,15	<0,09	<0,09	<0,09	<0,09	<0,09
House 13	ng/m3	<0,11	<0,11	<0,11	<0,06	<0,06	<0,06	<0,06	<0,06
House 14	ng/m3	<0,08	<0,08	<0,08	<0,05	<0,05	<0,05	<0,05	<0,05
House 15	ng/m3	<0,14	<0,14	<0,14	<0,08	<0,08	<0,08	<0,08	<0,08
House 16	ng/m3	<0,16	<0,16	<0,16	<0,08	<0,08	<0,08	<0,08	<0,08
House 17	ng/m3	<0,05	<0,05	<0,05	<0,03	<0,03	<0,03	<0,03	<0,03
House 18	ng/m3	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
House 19	ng/m3	<0,03	<0,03	<0,03	<0,02	<0,02	<0,02	<0,02	<0,02
House 20	ng/m3	<0,04	<0,04	<0,04	<0,02	<0,02	<0,02	<0,02	<0,02
House 21	ng/m3	<0,03	<0,03	<0,03	<0,02	<0,02	<0,02	<0,02	<0,02
House 22	ng/m3	<0,11	<0,11	<0,11	<0,06	<0,06	<0,06	<0,06	<0,06
House 23	ng/m3	<0,08	<0,08	<0,08	<0,05	<0,05	<0,05	<0,05	<0,05
House 24	ng/m3	<0,05	<0,05	<0,05	<0,03	<0,03	<0,03	<0,03	<0,03





## **Complete results table Alkylphenols**

Matrix/ Sampling site		4tOP	4nOP	4nHP	4HP(br)	4nNP	4nDDP
<b>Sewage water</b>							
Alna 1, Hellerud, Pr.1	ng/L	<150	<130	<240	<190	<260	<280
Alna 1, Hellerud, Pr.2	ng/L	<150	<130	<240	<190	<260	<280
Alna 1, Hellerud, Pr.3	ng/L	<150	<130	<240	<190	<260	<280
Alna 2.Ind.omr. Pr 1	ng/L	<150	<130	<240	<190	<260	<280
Alna 2.Ind.omr. Pr 2	ng/L	<150	<130	<240	<190	<260	<280
Alna 2.Ind.omr. Pr 3	ng/L	<184	<130	<240	<190	<260	<280
Alna 2.Ind.omr. Pr 4	ng/L	<150	<130	<240	<190	<260	<280
<b>Surface water</b>							
Alna 3,Veslt.tj. Pr. 1	ng/L	<150	<130	<240	<190	<260	<280
Alna 4,Brubak, Pr. 1	ng/L	<150	<130	<240	<190	<260	<280
Alna 4,Brubak, Pr. 2	ng/L	<150	<130	<240	<190	<260	<280
Alna 4,Stikkpr, Pr. 4	ng/L	<150	<130	<240	<190	<260	<280
Alna 5,Kvæerner, Pr. 1	ng/L	<150	<130	<240	<190	<260	<280
Alna 5,Kvæerner, Pr. 2	ng/L	<150	<130	<240	<190	<260	<280
Alna 5,Kvæerner, Pr. 3	ng/L	<150	<130	<240	<190	<260	<280
Alna 5,Kvæerner, Pr. 4	ng/L	<150	<130	<240	<190	<260	<280
Alna 5,Stikkpr., Pr. 5	ng/L	<150	<130	<240	<190	<260	<280
<b>Sediment</b>							
Hovedøya	ng/g dw	<60	<60	<100	<90	<140	<140
Storøyodden 1/2	ng/g dw	<60	<60	<100	<90	<140	<140
Storøyodden 2/2	ng/g dw	<60	<60	<100	<90	<140	<140
Alna 4. Brubak	ng/g dw	<60	<60	<100	<90	<140	<140
Alna 5, Kvæerner	ng/g dw	<60	<60	<100	<90	<140	<140
<b>Blue mussel</b>							
Hovedøya 1	ng/g ww	<80	<80	<140	<120	<140	<150
Hovedøya 2	ng/g ww	<80	<80	<140	<120	<140	<150
Storøyodden 1	ng/g ww	<80	<80	<140	<120	<140	<150
Storøyodden 2	ng/g ww	<80	<80	<140	<120	<140	<150
Storøyodden 3	ng/g ww	<80	<80	<140	<120	<140	<150
<b>Gull egg</b>							
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>19</b>
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>17</b>
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>40</b>
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>17</b>
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>38</b>
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<15
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>20</b>
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>43</b>
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>19</b>
Søndre Skjælholmen	ng/g ww	<35	<30	<30	<30	<60	<b>68</b>

**House dust**

House 1 a	ng/g	<b>53</b>	<25	<40	<40	<40	<40
House 1 b	ng/g	<b>52</b>	<25	<40	<40	<40	<40
House 2	ng/g	<25	<25	<40	<40	<40	<40
House 3	ng/g	<b>203</b>	<25	<40	<40	<40	<40
House 4	ng/g	<25	<25	<30	<40	<40	<40
House 5	ng/g	<b>38</b>	<25	<40	<40	<40	<40
House 6	ng/g	<b>52</b>	<25	<40	<40	<40	<40
House 7	ng/g	<25	<25	<40	<40	<40	<40
House 8 a	ng/g	<b>117</b>	<25	<40	<40	<40	<40
House 8 b	ng/g	<25	<25	<40	<40	<40	<40
House 9	ng/g	<b>57</b>	<25	<40	<40	<40	<40
House 10	ng/g	<25	<25	<40	<40	<40	<40
House 11	ng/g	<25	<25	<40	<40	<40	<40
House 12	ng/g	<25	<25	<40	<40	<40	<40
House 13	ng/g	<25	<25	<40	<40	<40	<40
House 14	ng/g	<b>34</b>	<25	<40	<40	<40	<40
House 15	ng/g	<b>129</b>	<25	<40	<40	<40	<40
House 16	ng/g	<b>64</b>	<25	<40	<40	<40	<40
House 17	ng/g	<25	<25	<40	<40	<40	<40
House 18	ng/g	<b>30</b>	<25	<40	<40	<40	<40
House 19	ng/g	<25	<25	<40	<40	<40	<b>174</b>
House 20	ng/g	<25	<25	<40	<40	<40	<40
House 21	ng/g	<25	<25	<40	<40	<40	<40
House 22	ng/g	<25	<25	<40	<40	<40	<b>61</b>
House 23	ng/g	<25	<25	<40	<40	<40	<40
House 24	ng/g	<b>57</b>	<25	<40	<40	<40	<40

**Complete results table  
BADGE, BFDGE, and related compounds**

Matrix/ Sampling site		BADGE	BADGE-HCl	BADGE-2HCl	BADGE-H <sub>2</sub> O	BADGE- 2H <sub>2</sub> O	BADGE-HCl- H <sub>2</sub> O	Sum BADGE
<b>Sewage water</b>								
Alna 1, Hellerud, Pr.1	ng/L	<20	<130	<3500	<100	<b>2 167</b>	<280	<b>2 167</b>
Alna 1, Hellerud, Pr.2	ng/L	<20	<130	<3500	<100	<b>861</b>	<280	<b>861</b>
Alna 1, Hellerud, Pr.3	ng/L	<20	<130	<3500	<100	<b>693</b>	<280	<b>693</b>
Alna 2.Ind.omr. Pr 1	ng/L	<20	<130	<3500	<100	<b>468</b>	<280	<b>468</b>
Alna 2.Ind.omr. Pr 2	ng/L	<20	<130	<3500	<100	<b>2 234</b>	<280	<b>2 234</b>
Alna 2.Ind.omr. Pr 3	ng/L	<20	<130	<3500	<100	<b>367</b>	<280	<b>367</b>
Alna 2.Ind.omr. Pr 4	ng/L	<20	<130	<3500	<100	<b>872</b>	<280	<b>872</b>
<b>Surface water</b>								
Alna 3, Veslt.tj. Pr. 1	ng/L	<20	<130	<3500	<100	<220	<280	
Alna 4, Brubak, Pr. 1	ng/L	<20	<130	<3500	<100	<220	<280	
Alna 4, Brubak, Pr. 2	ng/L	<20	<130	<3500	<100	<220	<280	
Alna 4, Stikkpr., Pr. 4	ng/L	<20	<130	<3500	<100	<220	<280	
Alna 5, Kværner, Pr. 1	ng/L	<20	<130	<3500	<100	<220	<280	
Alna 5, Kværner, Pr. 2	ng/L	<20	<130	<3500	<100	<220	<280	
Alna 5, Kværner, Pr. 3	ng/L	<20	<130	<3500	<100	<220	<280	
Alna 5, Kværner, Pr. 4	ng/L	<20	<130	<3500	<100	<220	<280	
Alna 5, Stikkpr., Pr. 5	ng/L	<20	<130	<3500	<100	<220	<280	
<b>Sediment</b>								
Hovedøya	ng/g dw	<10	<65	<1110	<40	<80	<110	
Storøyodden 1/2	ng/g dw	<10	<65	<1110	<40	<80	<110	
Storøyodden 2/2	ng/g dw	<10	<65	<1110	<40	<80	<110	
Alna 4. Brubak	ng/g dw	<10	<65	<1110	<40	<80	<110	
Alna 5, Kværner	ng/g dw	<10	<65	<1110	<40	<80	<110	
<b>Blue mussel</b>								
Hovedøya 1	ng/g ww	<30	<70	<1100	<40	<80	<120	
Hovedøya 2	ng/g ww	<30	<70	<1100	<40	<80	<120	
Storøyodden 1	ng/g ww	<30	<70	<1100	<40	<80	<120	
Storøyodden 2	ng/g ww	<30	<70	<1100	<40	<80	<120	
Storøyodden 3	ng/g ww	<30	<70	<1100	<40	<80	<120	
<b>Gull egg</b>								
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	
Søndre Skjælholmen	ng/g ww	<10	<20	<350	<20	<30	<50	

Matrix/ Sampling site		<b>BADGE</b>	<b>BADGE-HCl</b>	<b>BADGE-2HCl</b>	<b>BADGE-H<sub>2</sub>O</b>	<b>BADGE- 2H<sub>2</sub>O</b>	<b>BADGE-HCl- H<sub>2</sub>O</b>	<b>Sum BADGE</b>
<b>House dust</b>								
House 1 a	ng/g	<b>18</b>	<30	<500	<b>38</b>	<b>2 273</b>	<b>210</b>	<b>2 539</b>
House 1 b	ng/g	<15	<30	<500	<20	<b>913</b>	<40	<b>913</b>
House 2	ng/g	<b>28</b>	<30	<500	<b>120</b>	<b>1 662</b>	<b>158</b>	<b>1 968</b>
House 3	ng/g	<15	<30	<500	<b>30</b>	<b>984</b>	<b>108</b>	<b>1 122</b>
House 4	ng/g	<b>77</b>	<30	<500	<b>169</b>	<b>1 298</b>	<b>121</b>	<b>1 665</b>
House 5	ng/g	<15	<30	<500	<20	<b>437</b>	<b>75</b>	<b>512</b>
House 6	ng/g	<b>55</b>	<30	<500	<b>48</b>	<b>13 044</b>	<b>1 474</b>	<b>14 621</b>
House 7	ng/g	<b>197</b>	<30	<500	<b>173</b>	<b>3 430</b>	<b>667</b>	<b>4 467</b>
House 8 a	ng/g	<b>68</b>	<30	<500	<b>280</b>	<b>7 826</b>	<b>1 226</b>	<b>9 400</b>
House 8 b	ng/g	<b>135</b>	<b>119</b>	<500	<b>347</b>	<b>3 515</b>	<b>927</b>	<b>5 043</b>
House 9	ng/g	<b>35</b>	<30	<500	<b>122</b>	<b>2 384</b>	<b>148</b>	<b>2 688</b>
House 10	ng/g	<b>71</b>	<b>45</b>	<500	<b>113</b>	<b>1 311</b>	<b>164</b>	<b>1 704</b>
House 11	ng/g	<b>66</b>	<30	<500	<b>91</b>	<b>2 003</b>	<b>181</b>	<b>2 341</b>
House 12	ng/g	<15	<30	<500	<20	<b>879</b>	<b>105</b>	<b>984</b>
House 13	ng/g	<b>18</b>	<30	<500	<20	<b>1 167</b>	<b>165</b>	<b>1 350</b>
House 14	ng/g	<b>112</b>	<30	<500	<b>139</b>	<b>1 539</b>	<b>249</b>	<b>2 039</b>
House 15	ng/g	<15	<30	<500	<b>64</b>	<b>2 442</b>	<b>87</b>	<b>2 593</b>
House 16	ng/g	<b>27</b>	<30	<500	<20	<b>2 099</b>	<b>338</b>	<b>2 464</b>
House 17	ng/g	<b>121</b>	<30	<500	<b>137</b>	<b>2 111</b>	<b>325</b>	<b>2 694</b>
House 18	ng/g	<b>135</b>	<30	<500	<b>136</b>	<b>7 367</b>	<b>594</b>	<b>8 232</b>
House 19	ng/g	<b>76</b>	<30	<500	<20	<b>11 649</b>	<b>902</b>	<b>12 627</b>
House 20	ng/g	<b>68</b>	<30	<500	<b>60</b>	<b>2 832</b>	<40	<b>2 960</b>
House 21	ng/g	<b>180</b>	<30	<500	<b>411</b>	<b>1 087</b>	<b>130</b>	<b>1 808</b>
House 22	ng/g	<b>47</b>	<30	<500	<b>74</b>	<b>6 973</b>	<b>631</b>	<b>7 725</b>
House 23	ng/g	<b>59</b>	<30	<500	<b>667</b>	<b>6 894</b>	<b>379</b>	<b>7 999</b>
House 24	ng/g	<b>93</b>	<30	<500	<b>60</b>	<b>1 490</b>	<b>153</b>	<b>1 796</b>

Matrix/ Sampling site		BFDGE	BFDGE-2HCl	BFDGE- 2H2O
<b>Sewage water</b>				
Alna 1, Hellerud, Pr.1	ng/L	<30	<110	<250
Alna 1, Hellerud, Pr.2	ng/L	<30	<110	<250
Alna 1, Hellerud, Pr.3	ng/L	<30	<110	<250
Alna 2.Ind.omr. Pr 1	ng/L	<30	<110	<250
Alna 2.Ind.omr. Pr 2	ng/L	<30	<110	<250
Alna 2.Ind.omr. Pr 3	ng/L	<30	<110	<250
Alna 2.Ind.omr. Pr 4	ng/L	<30	<110	<250
<b>Surface water</b>				
Alna 3,Veslt.tj. Pr. 1	ng/L	<30	<110	<250
Alna 4,Brubak, Pr. 1	ng/L	<30	<110	<250
Alna 4,Brubak, Pr. 2	ng/L	<30	<110	<250
Alna 4,Stikkpr, Pr. 4	ng/L	<30	<110	<250
Alna 5,Kvæerner, Pr. 1	ng/L	<30	<110	<250
Alna 5,Kvæerner, Pr. 2	ng/L	<30	<110	<250
Alna 5,Kvæerner, Pr. 3	ng/L	<30	<110	<250
Alna 5,Kvæerner, Pr. 4	ng/L	<30	<110	<250
Alna 5,Stikkpr., Pr. 5	ng/L	<30	<110	<250
<b>Sediment</b>				
Hovedøya	ng/g dw	<20	<70	<130
Storøyodden 1/2	ng/g dw	<20	<70	<130
Storøyodden 2/2	ng/g dw	<20	<70	<130
Alna 4. Brubak	ng/g dw	<20	<70	<130
Alna 5, Kvæerner	ng/g dw	<20	<70	<130
<b>Blue mussel</b>				
Hovedøya 1	ng/g ww	<20	<70	<140
Hovedøya 2	ng/g ww	<20	<70	<140
Storøyodden 1	ng/g ww	<20	<70	<140
Storøyodden 2	ng/g ww	<20	<70	<140
Storøyodden 3	ng/g ww	<20	<70	<140
<b>Gull egg</b>				
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40
Søndre Skjælholmen	ng/g ww	<10	<20	<40

<b>Matrix/ Sampling site</b>		<b>BFDGE</b>	<b>BFDGE-2HCl</b>	<b>BFDGE- 2H2O</b>
<b>House dust</b>				
House 1 a	ng/g	<10	<30	<50
House 1 b	ng/g	<10	<30	<50
House 2	ng/g	<10	<30	<50
House 3	ng/g	<10	<30	<50
House 4	ng/g	<10	<30	<50
House 5	ng/g	<10	<30	<50
House 6	ng/g	<10	<30	<50
House 7	ng/g	<10	<30	<50
House 8 a	ng/g	<10	<30	<50
House 8 b	ng/g	<10	<30	<50
House 9	ng/g	<10	<30	<50
House 10	ng/g	<10	<30	<50
House 11	ng/g	<10	<30	<50
House 12	ng/g	<10	<30	<50
House 13	ng/g	<10	<30	<50
House 14	ng/g	<10	<30	<50
House 15	ng/g	<10	<30	<50
House 16	ng/g	<10	<30	<50
House 17	ng/g	<10	<30	<50
House 18	ng/g	<10	<30	<50
House 19	ng/g	<10	<30	<50
House 20	ng/g	<10	<30	<50
House 21	ng/g	<10	<30	<50
House 22	ng/g	<10	<30	<50
House 23	ng/g	<10	<30	<50
House 24	ng/g	<10	<30	<50



## **Complete results table UV filters**

Matrix/ Sampling site		Enzacamene	3-BC	2-EHMC(E)	2-EHMC	Homosalate	Tinuvin 622	ODPABA	OC
<b>Sewage water</b>									
Alna 1, Hellerud, Pr.1	ng/L	39	<10	450	1 350	190	<400	17	13 000
Alna 1, Hellerud, Pr.2	ng/L	44	<10	270	1 170	200	<400	8,5	7 500
Alna 1, Hellerud, Pr.3	ng/L	53	<10	550	1 750	440	<400	12	12 000
Alna 2.Ind.omr. Pr 1	ng/L	56	<10	310	1 510	250	<400	9,8	9 300
Alna 2.Ind.omr. Pr 2	ng/L	74	<10	320	1 620	400	<400	9,5	9 000
Alna 2.Ind.omr. Pr 3	ng/L	30	<10	96	366	76	<400	3,5	399
Alna 2.Ind.omr. Pr 4	ng/L	19	<10	88	278	28	<400	2,2	312
<b>Surface water</b>									
Alna 3,Veslt.tj. Pr. 1	ng/L	<20	<10	<0,4	<3	5,6	<400	5,1	42
Alna 4,Brubak, Pr. 1	ng/L	<5	<10	4,6	16	6,4	<400	<1	800
Alna 4,Brubak, Pr. 2	ng/L	<5	<10	1,1	5,2	<1	<400	<1	130
Alna 4,Stikkpr., Pr. 4	ng/L	<5	<10	1,6	6,3	1,2	<400	<1	<30
Alna 5,Kværner, Pr. 1	ng/L	<5	<10	0,71	0,71	<2	<400	<1	<30
Alna 5,Kværner, Pr. 2	ng/L	<5	<10	0,66	0,66	<2	<400	<1	<30
Alna 5,Kværner, Pr. 3	ng/L	<5	<10	0,75	0,75	<2	<400	<1	67
Alna 5,Kværner, Pr. 4	ng/L	<5	<10	0,53	0,53	50	<400	<1	35
Alna 5,Stikkpr., Pr. 5	ng/L	<5	<10	1,0	1,0	1,00	<400	<1	<30
<b>Sediment</b>									
Hovedøya	ng/g dw	<20	<5	<2	<2	<0,4	<100	<0,7	51
Storøyodden 1/2	ng/g dw	<5	<2	<5	<5	2,7	<100	<2	260
Storøyodden 2/2	ng/g dw	<5	<2	<5	<5	4,6	<100	<2	230
Alna 4. Brubak	ng/g dw	<2	<1	<2	<2	<0,4	<100	<0,7	81
Alna 5, Kværner	ng/g dw	<2	<1	<2	<2	<0,4	<100	<0,7	84
<b>Blue mussel</b>									
Hovedøya 1	ng/g ww	<0,5	<0,5	<0,1	<0,1	<0,2	<100	<0,3	<2
Hovedøya 2	ng/g ww	<0,5	<0,5	<0,1	<0,1	<0,2	<100	<0,3	<2
Storøyodden 1	ng/g ww	<0,5	<0,5	<0,1	<0,1	<0,2	<100	<0,3	<2
Storøyodden 2	ng/g ww	<0,5	<0,5	<0,1	<0,1	<0,2	<100	<0,3	<2
Storøyodden 3	ng/g ww	<0,5	<0,5	<0,1	<0,1	<0,2	<100	<0,3	<2
<b>Gull egg</b>									
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	7,4
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	<4
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	<4
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	<4
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	<4
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	4,9
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	<4
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	<4
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	<4
Søndre Skjælholmen	ng/g ww	<2	<3	<2	<2	<0,1	<100	<3	<4
<b>House dust</b>									
House 1 a	ng/g	9,9	<25	211	280	18	<100	4,4	517
House 1 b	ng/g	45	<50	1 313	1 831	309	<250	50	2 270
House 2	ng/g	65	<50	217	286	1 050	<100	28	6 600
House 3	ng/g	45	<25	1 000	1 325	143	<100	2,7	2 300
House 4	ng/g	37	<125	1 867	2 503	536	<250	84	2 600
House 5	ng/g	66	<50	500	685	219	<100	36	3 200
House 6	ng/g	38	<50	925	1 199	108	<100	18	4 500

Matrix/ Sampling site		Enzacamene	3-BC	2-EHMC(E)	2-EHMC	Homosalate	Tinuvin 622	ODPABA	OC
House 7	ng/g	63	<50	775	1 003	186	<100	34	4 400
House 8 a	ng/g	37	<200	949	1 224	144	<100	26	4 200
House 8 b	ng/g	21	<125	1 825	2 375	186	<100	11	3 300
House 9	ng/g	120	<50	950	1 250	400	<100	23	4 200
House 10	ng/g	20	<25	775	1 050	188	<100	10	3 000
House 11	ng/g	22	<25	1 771	2 451	88	<100	14	3 700
House 12	ng/g	9,9	<25	551	676	33	<100	25	1 700
House 13	ng/g	19	<25	425	539	53	<100	5,9	1 100
House 14	ng/g	46	<100	2 000	2 529	61	<100	17	970
House 15	ng/g	3,8	<100	2 700	3 297	105	<500	13	1 100
House 16	ng/g								
House 17	ng/g	9,6	<50	2 533	3 166	148	<250	21	1 600
House 18	ng/g	4,6	<50	1 000	1 216	45	<250	4,0	1 800
House 19	ng/g	4,6	<100	1 100	1 321	116	<400	13	1 000
House 20	ng/g	12	<300	1 000	1 244	262	<400	45	1 500
House 21	ng/g	12	<25	375	477	31	<100	11	1 400
House 22	ng/g	20	<50	1 348	1 680	94	<200	11	2 200
House 23	ng/g	42	<75	476	601	275	<100	75	3 600
House 24	ng/g	4,0	<25	6,1	7,0	5,2	<100	0,61	11
<b>Indoor air PUF</b>									
House 1 a	ng/m3	1,2	<0,52	1,1	1,7	4,3	<1,72	0,022	4,2
House 2	ng/m3	2,3	<0,54	0,92	1,5	11	<1,79	0,014	2,7
House 3	ng/m3	2,0	<0,63	0,54	1,0	63	<2,08	0,025	7,0
House 4	ng/m3	4,8	<0,47	3,1	5,3	61	<1,56	0,008	5,0
House 5	ng/m3	3,0	<0,5	0,95	1,5	60	<1,67	0,021	2,8
House 6	ng/m3	2,0	<0,48	0,52	1,1	8,8	<1,61	0,022	2,3
House 7	ng/m3	0,74	<0,37	0,30	0,38	1,8	<1,22	0,004	2,5
House 8 a	ng/m3	1,1	<0,48	2,0	3,4	7,0	<1,61	0,017	3,8
House 9	ng/m3	0,95	<0,92	6,7	8,5	72	<3,29	0,009	7,4
House 10	ng/m3	3,5	<0,68	1,4	2,4	17	<2,27	0,006	2,9
House 11	ng/m3	0,61	<0,47	0,22	0,34	12	<1,56	0,001	3,2
House 12	ng/m3	1,2	0,38	4,7	7,4	8,1	<1,67	0,007	5,9
House 13	ng/m3	0,79	<0,78	2,5	3,4	2,6	<3,13	0,024	3,5
House 14	ng/m3	1,1	0,65	1,6	2,5	8,6	<3,33	0,047	2,2
House 15	ng/m3	7,9	<0,58	2,8	4,2	3,1	<1,92	0,024	1,8
House 16	ng/m3	0,65	0,39	0,35	0,68	12	<1,52	0,025	2,2
House 17	ng/m3	0,26	<0,5	1,2	1,8	1,6	<1,67	0,003	2,0
House 18	ng/m3	<0,25	<0,33	0,39	0,55	0,93	<1,25	0,001	2,4
House 19	ng/m3	0,25	<0,33	1,1	1,6	1,2	<1,25	0,003	1,6
House 20	ng/m3	0,23	<0,33	0,85	1,2	1,5	<1,25	0,002	1,2
House 21	ng/m3	<0,16	<0,31	0,07	0,11	0,07	<1,17	0,000	0,76
House 22	ng/m3	0,36	<0,33	0,89	1,3	1,2	<1,25	0,019	2,1
House 23	ng/m3	0,22	<0,26	3,4	3,9	0,78	<0,96	0,001	7,3
House 24	ng/m3	0,32	<0,17	1,6	2,1	<4,96	<1,48	0,007	2,3

Matrix/ Sampling site		UV-320	UV-326	UV-327	UV-328	UV-329
<b>Sewage water</b>						
Alna 1, Hellerud, Pr.1	ng/L	1,3	55	5,4	68	28
Alna 1, Hellerud, Pr.2	ng/L	2,0	62	7,4	55	30
Alna 1, Hellerud, Pr.3	ng/L	1,6	73	6,7	51	33
Alna 2.Ind.omr. Pr 1	ng/L	1,8	115	7,5	61	34
Alna 2.Ind.omr. Pr 2	ng/L	2,6	86	8,1	53	26
Alna 2.Ind.omr. Pr 3	ng/L	0,69	32	6,1	22	15
Alna 2.Ind.omr. Pr 4	ng/L	0,45	31	3,4	24	14
<b>Surface water</b>						
Alna 3,Veslt.tj. Pr. 1	ng/L	<0,2	0,56	0,56	3,0	2,5
Alna 4,Brubak, Pr. 1	ng/L	0,94	10,0	5,5	17	5,2
Alna 4,Brubak, Pr. 2	ng/L	<0,2	1,8	0,93	4,0	2,2
Alna 4,Stikkpr, Pr. 4	ng/L	<0,2	2,4	1,7	5,1	2,3
Alna 5,Kværner, Pr. 1	ng/L	<0,2	<0,5	0,27	0,79	<1
Alna 5,Kværner, Pr. 2	ng/L	<0,2	<0,5	<0,2	0,71	<1
Alna 5,Kværner, Pr. 3	ng/L	0,29	1,4	0,81	3,0	1,1
Alna 5,Kværner, Pr. 4	ng/L	<0,2	1,1	0,60	3,4	<1
Alna 5,Stikkpr., Pr. 5	ng/L	<0,2	1,7	0,80	2,8	1,5
<b>Sediment</b>						
Hovedøya	ng/g dw	4,3	5,5	7,1	21	<8
Storøyodden 1/2	ng/g dw	<2	<1	<2	<2,5	<20
Storøyodden 2/2	ng/g dw	<2	<2	<2	<2,5	<20
Alna 4. Brubak	ng/g dw	<1	<2	<0,8	1,7	<8
Alna 5, Kværner	ng/g dw	<1	1,7	<0,8	5,8	<8
<b>Blue mussel</b>						
Hovedøya 1	ng/g ww	<0,5	<0,4	<0,5	<0,6	<3
Hovedøya 2	ng/g ww	<0,5	<0,4	<0,5	<0,6	<3
Storøyodden 1	ng/g ww	<0,5	<0,4	<0,5	0,66	<3
Storøyodden 2	ng/g ww	<0,5	<0,4	<0,5	<0,6	<3
Storøyodden 3	ng/g ww	<0,5	<0,4	<0,5	<0,6	<3
<b>Gull egg</b>						
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	0,35	1,6	<4
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	0,34	13	<4
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	<0,3	1,9	<4
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	0,39	4,3	<4
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	0,34	0,81	<4
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	0,49	12	<4
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	<0,3	4,4	<4
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	<0,3	0,40	<4
Søndre Skjælholmen	ng/g ww	<0,3	<0,3	0,52	60	<4
Søndre Skjælholmen	ng/g ww	0,32	0,35	0,57	6,7	<4
<b>House dust</b>						
House 1 a	ng/g	2,2	32	10	73	11
House 1 b	ng/g	28	408	235	688	83
House 2	ng/g	16	575	220	625	325
House 3	ng/g	3,1	95	232	275	36
House 4	ng/g	25	296	52	15 000	189
House 5	ng/g	31	750	236	1 400	1 301
House 6	ng/g	41	825	475	2 500	325

Matrix/ Sampling site		UV-320	UV-326	UV-327	UV-328	UV-329
House 7	ng/g	475	24	186	4 000	8 250
House 8 a	ng/g	475	234	72	1 275	7 750
House 8 b	ng/g	3,0	1 575	33	750	119
House 9	ng/g	7,4	250	81	375	692
House 10	ng/g	11	300	46	325	144
House 11	ng/g	78	486	131	260	178
House 12	ng/g	62	100	42	4 000	123
House 13	ng/g	3,4	42	18	82	55
House 14	ng/g	11	117	18	466	121
House 15	ng/g	3,5	1 600	26	528	135
House 16	ng/g					
House 17	ng/g	15	800	800	867	150
House 18	ng/g	3,7	143	78	688	128
House 19	ng/g	5,3	376	67	1 000	101
House 20	ng/g	79	656	200	18 000	1 600
House 21	ng/g	3,1	169	27	1 700	84
House 22	ng/g	25	565	216	3 130	609
House 23	ng/g	36	91	65	1 275	229
House 24	ng/g	<1	0,95	<1	0,87	7,8
<b>Indoor air PUF</b>						
House 1 a	ng/m3	0,014	0,08	0,03	0,29	0,38
House 2	ng/m3	0,005	0,04	0,01	0,10	0,07
House 3	ng/m3	0,008	0,14	0,03	0,18	0,21
House 4	ng/m3	0,005	0,07	0,04	0,13	0,07
House 5	ng/m3	0,008	0,06	0,01	5,3	1,1
House 6	ng/m3	0,005	0,06	0,03	0,19	0,69
House 7	ng/m3	0,009	0,06	0,02	0,19	0,05
House 8 a	ng/m3	0,259	0,06	0,01	0,75	1,7
House 9	ng/m3	0,030	0,17	0,04	0,25	1,2
House 10	ng/m3	0,007	0,03	0,02	0,07	2,2
House 11	ng/m3	0,006	0,04	0,01	0,09	0,49
House 12	ng/m3	0,012	0,21	0,02	0,16	0,40
House 13	ng/m3	0,300	0,10	0,01	0,33	0,35
House 14	ng/m3	0,039	0,15	0,02	0,29	0,42
House 15	ng/m3	0,006	0,05	0,01	0,16	0,27
House 16	ng/m3	0,002	0,04	0,01	0,15	0,47
House 17	ng/m3	0,002	0,06	0,01	0,11	0,28
House 18	ng/m3	0,001	0,19	0,03	0,09	1,4
House 19	ng/m3	0,001	0,03	0,01	0,33	0,29
House 20	ng/m3	0,001	0,04	0,01	0,16	0,17
House 21	ng/m3	0,000	0,03	0,00	0,02	0,06
House 22	ng/m3	0,002	0,13	0,01	2,3	0,35
House 23	ng/m3	0,002	0,02	0,04	0,09	0,11
House 24	ng/m3	0,019	0,08	0,01	0,28	0,43

Matrix/ Sampling site		Ensilizole	BP1	BP2	BP3	BP8
<b>Sewage water</b>						
Alna 1, Hellerud,Pr.1	ng/L	<b>868</b>	<16	<90	<b>660</b>	<41
Alna 1, Hellerud,Pr.2	ng/L	<b>469</b>	<16	<90	<b>790</b>	<41
Alna 1, Hellerud,Pr.3	ng/L	<b>1 310</b>	<16	<90	<b>1 400</b>	<41
Alna 2.Ind.omr. Pr 1	ng/L	<b>363</b>	<16	<90	<b>1 100</b>	<41
Alna 2.Ind.omr. Pr 2	ng/L	<b>421</b>	<16	<90	<b>1 100</b>	<41
Alna 2.Ind.omr. Pr 3	ng/L	<b>115</b>	<16	<90	<b>250</b>	<41
Alna 2.Ind.omr. Pr 4	ng/L	<b>55</b>	<16	<90	<b>180</b>	<41
<b>Surface water</b>						
Alna 3,Veslt.tj. Pr. 1	ng/L	<b>310</b>	<16	<90	<b>13</b>	<41
Alna 4,Brubak, Pr. 1	ng/L	<b>22</b>	<16	<90	<b>12</b>	<41
Alna 4,Brubak, Pr. 2	ng/L	<b>29</b>	<16	<90	<10	<41
Alna 4,Stikkpr, Pr. 4	ng/L	<b>21</b>	<16	<90	<10	<41
Alna 5,Kværner,Pr. 1	ng/L	<b>55</b>	<16	<90	<10	<41
Alna 5,Kværner,Pr. 2	ng/L	<b>99</b>	<16	<90	<10	<41
Alna 5,Kværner,Pr. 3	ng/L	<b>44</b>	<16	<90	<10	<41
Alna 5,Kværner,Pr. 4	ng/L	<b>24</b>	<16	<90	<10	<41
Alna 5,Stikkpr.,Pr. 5	ng/L	<b>9,8</b>	<16	<90	<10	<41
<b>Sediment</b>						
Hovedøya	ng/g dw	<20	<12	<25	<7	<36
Storøyodden 1/2	ng/g dw	<20	<12	<25	<20	<36
Storøyodden 2/2	ng/g dw	<20	<12	<25	<20	<36
Alna 4. Brubak	ng/g dw	<20	<12	<25	<7	<36
Alna 5, Kværner	ng/g dw	<20	<12	<25	<7	<36
<b>Blue mussel</b>						
Hovedøya 1	ng/g ww	<20	<12	<25	<4	<36
Hovedøya 2	ng/g ww	<20	<12	<25	<4	<36
Storøyodden 1	ng/g ww	<20	<12	<25	<4	<36
Storøyodden 2	ng/g ww	<20	<12	<25	<4	<36
Storøyodden 3	ng/g ww	<20	<12	<25	<4	<36
<b>Gull egg</b>						
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
Søndre Skjælholmen	ng/g ww	<70	<5	<25	<5	<10
<b>House dust</b>						
House 1 a	ng/g	<b>138</b>	<b>138</b>	<100	<b>47</b>	<50
House 1 b	ng/g	<b>43</b>	<50	<250	<b>530</b>	<125
House 2	ng/g	<10	<b>27</b>	<100	<b>221</b>	<50
House 3	ng/g	<b>43</b>	<20	<100	<b>550</b>	<50
House 4	ng/g	<26	<b>27</b>	<250	<b>800</b>	<135
House 5	ng/g	<10	<20	<100	<b>325</b>	<50
House 6	ng/g	<10	<b>34</b>	<100	<b>74</b>	<50

Matrix/ Sampling site		Ensulizole	BP1	BP2	BP3	BP8
House 7	ng/g	<b>94</b>	<20	<100	<b>155</b>	<50
House 8 a	ng/g	<10	<20	<100	<b>223</b>	<b>61</b>
House 8 b	ng/g	<10	<b>289</b>	<100	<b>625</b>	<b>32</b>
House 9	ng/g	<b>11</b>	<b>69</b>	<100	<b>775</b>	<50
House 10	ng/g	<10	<b>660</b>	<100	<b>725</b>	<50
House 11	ng/g	<10	<b>22</b>	<100	<b>153</b>	<50
House 12	ng/g	<10	<20	<100	<b>69</b>	<50
House 13	ng/g	<10	<20	<100	<b>350</b>	<50
House 14	ng/g	<35	<b>269</b>	<400	<b>498</b>	<200
House 15	ng/g	<40	<100	<400	<b>279</b>	<200
House 16	ng/g					
House 17	ng/g	<b>61</b>	<b>32</b>	<250	<b>484</b>	<125
House 18	ng/g	<25	<50	<250	<b>211</b>	<125
House 19	ng/g	<b>100</b>	<100	<400	<b>451</b>	<200
House 20	ng/g	<10	<100	<400	<b>177</b>	<200
House 21	ng/g	<10	<20	<100	<b>98</b>	<50
House 22	ng/g	<15	<50	<200	<b>443</b>	<100
House 23	ng/g	<10	<b>107</b>	<100	<b>475</b>	<b>94</b>
House 24	ng/g	<b>262</b>	<50	<100	<b>6,0</b>	<50
<b>Indoor air PUF</b>						
House 1 a	ng/m3	<0,03	<0,02	<0,12	<b>1,0</b>	<0,05
House 2	ng/m3	<0,04	<0,02	<0,13	<b>2,7</b>	<0,05
House 3	ng/m3	<0,04	<0,02	<0,15	<b>3,1</b>	<0,06
House 4	ng/m3	<0,03	<0,02	<0,11	<b>10</b>	<0,05
House 5	ng/m3	<0,03	<0,02	<0,12	<b>7,5</b>	<0,05
House 6	ng/m3	<0,03	<0,02	<0,11	<b>3,5</b>	<b>0,34</b>
House 7	ng/m3	<0,02	<0,01	<0,09	<b>0,74</b>	<0,04
House 8 a	ng/m3	<0,03	<0,02	<0,11	<b>2,7</b>	<0,05
House 9	ng/m3	<0,03	<0,01	<0,09	<b>3,8</b>	<0,04
House 10	ng/m3	<0,05	<0,02	<0,16	<b>8,2</b>	<0,07
House 11	ng/m3	<0,03	<0,02	<0,11	<b>5,2</b>	<0,05
House 12	ng/m3	<b>0,04</b>	<0,02	<0,12	<b>1,6</b>	<0,05
House 13	ng/m3	<0,03	<0,02	<0,11	<b>1,2</b>	<0,05
House 14	ng/m3	<0,03	<0,02	<0,12	<b>4,2</b>	<0,05
House 15	ng/m3	<0,04	<0,02	<0,13	<b>6,2</b>	<0,06
House 16	ng/m3	<0,03	<0,02	<0,11	<b>1,8</b>	<0,05
House 17	ng/m3	<0,03	<0,02	<0,12	<b>2,2</b>	<0,05
House 18	ng/m3	<0,03	<0,02	<0,12	<b>1,2</b>	<0,05
House 19	ng/m3	<0,03	<0,02	<0,12	<b>1,8</b>	<0,05
House 20	ng/m3	<0,03	<0,02	<0,12	<b>1,6</b>	<b>0,59</b>
House 21	ng/m3	<0,03	<0,02	<0,11	<b>0,13</b>	<0,05
House 22	ng/m3	<0,03	<0,02	<0,12	<b>1,0</b>	<0,05
House 23	ng/m3	<0,03	<0,01	<0,09	<b>0,69</b>	<0,04
House 24	ng/m3	<0,03	<0,02	<0,11	<b>1,3</b>	<b>0,03</b>

## **Complete results table Other additives and Pharmaceuticals**



Matrix/Sampling site		BTA	TTA	NBBs	DOTO	Acetylcidrene	Benzocaine	Climbazole	Dapsone
<b>Sewage water</b>									
Alna 1, Hellerud, Pr.1	ng/L	<b>49</b>	<b>75</b>	<2000	<b>5,4</b>	<b>61</b>	<40	<b>39</b>	<5
Alna 1, Hellerud, Pr.2	ng/L	<b>129</b>	<40	<2000	<b>16</b>	<b>43</b>	<40	<b>23</b>	<5
Alna 1, Hellerud, Pr.3	ng/L	<b>200</b>	<40	<2000	<b>14</b>	<b>41</b>	<40	<7	<5
Alna 2.Ind.omr. Pr 1	ng/L	<b>256</b>	<40	<2000	<b>10</b>	<20	<40	<b>22</b>	<5
Alna 2.Ind.omr. Pr 2	ng/L	<b>292</b>	<40	<2000	<b>8,2</b>	<20	<40	<7	<5
Alna 2.Ind.omr. Pr 3	ng/L	<b>146</b>	<b>198</b>	<2000	<b>9,7</b>	<20	<40	<b>17</b>	<5
Alna 2.Ind.omr. Pr 4	ng/L	<b>168</b>	<b>197</b>	<2000	<b>9,2</b>	<20	<40	<b>46</b>	<5
<b>Surface water</b>									
Alna 3,Veslt.tj. Pr. 1	ng/L	<40	<40	<2000	<0,5	<20	<40	<7	<5
Alna 4,Brubak, Pr. 1	ng/L	<b>22</b>	<b>164</b>	<2000	<b>6,0</b>	<20	<40	<7	<5
Alna 4,Brubak, Pr. 2	ng/L	<b>25</b>	<b>195</b>	<2000	<b>1,7</b>	<20	<40	<7	<5
Alna 4,Stikkpr, Pr. 4	ng/L	<40	<b>196</b>	<2000	<b>2,9</b>	<20	<40	<7	<5
Alna 5,Kværner,Pr. 1	ng/L	<b>12</b>	<b>54</b>	<2000	<0,5	<20	<40	<7	<5
Alna 5,Kværner,Pr. 2	ng/L	<b>21</b>	<b>72</b>	<2000	<0,5	<20	<40	<7	<5
Alna 5,Kværner,Pr. 3	ng/L	<b>105</b>	<40	<2000	<b>0,83</b>	<20	<40	<7	<5
Alna 5,Kværner,Pr. 4	ng/L	<b>35</b>	<b>199</b>	<2000	<b>1,6</b>	<20	<40	<7	<5
Alna 5,Stikkpr.,Pr. 5	ng/L	<b>33</b>	<b>218</b>	<2000	<b>0,98</b>	<20	<40	<7	<5
<b>Sediment</b>									
Hovedøya	ng/g dw	<50	<34	<650	<b>9,2</b>	<50	<25	<3	<1
Storøyodden 1/2	ng/g dw	<50	<b>212</b>	<650	<6	<100	<25	<3	<1
Storøyodden 2/2	ng/g dw	<50	<b>378</b>	<650	<6	<100	<25	<3	<1
Alna 4. Brubak	ng/g dw	<50	<34	<650	<3	<50	<25	<3	<1
Alna 5, Kværner	ng/g dw	<50	<b>31</b>	<650	<3	<50	<25	<3	<1
<b>Blue mussel</b>									
Hovedøya 1	ng/g ww	<50	<34	<650	<2	<15	<25	<3	<1
Hovedøya 2	ng/g ww	<50	<34	<650	<2	<15	<25	<3	<1
Storøyodden 1	ng/g ww	<50	<34	<650	<2	<30	<25	<3	<1
Storøyodden 2	ng/g ww	<50	<34	<650	<2	<20	<25	<3	<1
Storøyodden 3	ng/g ww	<50	<34	<650	<2	<15	<25	<3	<1
<b>Gull egg</b>									
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
Søndre Skjælholmen	ng/g ww	<10	<25	<650	<0,1	<20	<10	<3	<2
<b>House dust</b>									
House 1 a	ng/g	<50	<50	<500	<b>59</b>	<b>102</b>	<50	<10	<5
House 1 b	ng/g	<100	<100	<1250	<b>96</b>	<b>273</b>	<100	<25	<10
House 2	ng/g	<50	<50	<500	<b>140</b>	<225	<50	<10	<5
House 3	ng/g	<50	<50	<500	<b>59</b>	<b>144</b>	<50	<10	<5
House 4	ng/g	<100	<100	<1350	<b>282</b>	<b>447</b>	<100	<25	<10
House 5	ng/g	<50	<50	<500	<b>525</b>	<100	<50	<10	<5
House 6	ng/g	<50	<50	<500	<b>325</b>	<b>725</b>	<50	<10	<5

Matrix/Sampling site		BTA	TTA	NBBs	DOTO	Acetylcodrene	Benzocaine	Climbazole	Dapsone
House 7	ng/g	<50	<50	<500	<b>43</b>	<b>176</b>	<50	<10	<5
House 8 a	ng/g	<50	<50	<500	<b>86</b>	<b>236</b>	<50	<10	<5
House 8 b	ng/g	<50	<50	<500	<b>70</b>	<b>115</b>	<50	<10	<5
House 9	ng/g	<50	<50	<500	<b>325</b>	<b>207</b>	<50	<10	<5
House 10	ng/g	<50	<50	<500	<b>4 000</b>	<b>191</b>	<50	<10	<5
House 11	ng/g	<50	<50	<500	<b>263</b>	<b>3 143</b>	<50	<10	<5
House 12	ng/g	<50	<50	<500	<b>38</b>	<150	<50	<10	<5
House 13	ng/g	<50	<50	<500	<b>1 325</b>	<b>93</b>	<50	<10	<5
House 14	ng/g	<200	<200	<2000	<b>779</b>	<b>400</b>	<200	<40	<20
House 15	ng/g	<200	<200	<2000	<b>236</b>	<200	<200	<40	<20
House 16	ng/g								
House 17	ng/g	<100	<100	<1250	<b>1 067</b>	<200	<100	<30	<15
House 18	ng/g	<100	<100	<1250	<b>1 938</b>	<180	<100	<30	<10
House 19	ng/g	<200	<200	<2000	<b>12 000</b>	<300	<200	<40	<20
House 20	ng/g	<200	<200	<2000	<b>1 200</b>	<300	<200	<40	<20
House 21	ng/g	<50	<50	<500	<b>23 750</b>	<b>137</b>	<50	<10	<5
House 22	ng/g	<100	<100	<1000	<b>1 435</b>	<b>249</b>	<100	<20	<10
House 23	ng/g	<50	<50	<500	<b>1 275</b>	<b>146</b>	<50	<10	<5
House 24	ng/g	<50	<50	<500	<b>325</b>	<50	<50	<b>36</b>	<5
<b>Indoor air PUF</b>									
House 1 a	ng/m3	<0,02	<0,09	<6,9	<b>0,015</b>	<b>16</b>	<0,07	<0,02	<0,01
House 2	ng/m3	<0,02	<0,09	<7,14	<b>0,013</b>	<8,93	<0,07	<0,02	<0,01
House 3	ng/m3	<0,02	<0,1	<8,33	<b>0,011</b>	<b>23</b>	<0,08	<0,02	<0,01
House 4	ng/m3	<0,02	<0,08	<6,25	<b>0,008</b>	<b>37</b>	<0,06	<0,02	<0,01
House 5	ng/m3	<0,02	<0,08	<6,67	<b>0,010</b>	<b>25</b>	<0,07	<0,02	<0,01
House 6	ng/m3	<0,02	<0,08	<6,45	<b>0,027</b>	<11,29	<0,06	<0,02	<0,01
House 7	ng/m3	<0,01	<0,06	<4,88	<b>0,011</b>	<1,22	<0,05	<0,01	<0,01
House 8 a	ng/m3	<0,02	<0,08	<6,45	<b>0,013</b>	<b>28</b>	<0,06	<0,02	<0,01
House 9	ng/m3	<0,01	<0,07	<13,16	<b>0,005</b>	<b>24</b>	<0,05	<0,01	<0,01
House 10	ng/m3	<0,02	<0,11	<9,09	<b>0,008</b>	<b>27</b>	<0,09	<0,02	<0,01
House 11	ng/m3	<0,02	<0,08	<6,25	<b>0,020</b>	<b>6,8</b>	<0,06	<0,02	<0,01
House 12	ng/m3	<0,02	<0,08	<6,67	<b>0,012</b>	<b>27</b>	<0,07	<0,02	<0,01
House 13	ng/m3	<0,02	<0,08	<11,72	<b>0,006</b>	<b>14</b>	<0,06	<0,02	<0,01
House 14	ng/m3	<0,02	<0,08	<12,5	<b>0,012</b>	<b>34</b>	<0,07	<0,02	<0,01
House 15	ng/m3	<0,02	<0,1	<7,69	<b>0,034</b>	<b>49</b>	<0,08	<0,02	<0,01
House 16	ng/m3	<0,02	<0,08	<6,06	<b>0,008</b>	<b>26</b>	<0,06	<0,02	<0,01
House 17	ng/m3	<0,02	<0,08	<6,67	<b>0,013</b>	<b>3,3</b>	<0,07	<0,02	<0,01
House 18	ng/m3	<0,02	<0,08	<4,17	<b>0,005</b>	<b>5,3</b>	<0,07	<0,02	<0,01
House 19	ng/m3	<0,02	<0,08	<4,17	<b>0,005</b>	<b>9,3</b>	<0,07	<0,02	<0,01
House 20	ng/m3	<0,02	<0,08	<4,17	<b>0,009</b>	<b>9,4</b>	<0,07	<0,02	<0,01
House 21	ng/m3	<0,02	<0,08	<3,91	<b>0,011</b>	<b>0,93</b>	<0,06	<0,02	<0,01
House 22	ng/m3	<0,02	<0,08	<4,17	<b>0,006</b>	<b>9,5</b>	<0,07	<0,02	<0,01
House 23	ng/m3	<0,01	<0,06	<3,21	<b>0,004</b>	<b>2,6</b>	<0,05	<0,01	<0,01
House 24	ng/m3	<0,02	<0,08	<5,17	<b>0,004</b>	<b>13</b>	<0,06	<0,02	<0,01



## **NILU – Norwegian Institute for Air Research**

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