

Nordic Screening of Chemicals

Aims and Results Obtained



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Nordic co-operation

Nordic cooperation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and three autonomous areas: the Faroe Islands, Greenland and Åland.

Nordic cooperation has firm traditions in politics, the economy, and culture. It plays an important role in European and international collaboration, and aims at creating a strong Nordic community in a strong Europe.

Nordic cooperation seeks to safeguard Nordic and regional interests and principles in the global community. Common Nordic values help the region solidify its position as one of the world's most innovative and competitive.

Background to the Nordic screening initiative

For the purpose of obtaining information on newly discovered persistent organic pollutants (POPs), as well as other potential problem substances used in society, the national environmental monitoring schemes were in 2001 supplemented by a joint Nordic screening programme that measures pollutants in coordinated campaigns. Within the frame of this programme concentrations of a selection of hazardous substances have been measured in strategically chosen media on one or several occasions in coordinated campaigns.

The aim of the Nordic environmental screening of substances is to obtain a snapshot of the occurrence of potentially hazardous substances in the environment both in regions most likely to be polluted as well as in some very pristine environments. The focus is on little known, antropogenic substances and their derivatives, which are either used in high volumes or are likely to be persistent and hazardous to humans and other organisms. If substances being screened are found in significant amounts this may result in further investigations or monitoring on national level.

The results from screening can be used when analysing possible environmental effects of the selected substances, and to assess whether they pose a risk to the environment or not. The screening strategy is also valuable when data on chemicals are needed within the REACH system.

The Nordic screening project is run by a steering group with representatives from the National Environmental Research Institute of Denmark, the Finnish Environment Institute, the Environment and Food Agency of Iceland, the Food-, Veterinary and Environmental Agency of the Faroe Islands, the Norwegian Pollution Control Authority and the Swedish Environmental Protection Agency.

The project has been financed and supported by the Nordic Council of Ministers through the Nordic Chemicals Group and the Nordic

Substances chosen for screening by the steering group for the screening project

Year	Substances chosen for screening	Comments
2002	Musk substances	TemaNord 2004:503
2003	Perfluorinated alkylated substances	TemaNord 2004:552
2004	Siloxanes	TemaNord 2005:593
2005	Bronopol, resorcinol, triclosan, m-cresol	TemaNord 2007:585
2006	Phenolic substances	Will be published 2008

Monitoring and Data Group as well as the participating institutions. The respective participating Nordic countries organise sample selection and collection and transport of samples based on a sampling protocol provided by laboratories. We have as far as possible used the same methods all through the process.

With a Nordic cooperation we have the great advantage of being able to

- share costs and get a more effective use of available resources
- get a better representativity of the results since a larger area is covered
- see similarities and differences across national borders and
- share competence.

Some words about a strategy for screening

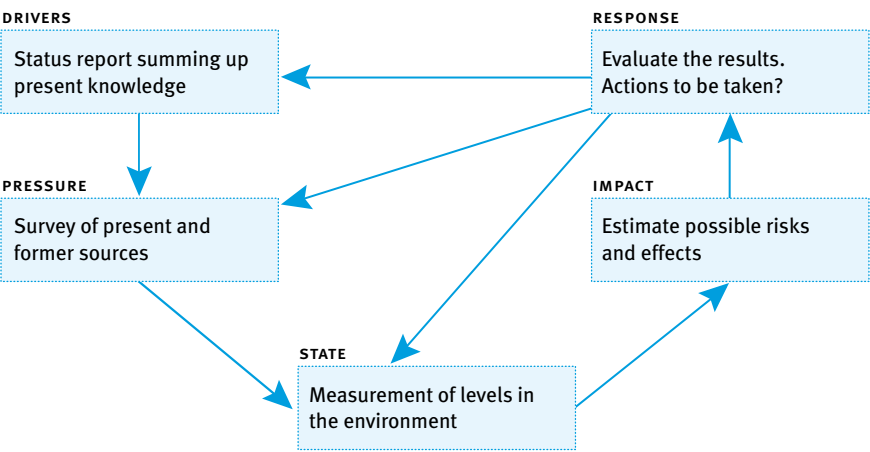
An important aspect of screening is to draw attention to new environmental pollutants and to furnish data to those who work with chemicals regulation. The primary aim however, is to get a snapshot of the ambient level of the selected pollutant or group of pollutants, in order to elucidate the sources, the background concentration and the possible risk of exposure to the environment.

The substance is chosen based on the physio-chemical and toxicological properties, the amounts used and with a view towards what the results will be used for. A further reason for choosing a given substance may be so that the results can be used to fill gaps in data for risk assessment or to justify a risk-reducing measure.

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Strategy for screening according to the DPSIR model

(Modified from a picture by Henrick Blank, Jönköping County Administrative Board, 2001)



The actual screening – the measurement study

The sampling strategy is based on what is known about the properties of the substances, their sources and where they occur. The purpose of the study and why this particular substance has been chosen influence the choice of sampling site and sample types. In choosing which and where samples are to be taken, a balance is found between sampling as many different sample types as possible and to sample at different sites to elucidate geographical variation.

Evaluation

An important part of all studies, including screening studies, is evaluation. Can the screening be considered to be finished or are other data needed to draw conclusions and answer the questions underlying the choice of substance? It is also important that the results are disseminated and that the need for actions of various kinds are considered, as well as who should be targeted by the proposals. First and foremost, it should be decided whether the screening's measurement study has been technically successful, i.e. whether results have been obtained in sufficient quantity and of good quality.

When the results of a screening study are reported, conclusions are drawn concerning the study and the information is compiled in a final report. This is part of the work of disseminating information on the results of the screening.

Some results obtained

Musk substances

Musk compounds comprise an important part of scent added to cosmetics, washing and cleaning agents etc. A major part of these compounds are the synthetic musks whereof some are polycyclic musks. The reason for choosing musk substances was to check that nitromusks were not creating a problem and to check the environmental pressures of polycyclic musks.

Samples of rain water, sewage sludge, blue mussels and liver from red fox, polar fox or racoon dog were analysed for content of nine synthetic musk compounds i.e. six polycyclic musks. These compounds represent the major part of synthetic musk compounds used in cosmetics, washing and cleaning agents etc.

The results show high concentrations of especially polycyclic musk compounds in sewage sludge, with maximum concentration of Galaxolide (HHCB) being 26,500 µg/kg dry weight and of Tonalide (AHTN) 3,600 µg/kg dry weight. Polycyclic musks were also detected in samples of blue mussels. Galaxolide was detected in some rainwater samples at concentrations in the range 12-29 ng/l.

The environmental significance of the findings is difficult to assess, as there is a lack of data concerning effects of synthetic musk compounds.

Perfluorinated substances

Perfluorinated alkylated substances (PFAS) make up a large group of chemicals that have been used in different industrial and consumer products since the 1950s. The substances are mainly used in fire fighting foams, protective coating, textiles, floor wax, polish and electronic industries. From this use the substances are likely to end up in waste dumps, sewage water and the general environment.

Range of concentration of musk substances found in sewage sludge

	n	DPMI	HHCB	AHTN	ATII
Denmark	5	n.d.–54	11,400–26,500	1,130–3,610	242–891
Finland	5	<12–59	495–6,000	97–2,270	n.d.–218
Iceland	4	n.d.	408–2,160	98–553	n.d.
Norway	5	n.d.–128	254–22,400	68–3,500	n.d. –601
Sweden	8	n.d.–17	7,820–24,000	952–3,350	38–252

n = number of samples. n.d. = not detected

Levels of musk substances are given as ug/kg dry weight

The reason for choosing this substance group was that it had been found in biota from the arctic and that we wanted to get a broader picture of the problem as a background for further actions.

Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) were found in nearly all samples in a joint Nordic screening project, although the concentrations were below the reported toxicological threshold levels with a possible exception for the marine predating mammals. Other perfluorinated alkylated substances (PFAS) were also commonly found. Since the chemicals of this group are very persistent, measures should be considered to ensure that PFAS will not turn into environmental problems in the future.

Siloxanes

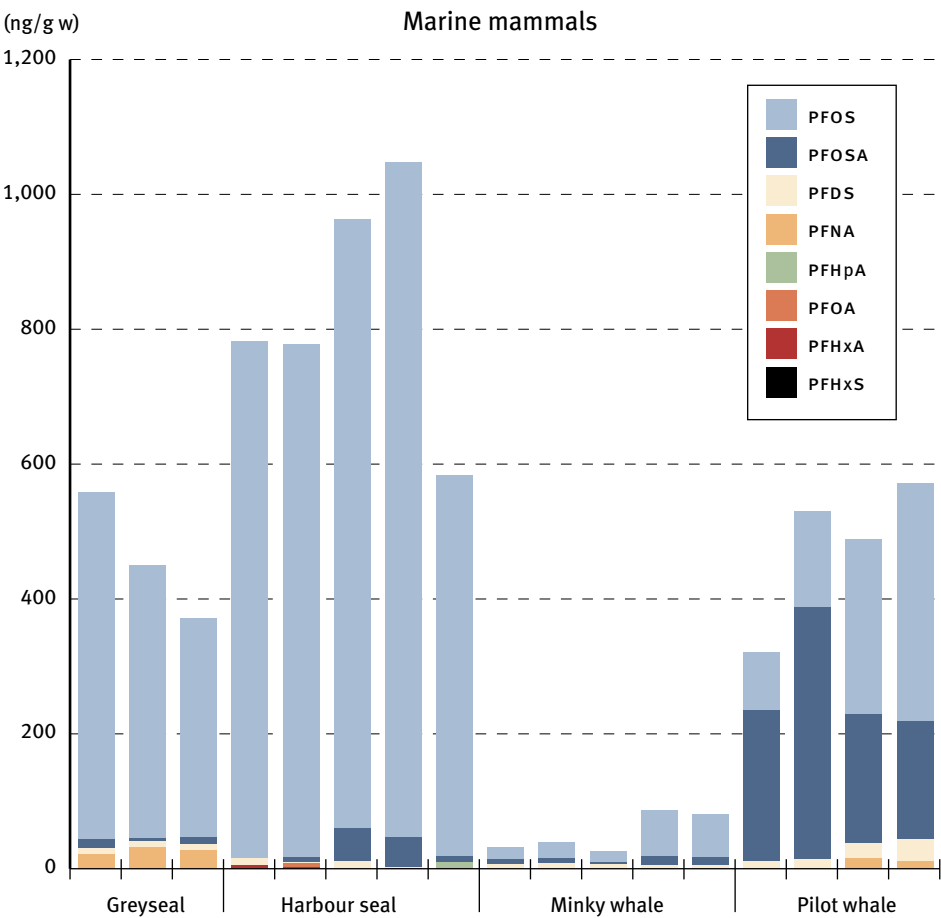
Siloxanes belong to a group of substances used in a number of industrial applications and in consumer products such as additives in fuel, car polish, cleaners, anti-foamers and car waxes. Besides this, they are widely used in e.g. personal care and biomedical products. As a result of their wide use, siloxanes are presumably spread into the environment both via point sources and via diffuse sources and may be found in the environment. Recent studies have suggested that siloxanes may have direct or indirect toxic effects on various biological processes.

Siloxanes are among the substances discussed in the EU chemicals work. Large volumes are used in The Nordic countries, and data that could show a clearer picture of the environmental fate (i.e. degradation and bioavailability) of these substances were missing.

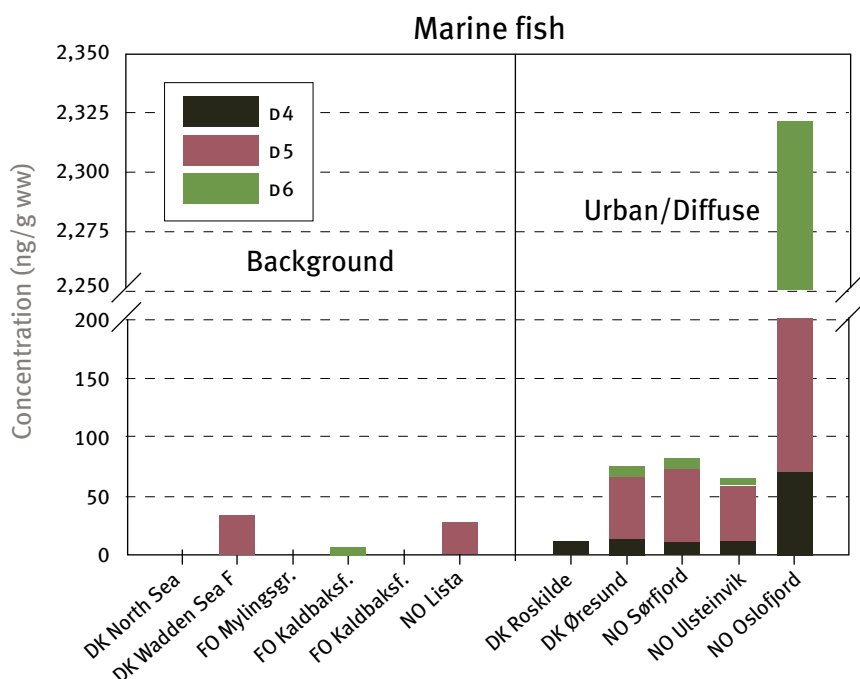
Sampled media types were air, biota, sediment, sludge, soil and water. Siloxanes were found in all the analysed samples types except soils. The results indicate that there is a general pollution of siloxanes in the Nordic environment, close to dense population and major sources. There was, however, a great variation in concentrations. The cyclic siloxanes occurred in all media in significantly higher concentrations than the linear siloxanes. At present, the observed

	ADBI	AHDI	MX	MK	MA
	63–294	<12–323	n.d.	n.d.	n.d.–83
	n.d.–100	<12–55	n.d.	n.d.	n.d.
	n.d. –175	n.d.	n.d.	n.d.	n.d.
	n.d. –170	n.d.–64	n.d.	n.d.	n.d.
	52 –153	n.d.–34	n.d.	n.d.	n.d. –23

concentrations are not alarmingly high, and many background sites seem to be non-contaminated. However, the use of siloxanes is extensive and it is possible that continued use will lead to increased environmental levels, eventually reaching effect concentrations. The results from this screening study has been used in the EU evaluation of siloxanes.



Compound specific level distribution for PFAS residues in marine mammals (livers), harbour seals (Denmark), grey seals (Sweden), minky whales (Iceland) and pilot whales (Faroe Islands)



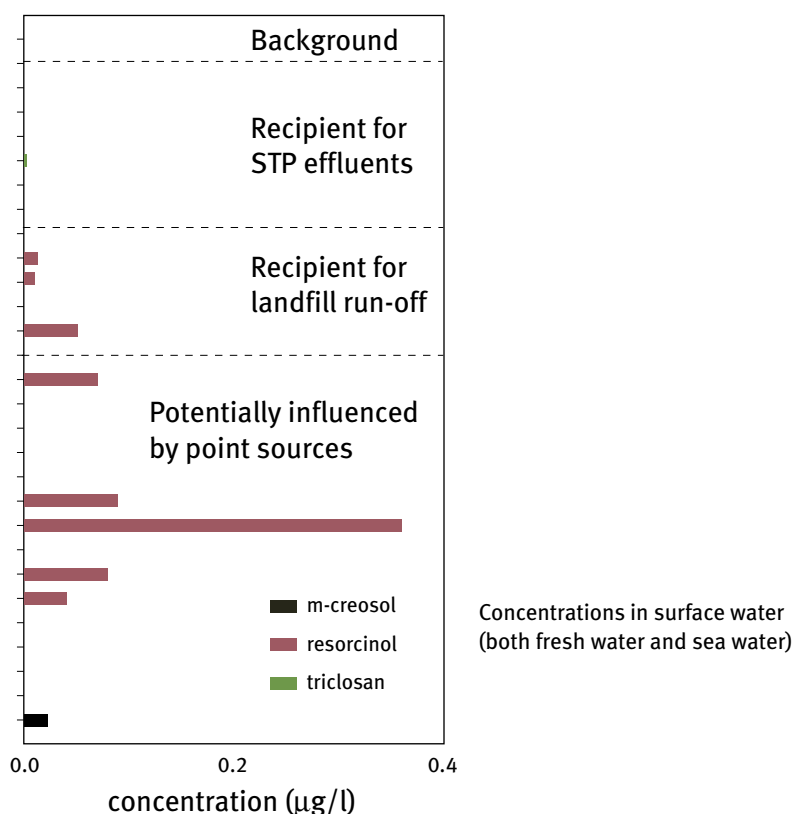
Concentration and distribution of cyclic siloxanes in marine fish liver. Some of the reported concentrations were between the limit of detection and quantification and thus have a larger uncertainty.

Resorcionol, bronopol, triclosan, m-cresol

The substances of focus in this study are included due to their toxicity and volume, and not because they are very persistent or bioaccumulating.

- Bronopol is used as a preservative in cosmetiques, hygiene products, glue and paint. It can also be used as a slimicide and bactericide in industrial processes.
- m-Cresol is a component in wood preservatives, but also in pharmaceutical industry and in smoke flavouring. It can be used as a bactericide and fungicide.
- Resorcinol is an essential component of e.g. adhesive systems, light screening agents for the protection of plastics from exposure to ultraviolet light, pharmaceuticals, flame retardants, agriculture chemicals, and lotions.
- Triclosan is a chlorinated phenolic compound that for many years has been used as a biocide in several consumer products.

Despite a high consumption of bronopol in the Nordic countries as well as in the EU, it was not found in any of the samples analyzed. It undergoes rapid hydrolysis as well as biodegradation, which may explain its absence in the environmental samples.



Resorcinol is widely used and was also frequently found in the municipal influent water samples. It is still present in some effluent water samples and was also detected in environmental samples of water and sediment.

Triclosan was found in high concentrations in sewage treatment plant (STP) sludge, in STP effluent water and in sediment outside STPs. This may be a reflection of the use of triclosan in health care products. The present study shows that, despite a stated decreased usage of the compound within the industry, levels in the environment are still high.

m-Cresol was found in several influent samples to municipal STPs and in leachate water samples. A high removal efficiency of the substance seems to limit its environmental distribution.



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Links

Nordic environmental screening of substances:

<http://www.ust.is/ness/index.html>

National screening results:

Denmark: <http://www.dmu.dk> and <http://www.mst.dk>

Faroe Islands: <http://www.us.fo>

Finland: <http://www.environment.fi>

Norway: <http://www.sft.no>

Sweden: <http://www.naturvardsverket.se>

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