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REPORT

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Abstract

This report is a compilation of analytical method codes and descriptions used in the Norwegian contribution to the Joint Assessment and Monitoring Programme (JAMP) for investigation of the levels and trends of contaminants in near shore waters. It concerns primarily selected metals, organochlorines (e.g. PCBs, DDTs, HCHs, HCB), polycyclic aromatic hydrocarbons (PAHs) in seawater, sediment and marine biota collected 1981-1999 and analysed through to 2000. The method descriptions are brief and focus on the principles involved.

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O-80106

JOINT ASSESSMENT AND MONITORING PROGRAMME (JAMP)

Overview of Norwegian analytical methods 1981-2000

Foreword

This report presents the method overview and brief descriptions of chemical analyses used for 1981-1999 Norwegian investigations (analysed during the period 1981-2000) for the Joint Monitoring and Assessment Programme (JAMP, earlier the Joint Monitoring Programme - JMP). JAMP is administered by the Oslo and Paris Convention (OSPAR). JAMP receives guidance from the International Council for the Exploration of the Sea (ICES).

The Norwegian JAMP was carried out by the Norwegian Institute for Water Research (NIVA) by contract from the Norwegian Pollution Control Authority (SFT), (NIVA contract O-80106).

Information for this report was compiled by the Norwegian Institute for Water Research (NIVA) by contract from the Norwegian State Pollution Control Authority (SFT) (NIVA contract 80106) The report is an updated version of information reported earlier that concerned 1981-1992 (Green 1993).

The different methods have been reviewed by representatives of the respective analytical laboratories

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1. Introduction

Oslo-Paris convention (OSPAR) was established in 1992 and represents a union between the Oslo commission, established in 1972 and the Paris commission initiated in 1974. The aim of OSPAR is to protect the marine environment against anthropogenic contamination in the North east Atlantic. Administered by OSPAR and advised by the International Council for the Exploration of the Sea (ICES), OSPAR carries out the *Joint Assessment and Monitoring Programme* (JAMP, earlier the *Joint Monitoring Programme* JMP). JAMP was started in 1996 and is based largely on the Joint Monitoring Programme (JMP) initiated in November 1980. JAMP is implemented by contract from the Norwegian Pollution Control Authority (SFT).

Data collected for JAMP is submitted to ICES with corresponding codes for the analytical methods used. This report defines these codes and gives an outline of the analytical methods employed by JAMP in Norway 1981-2000 for the analyses of contaminants in sea water, sediment and marine biota samples (collected 1981-2000).

This report is largely based on information filed at the International Council for the Exploration of the Sea (ICES) (OSPAR 1984; Green 1988, Green 1993). It includes updated and extended information but retains the same codes and abbreviations. Chapter 2 summarises the analytical methods employed sorted in various ways for convenient reference. Chapter 3 gives a brief description of each method.

2. Method overview

2.1 Medium and method code

An overview of analytical methods for trace metals, chlorinated hydrocarbons and other substances in the marine environment is shown in **Table 1** and **Table 2**.

Table 1. An overview of analytical methods for trace metals, chlorinated hydrocarbons and other substances for sea water and sediment as employed by JAMP. (Parameter codes are defined in Appendix A).

Medium	method code	institute code	contaminant(s) etc.	sampling year(s)
Sea water				
	320	SIIF	Hg	84
	322	SERI	Hg	84-86
	330	SIIF	Cd	83
	331	NIVA	Cu,Zn	85-90
	331	NIVA	Cd,Pb	84-90
	331	NIVA	Fe,Ni,Co	86
	332	NIVA	Hg	86-90
Sediment				
	350	NIVA	Hg	86,90,92
	351	NIVA	Cu,Zn	86,90,92
	353	NIVA	Cd,Pb	86,90,92,93, 94,96,97
	353	NIVA	Cr,Ni	94
	354	NIVA	As	96
	360	NIVA	PCB[1],DDT	86,92,96
	369	NIVA	PAH[2]	92
	390	NIVA	NTOT,CORG	86,90,92

650	FORC	Pb-210	
760	IMRN	PCB[1]	90
769	IMRN	PAH[2]	90

[1]) selected individual chlorobiphenyls and pesticides (cf., Appendix A).
[2]) selected PAHs (cf., Appendix A).

Table 2. An overview of analytical methods for trace metals, chlorinated hydrocarbons and other substances for marine organisms as employed by JAMP. (Parameter codes are defined in Appendix A).

Medium	method code	institute code	contaminant(s) etc.	sampling year(s)
Marine biota				
	120	SIIF	Hg	81-85
	121	SIIF	Hg[3]	83-85
	130	SIIF	Ni	83
	130	SIIF	Cu,Pb	83-84
	130	SIIF	Cd	81-85
	130	SIIF	Pb[3]	83-85
	131	SIIF	Zn	83-84
	132	SIIF	Mn,Zn	84-85
	220	VETN	Hg	82-85
	220	VETN	Se[3]	85
	230	VETN	Cd	82-85
	240	VETN	Se	82
	310	NIVA	Hg	86-99
	311	NIVA	Cu,Zn	86-99
	312	NIVA	Cd,Pb	86-99
	312	NIVA	Cr	92,96
	312	NIVA	Ag,As,Co,	96
	401	FIER	Hg	84,87
	402	FIER	Cd	84,87
	403	FIER	Pb	87
	404	FIER	Cu	87
	405	FIER	Zn	87
	406	FIER	As[3]	83
	110	SIIF	PCB[1]	81
	111	SIIF	PCB[1],	82-91
	210	VETN	PCB,HCB,DDEPP	82-85
	211	VETN	PCB	82-85
	309	NIVA	PAH[2]	87,92,95-99
	320	NIVA	TBT	97-99
	340	NIVA	PCB[1]	87,90-99
	341	NIVA	PCB[1]	90-99
	510	NACE	PCB[1]	86-89
	511	NACE	PCB	86-89
	605	SIIF	EPOCl	86-91
	607	IFEN	EPOCl	97-98
	610	NACE	EPOCl	86-89
	615	NIVA	EPOCl	90-92
	841	NILU	"Dioxins" [4]	95-96
	842	NILU	"Dioxins" [4]	95-96

[1]) selected individual chlorobiphenyls and pesticides (cf., Appendix A).
[2]) selected PAHs (cf., Appendix A).
[3]) not in data base
[4]) selected dibenzo dioxins and dibenzo furans (cf., Appendix A).

Overview of chemical analyses for sea water 1981-1990 is shown in **Table 3**. A more detailed overview of chemical analyses for sediment and biota 1981-2000 is given in Appendix C and Appendix D. Intercalibration codes (and in some cases laboratory codes) are given to distinguish different ICES exercises.

Table 3. An overview of detection limits relating to analyses of contaminants in sea water and marine sediments. (Parameter codes are defined in Appendix A).

medium	parameter	detection limit ppb[1]	institute	sample year	method code	Intercal-ibration
Sea water						
	Cr	200	NIVA	87	331	-
	Mn	500	NIVA	87	331	-
	Fe	50	NIVA	87	331	-
	Co	5	NIVA	87	331	-
	Ni	10	NIVA	87	331	-
	Cu	10	NIVA	86-90	331	4I
		50	NIVA	85	331	4Z
	Zn	70	NIVA	85	331	4Z
		10	NIVA	86-90	331	4I
	Cd	1	NIVA	85	331	4Z
		0.5	NIVA	86-90	331	4I
		5	NIVA	84	331	4Z
		100	SIIF	83	330	4F
	Hg	0.02	SERI	84-85	322	4H
		0.02	SERI	86-90	322	4I
		2	NIVA	86	332	4I
		10	SIIF	84	320	4F
	Pb	6	NIVA	86-90	331	4Z

*) mg/g

1) note definition in Appendix A

A detailed overview of chemical analyses employed by JAMP 1981-2000 in Norway for trace metals, chlorinated hydrocarbons and other substances in sediment biota can be found in Appendix C and Appendix D, respectively.

2.2 Comment on detection limit

The detection limits given here are approximations based on 3 times the standard deviation of the 'blank' or near zero concentration of a solution. However, day-to-day variations in the analytical instrument may lead to minor variation in detection limits.

3. Method descriptions

The following descriptions focus on the principles involved and hence are not intended as detailed specifications. The descriptions may vary arbitrarily in detail and may be coupled to specific time periods (cf., **Table 3**, Appendix C and Appendix D). Hence, they may not necessarily reflect methods currently practised by the contributing institutes.

3.1 Analyses of sea water

3.1.1 Sampling method codes

code	***description***
	Samplers for sea water
1	Hydrobios hydrographical water sampler
2	Ruttner industrial water sampler
3	Ultracleaned polyethylene flask
4	Ultracleaned glass Erlenmeyer flask
	Sampler deployment for sea water
1	2 nylon lines
2	Nylon line, brass messenger
3	By plastic-gloved hands
	Methods of pretreatment of sea water samples
0	None
1	Membrane filter
	Methods of preservation of sea water samples
0	None
1	Nitric acid addition
2	Freezing
3	Nitric acid addition and freezing

3.1.2 Inorganic determinations

code ***description***

320 **Mercury in sea water (SIIF)**

Reference: Omang 1971.

322 **Mercury in sea water (SERI)**

Reference: Iverfeldt 1984.

Abstract (cf. Iverfeldt 1984)

The 0.5-liter glass Erlenmeyer sampling bottles are specially cleaned: first filled with 6M HCl for 7 days, then 7M HNO_3 for 7 days and finally with deionized water with 1 mL conc. HNO_3/litre sample for 7 days. The bottles are rinsed extensively between each stage. After sampling, » 1 mL conc. HNO_3/litter sample is added to achieve a pH of 1-2.

Mercury is preconcentrated on a gold trap after being reduced and volatilised by $NaBH_4$ from an all quartz glass reduction vessel. Mercury free nitrogen gas is used for purging.

The gold trap is constructed as gold grains in layers separated by SiO_2 glass pieces. All gold traps used are individually calibrated and give the same response.

The gold traps are analysed by a double amalgamation step; i.e. the mercury is transferred by heating, to about 800^0C, to a second gold trap. This gold trap is analysed using a helium direct current-plasma emission spectrometer (DCPAES). A Keithley 427 Current Amplifier and a Shimadzu Chromatopac C-R2AX Integrator are used. The system isoptimized for the mercury line at 253.65 nm using a Hg(0) diffusion tube.

The stable sensitivity of the DCPAES instrument is ensured by a check before and after every sample determination.

Standard solutions are prepared from commercial stock solutions of CH_3HgCl (1000 ppm, Alfa Products) and mercuric nitrate (1 mL = 1 mg Hg, BDH Spectrosol).

This combination resulted in the extremely low detection limit of 0.02 ng/litre with 5% reproducibility (Cossa & Courau 1984).

330 **Cadmium in sea water (SIIF)**

Reference: Paus 1973.

331 **Cadmium, copper, zinc, lead, iron, nickel, cobalt in sea water (NIVA)**

The 1-liter polyethylene sampling bottles are specially cleaned: first filled with 6M HCl for 7 days, then 7M HNO_3 for 7 days and finally with deionized water with 1 mL conc.

HNO_3/litre sample for 7 days. The bottles are rinsed extensively between each stage. After sampling, 1 mL conc. HNO_3/litter sample is added to achieve a pH of 1-2.

The analysis uses chelation with APDC (ammonium-pyrrolidine dithio-carbamate) and DDTC (diethylammonium-N,N-diethyl- dithio-carbamate) extraction with freon, reversed extraction back into water acidified with HNO_3 and reading using a graphite furnace atomic absorption electrothermal spectrometry or GFAAS.

50-250 mL of the acidified sample is transferred to a separator funnel, buffer is added to pH=4.75 and 20 mL of freon. The mixture is vigorously shaken for 120 seconds. After separation of the phases, the organic one is transferred to a 50 mL plastic bottle. The extraction is repeated with further 10 mL of freon, and the organic phase added to the first 20 mL after separation. 0.1 mL concentrated nitric acid is added to the organic phase. The bottle is vigorously shaken and let to stand at least 5 minutes. 4.9 mL deionized water is added and the solution is shaken; this process is repeated after 30 minutes. More acid and water are used for back-extraction if a greater volume of the solution is necessary for the determination.

Apparatus: Perkin Elmer 2380 AAS, HGA 500 (Perkin Elmer graphite furnace), AS 40 (Perkin Elmer autosampler), HCL (hollow cathode lamp).

Since 1999: Perkin Elmer Analyst 700.

332 Mercury in sea water (NIVA)

Sample-bottle preparation and sampling is the same procedure as 331.

$SnCl_2$ is added to 250 mL of acidified sample. The liberated mercury is driven off with air as carrier gas through a gold trap onto which the mercury is amalgamated. CVAAS (cold-vapour atomic absorption spectrometry) is used to quantify the sample. When all the mercury is trapped, the gold is heated to at least 500^0C, and the mercury is driven off by the carrier gas into a quartz cell where the atomic absorption signal is measured at 253.7 nm. Apparatus: Perkin Elmer 300SG AAS converted with gold trap.

Since 1988: a maximum of 100 mL sample used, diluted if Hg >50 ng/l; Perkin Elmer 1100 B with gold trap used, helium replaced air as carrier gas and lowest signal was 2.5 ng/l.

Since 1994: Perkin Elmer FIMS 400 with gold trap, lowest signal 1.0 ng/L. Argon was used as carrier gas.

3.2 Analyses of sediments

3.2.1 Sampling methods

code	*description*
	Sampling of sediment
GC	Reference: Niemistö 1974. Gravity corer with inner diameter of 50 mm.
GS	Grab sampler
	Methods of storage/preservation of sediment samples
01	Frozen (prior to inorganic analyses) and freeze dried (prior to organic analyses)
	Methods of grain size analysis of sediment
01	Dry sieving
	Methods of structural analysis of sediment
01	Visual observation through clear plastic cores
	Methods of sediment extraction
HFO	'Total' digestion with mineral acids including hydrofluoric acid (HF), in open vessels, evaporation of excess HF before analysis.
HNO	(outdated code = HNO1 3) Extraction with 1:1 HNO_3 (suprapur) for inorganic analyses on "fresh" (i.e., frozen) material.
EXN	(outdated code = EXN1 2) Extraction of (organic) contaminants by shaking with non-polar solvents cyclohexane/isopropanol (1:1 v/v) on freeze dried material.

3.2.2 Inorganic determinations

code ***description***

350 **Mercury in sediment (NIVA)**

Sample preparation

Samples are freeze dried, homogenated and digested in autoclave. (Freezing-drying of sediment has been practised since 1983).

Extraction (oxidation)

Approximately 1g of the sample is accurately weighed in Pyrex flasks, 20 mL 7N (concentrated) nitric acid (suprapur) is added and the solution heated 120°C for 30 min in an autoclave. The solution is transferred to a 100 mL volumetric flask and diluted to the mark with deionized water.

Determination

Prior to 1988: Mercury is determined by CVAAS (cold-vapour atomic absorption spectrometry), using the instrument Coleman Model MAS-50. 50 mL of the sample solution is transferred to the aeration flask. The lowest signal detectable corresponds to 0.03 µg mercury.

Since 1988: a maximum of 30 mL sample used, Perkin Elmer 1100 B with gold trap used, and helium replaced air as carrier gas and lowest signal was 0.010 µg/g (1g/100 mL)

Since 1994: FIMS 400 (Perkin Elmer) without gold trap, lowest signal 0.005 µg/g (1g/100 mL) Argon has been used as carrier gas.

351 **Aluminium, cadmium, cobalt, lead, lithium, chromium, copper, iron, manganese, nickel and zinc in sediment (NIVA)**

Same procedure as 350: #1-2, Drying and nitric acid Extraction.

Prior to 1992 (1990-91 JMP samples) 'total' extraction (HFO): Approximately 0.1g of the sample is accurately weighed in, 2 mL of hydrofluoric acid and 6 mL of concentrated nitric acid ('aqua regia') is added and the solution heated in a microwave oven. The solution is transferred to a 100 mL volumetric flask and diluted to the marked with deionized water.

Since 1992 'total' extraction (HFO): 0.2g of freeze dried homogenated sample is digested in Teflon vessels with 1 mL 'aqua regia' plus 6 mL hydrofluoric acid neutralised with boric acid and diluted to 100 mL. (cf., Loring D.H., Rantala, R.T.T., 1992. ICES manual for the geochemical analyses of marine sediment and suspended particulate matter).

Determinations by **flame atomic absorption spectrometry** using acetylene/air flame. Instrument: *Prior to 1986* a Perkin Elmer model 2380 was used and *since 1986* the PERKIN ELMER 560 has been used. For determinations of low concentrations (below detection limits) the flameless method (352) is used. The following are elements often analysed by flame and their respective detection limits of extract solution:

Since 1999: Perkin Elmer Analyst 700.

Element		µg/l
Al	**aluminium**	1000
Cr	**chromium**	50
Cu	**copper**	100
Fe	**iron**	200
Li	**lithium**	10
Mn	**manganese**	50
Ni	**nickel**	100
Zn	**zinc**	10

352 Aluminium, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, and nickel in seabed sediment (NIVA)

Graphite furnace absorption is used for low concentrations.

Same procedure as 350: #1-2, Drying and Extraction, otherwise same as procedure 351.

Concentrations are determined by **graphite furnace atomic absorption,** electrothermal spectrometry or GFAAS, using a hollow cathode lamp (HCL) or an electrodeless discharge lamp (EDL) as a light source. *Prior to 1986* a Perkin Elmer model 560 with HGA-500 graphite furnace was used and *since 1986* the Perkin Elmer 2380 has been used instead of the Perkin Elmer 560.

Since 1999: Perkin Elmer Analyst 700 and P.E. Zeeman 4100.

A 20 µl portion of extract, treated with HNO_3, is injected into graphite tube. The sample is then heated electrothermally in a stepwise manner through drying, ashing and atomisation by a programme designed for each element. The programme which controls the ramp time, holding time and temperature for each phase is often adjusted to achieve optimal results.

The elements analysed and approximated limit of detection for the extract are:

Element		µg/l
Al	**aluminium**	5
Cd	**cadmium**	0.1
Co	**cobalt**	5
Cr	**chromium**	0.5
Cu	**copper**	0.5
Fe	**iron**	5
Li	**lithium**	10
Mn	**manganese**	0.5
Ni	**nickel**	5
Pb	**lead**	0.5

353 Cadmium, chromium, nickel and lead in seabed sediment (NIVA)

As 352 but *since 1992* the L'vov platform technique is used for these metals.

354 Arsenic (NIVA)

Graphite furnace absorption is used for low concentrations.

650 Pb-210 dating (FORC)

Reference: Pheiffer-Madsen & Sørensen 1979.

Excerpt (Larsen & Jensen 1989): "The determination of time- dependent sediment parameters is based on the vertical distribution of the natural radioactive isotope lead-210 [= ^{210} Pb]. The content of unsupported lead-210, that lead-210 not produced in the sediment) decreases regularly downwards in undisturbed and steadily deposited sediment owing to radioactive decay. Departures from this predictable lead-210 profile in the topmost sediment column permit an assessment of mixing and/or intermittent erosion."

Dried slices of sediment are analysed.

3.2.3 Organic determinations

code ***description***

360 **PCB, QCB, OCS, HCB, DDTEP (p,p'DDE + p,p'DDT), HCHB, (b HCH), HCHG (g HCH = g BHC) in sediment (NIVA)**

Prior to 1990: the method is similar to SIIF method JAMP code 110.

Cleaning of chemicals and equipment

The equipment is washed with soap and water, rinsed first in water, then in distilled water and then with acetone. Finally, the glass equipment is heated to 550°C.

The equipment is washed with soap and water, then rinsed in 1:5 mixture of HNO_3 and H_2SO_4, respectively. Finally, the equipment is rinsed with acetone and cyclohexane.

All solvents are distilled in a special room for this purpose. Distilled water is shaken twice with distilled cyclohexane before use. Sodium sulphate is washed twice with distilled cyclohexane and heated to 550°C.

Extraction

10 g freeze dried, homogenised material is extracted twice with a mixture of the non-polar solvents cyclohexane/isopropanol (1:1 v/v). The two hour extraction is performed in a continuously shaken Erlenmeyer flask with 200 mL solvent mixture. The extraction is repeated with half solvent volume. The two extracts are combined and the cyclohexane phase separated by addition of 150+ mL distilled water (excess water relative to isopropanol). The isopropanol/water phase is decanted and the cyclohexane phase washed once with distilled water (several times if also determination of total persistent organic chlorine). The extract is dried over sodium sulphate and then weighed.

Clean-up of extract

2 mL cyclohexane extract is shaken vigorously with 2 mL concentrated sulphuric acid and then centrifuged. This process is repeated.

Gas chromatographic condition

Carlo Erba 2350 with electron-capture detector (ECD). Splitless injection at 70°C and then programmed temperature raise with 7°/min to 230°C. Column: 30mx0.259 mm (inner diameter), 0.25 µ DB-5 fused silica capillary column. Carrier gas: H_2, 0.8 bar.

Identification and quantification

The sample is quantified using 4-5 dominant peaks in the Clophen A60 standard.

Since 1990 the principle is the same but details have been altered as followed.

Since 1992: Samples are processed by NIVA method H3-1 and analysis follow NIVA method H3-3.

Cleaning of chemicals and equipment

The equipment is washed in soap and water, then rinsed in water and finally with acetone. The air-dried glass equipment is heated to 550°C.

All solvents are either distilled in a special room for this purpose or if the quality is satisfactory commercial solutions are used. Distilled water is shaken with distilled cyclohexane before use. Sodium sulphate is washed with distilled cyclohexane and heated to 550°C.

Since 1995 all solvents and chemicals are commercial and used as delivered.

Extraction

Since 1991/1992, *0*.5–5 g freeze dried, homogenised material, with internal standards added, is disintegrated/extracted twice with an ultrasonic disintegrator, and with acetone and cyclohexane (15:20) as the solvent. The two extracts are combined and the acetone/cyclohexane-extraction is washed twice with ion exchanged water.

Clean-up of extract

2 mL cyclohexane extract is shaken by whirl mixer with 6 mL concentrated sulphuric acid and then centrifuged. This process is repeated.

Since 1992

After extraction the samples are evaporated and filtrated using dichloromethane before clean-up using gel permeation chromatography (GPC). After the clean-up the sample solvent is changed back to cyclohexane again and the volume adjusted to 2 mL. The extract is them shaken twice with concentrated sulphuric acid and the organic phase isolated by centrifuging. Before analysis the sample volume is adjusted by evaporation with N_2.

Gas chromatographic condition

Analysis is performed using a HP 5890 Series II gas chromatograph with electron-capture detector (ECD). Samples are injected in a splitless mode at 90°C and then the oven temperature is raised by 3°/min to 280°C. The column used is a 60m x 0.25 mm ID fused silica column with 0.25 µm phase thickness, the phase is 5% phenyl 95% dimethyl siloxane. H_2 at a flow of 1-2 mL/min is used as carrier.

Identification and quantification

The individual PCB-congeners are identified by their retention times and quantified using internal standards and a eight-level calibration curve in the concentration range of the CBs in the solution to be analysed.

369 PAH in sediment (NIVA)

Extraction

Deuterated internal standards are added to about 0.5-5g of freeze dried sediment and the sample is extracted in Soxhlet with dichloromethane. The extract is then cleaned with DMF:water, or by silica gel, or both, if the extraction requires it. All the filtered extractions are rinsed with GPC, and the eluent is now dichloromethane. Afterwards the solvent is changed back to cyclohexane. Finally, the sample is evaporated to a small volume before GC analysis.

Determination by GC

PAHs are determined on GC coupled to mass-selective detector. The compounds are detected by their respective molecular ions and retention time and quantified by using National Institute for Standards and Technology (NIST) Certified Reference Material (CRM) numbers 1491 and 1941a. Corone and Dibenzopyrene are quantified with the help of in house standards.

760 PCB in sediment (IMRN)

PCB in total sediment (50 g) were extracted 3 times by acetone and hexane:Acetone (3:1) using repeated ultrasonication and agitation (Jensen *et al.* 1977).

Sulphur was removed with metallic mercury.

A florisil column (100-230 mesh, 30 cm x 6 mm ID) was used for the separation of the extract into 3 fractions. The first fraction eluted with 2 mL pentane was discarded; the second fraction eluted with 6.5 mL pentane contained PCB, HCB, aldrin, o,p-DDE, p,p-DDE and o,p-DDT; and the third fraction eluted with 10mL pentane:acetone (9:1) contained, alpha-HCH, beta-HCH, gamma-HCH (Lindane), o,p-DDD, p,p-DDD, o,p-DDT (20%) and p,p-DDT.

The third fraction needed further clean up on a neutral alumina column (30 cm x 6 mm ID; deactivated with 6% water). The chlorinated pesticides were eluted with 18 mL pentane. Beta-HCH was not eluted using this method.

A few samples (1990 sediment stations 15S-67S) were cleaned up before separation on the florisil column. A short silica column (10 cm x 6 mm ID) was used, followed by a alumina column (10 cm x 6 mm ID, acidic Al_2O_3). Pentane:dichloromethane (4:1) was used for elution of the compounds.

The chlorinated compounds were quantified on GC (ECD) using two different columns: SE-54 CB, fused silica, 50 m x 0.20 mm, 0.11 µm; SP-2330, fused silica, 60 m x 0.25 mm, 0.20 µm.

769 PAH in sediment (IMRN)

Ca.50 g of total sediment (< 2 mm) were extracted three times with acetone and hexane:acetone (3:1) using ultrasonication and agitation.

The clean-up of the extract was carried out on a short silica column (10 cm x 6 mm ID) using pentane:dichloromethane (9:1) as eluent. GC/MS equipped with a SE-54 fused silica capillary column (50 m x 0.20 mm ID, 0.11 µm film thickness) was used for the analysis of 2-6 ring aromatic hydrocarbons.

3.2.4 Organic carbon determinations

code ***description***

390 Total organic nitrogen and organic carbon (CORG) in sediment (NIVA)

5-8 mg of freeze dried sample is weighed in a tin-foiled capsule and heated to over 1800 °C in an oven. The carbon in the gas is analysed in a C-N 11O6 Carlo-Erba element analyser. Detection limit for C is 1 µg/mg and N is 1 µg/mg.

3.3 Analyses of marine biota

3.3.1 Inorganic determinations

code ***description***

120 Mercury in biota (SIIF)

Representative samples are homogenised in a whirlmixer.

1.0g sample is weighed into a special digestion apparatus with reflux (Bethge apparatus).

10 mL conc. HNO_3 and 1 mL 47% HBr is added and the solution boiled for approximately 30 min. under reflux.

The solution is cooled down to room temperature and diluted to volume into a 50 mL volumetric flask with distilled water.

Mercury is determined with CVAAS (cold-vapour atomic absorption spectrometry). Mercury is reduced with $SnCl_2$.

121 Mercury in shellfish (SIIF)

Same procedure as 120 but bomb digestion (pressurised decomposition) with HNO_3 at 160°C is used instead of pretreatment with HNO_3 and HBr.

130 Cadmium, lead, copper and nickel in biota (SIIF)

Representative samples are homogenised in a whirlmixer. 1g freeze dried sample is weighed into a vitrosil vessel and dried at 110°C to constant weight to determine the total water content.

The vessel is then placed in a cold muffle furnace and the temperature increased slowly to 450°C. The vessel is removed from the furnace and cooled down to room temperature. After wetting the ash with 1 mL conc. HNO_3 and approximately 2 mL H_3O, gentle heating on a hot plate is performed.

The final solution is diluted to volume into a 50 mL volumetric flask with distilled water.

Cadmium is determined after extraction with APDC and MIBK (ammonium-pyrrolidine-dithio-carbamate and methylisobutylketon) with flame atomic absorption spectrometry.

131 Zinc in biota (SIIF)

Same procedure as 130 (cadmium) but without extraction with APDC/MIBK.

132 Zinc and manganese in biota (SIIF)

Same procedure as 131 but quantified by ICP.

220 Mercury and selenium in fish (VETN)

Samples are digested in a mixture of nitric and perchloric acid and the mercury content is determined by CVAAS (cold- vapour atomic absorption spectrometry).

Reference: Haugen *et al.* 1985.

Abstract (Haugen *et al.* 1985)

Tissue samples are digested in a mixture of nitric and perchloric acid in a temperature programmable aluminium block. Maximum temperatures for the mercury and selenium determinations are 180 and 225°C, respectively. After reduction of hexavalent selenium with hydrochloric acid and dilution, the samples are transferred to a programmable sample changer. Both elements are determined with hydride generator producing a continuous, integratable signal. The precision at an absorbance reading of 0.4 is better than 1% and the quantification limit is better than 0.02 µg/g, when using a 1.0 g sample. Good agreement was obtained with other methods. Seven determinations of selenium in NBS bovine liver (1577a) gave an average of 0.71 µg Se/g, which is equivalent to the certified value.

230 Cadmium in fish (VETN)

Samples are digested by boiling with concentrated nitric acid (Suprapur) during several hours. The metal content is recorded by graphite furnace atomic absorption spectrometry. Quantification is based on standard addition to the digested samples.

240 Selenium in biota (VETN)

Reference: Norheim & Nymoen 1981.

Abstract (Norheim & Nymoen 1981)

The fluorimetric method is used, employing 2,3- diaminonaphtalene (DAN) as a complexing agent. The method uses 5 g of material in an automatic wet digestion procedure with 17 mL of 3+7 mixture of perchloric and nitric acid. The solution is heated slowly (225°C) in a thermostatically controlled aluminium block to distil off the nitric acid without charring. After digestion the hexavalent selenium is reduced with hydrochloric acid. EDTA (ethylenediaminetetraacetic acid) is added and aminoacetic acid is used as buffer. The pH is adjusted to 2.4 using a 35cm long electrode. DAN is added and the solution is heated at 60°C for 1hr. Finally, the solution is extracted with cyclohexane and the selenium content is measured fluorometrically on a Perkin Elmer Model 1000 filter instrument. The detection limit is 10 ppb wet weight.

310 Mercury in biota (NIVA)

Homogenising of large samples (e.g., fish fillet) by Tedal Quick Foodmaster Holberth silent cutter commercial use. Stainless steel blades are used. For smaller samples (e.g., liver) a Silverson 4R Homogeniser is used.

Drying procedure

An accurately weighed sample of approximately 1g is freeze dried until constant weight. If the sample has excessive fat content (e.g., fish liver, and therefore, can not be freeze-dried) the sample is dried at 105°C for one hour. The samples are cooled in a desiccator for one hour before weighing. Normally mercury is determined on wet samples and the water content is determined of a subsample.

Since 1991 (1990 JMP samples) extracts have been made from wet (fresh) samples.

Extraction (oxidation)

Prior to 1991: 50-200 mg freeze-dried sample is weighed in Teflon vessels, 2 mL concentrated nitric acid (suprapur) is added and capped loosely. The solution is heated for about 2 hrs. at 50°C in a thermostatically controlled aluminium block until foaming ceases. The temperature is raised to 110°C and kept there for 6-8 hrs. The solution is then cooled. For samples with high fat content (e.g., liver) 2 mL of 30% H_2O_2 is added and the solution is heated again to 110°C for 3-4hrs. After cooling the solution is diluted to 25 mL. For mercury samples approximately 200 mg material is used and the solution is diluted to 100 mL.

Since 1991: extracts are made from 0.2-0.5g dried or 1-2.5g wet sample. For wet samples, two alternative methods could be chosen: 1) 2-2.5g wet sample + 20 mL 1:1 HNO_3 to 100 mL in Pyrex vessels, or 2) 1-2g wet sample + 10 mL 1:1 HNO_3 to 50 mL, digested for 30 min in autoclave and then diluted to 50 mL in Teflon vessels. Pyrex vessels are used if mercury concentrations are to be determined along with other metals (e.g. blue mussel samples). If there is excessive fat in a sample 2 mL 30% hydrogen Pyroxide (H_2O_2) is added.

Since 1994: microwave digestion if mercury is determined together with other elements. *0*.5-1.5g wet sample and 5 mL concentrated HNO_3 - dilute to 50 mL.

Determination

Prior to 1988: Mercury is determined by CVAAS (cold-vapour atomic absorption spectrometry), using the instrument Coleman Model MAS-50. 50 mL of the sample solution is transferred to the aeration flask. Tin chloride is added as a reducing agent.

Since 1988: a maximum of 30 mL sample is used, up to concentrations 1.5 µg/l, and diluted if Hg in the solution is more than 1.5 µg/l. A PERKIN ELMER 1100 B with gold trap is used with helium as carrier gas.

Since 1994: FIMS 400 (Perkin Elmer) without gold trap. Lowest signal 0.005 µg/g. Argon is used as carrier gas.

311 Copper, iron and zinc in biota (NIVA)

(Same homogenising, drying and extraction procedure as 310.)

Determinations by flame atomic absorption spectrometry using acetylene/air flame. Instrument: *Prior to 1986* a Perkin Elmer model 2380 was used and *since 1986* the Perkin Elmer 560 has been used. For determinations of low concentrations (below detection limits) the flameless method (352) is used. The following are elements often analysed by flame and their respective detection limits of extract solution:

Element		µg/l
Cu	**copper**	50
Fe	**iron**	200
Zn	**zinc**	10

312 Arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, and zinc in biota (NIVA)

(Same homogenising, drying and extraction procedure as 310.)

Determination

Concentrations are determined by graphite furnace atomic absorption electrothermal spectrometry or GFAAS using a hollow cathode lamp (HCL) or an electrodeless discharge lamp (EDL) as a light source. *Prior to 1986* a Perkin Elmer model 560 with HGA-500 graphite furnace was used and *since 1986* the Perkin Elmer 2380 has been used instead of the Perkin Elmer 560.

A 20 µl portion of extract, treated with HNO_3, is injected into graphite tube. The sample is then heated electrothermally in a stepwise manner through drying, ashing and atomisation by a programme designed for each element. The programme which controls the ramp time, holding time and temperature for each phase is adjusted to achieve optimal results.

Since 1992 the GFAAS with Zeeman correction (Perkin Elmer Zeeman 4100) has been used for determination of cadmium and lead.

The elements analysed and approximated limit of detection for the extract are:

Element		µg/l
Al	**aluminium**	5
Cd	**cadmium**	0.1
Co	**cobalt**	5
Cr	**chromium**	0.5
Cu	**copper**	0.5
Fe	**iron**	5
Mn	**manganese**	0.5
Ni	**nickel**	5
Pb	**lead**	0.5
Zn	**zinc**	10
As	**Arsenic**	2

401 Mercury in biota (FIER)

References: Eliann & Julshamn 1978; Julshamn *et al.* 1982.

Abstract (Eliann & Julshamn 1978; Julshamn *et al.* 1982)

Representative samples are homogenised in a whirlmixer. About 1g of sample tissue is dried at 95°C for 24 hrs. 0.5 g sample is weighed into a special digestion apparatus with reflux (Bethge apparatus).

10 mL conc. HNO_3/H_2SO_4 (1+1) + V_2O_5 (0.1% w/v) are added. The solution is boiled for approximately 30 min under reflux.

The solution is cooled down to room temperature and diluted to volume into a 50 mL volumetric flask with distilled water and MnO_4.

Mercury is determined by CVAAS (cold-vapour atomic absorption spectrometry), EDL (electrodeless discharge lamp), wavelength = 253.6 nm, Perkin Elmer 370 AAS, Perkin Elmer mercury analysis system (303-0830 and 303-0832). Mercury is reduced with $SnCl_2$ to avoid interference with iodine.

Quantification is based on standard curves. Detection limit: dry weight sample. 5 ng/g.

402 Cadmium in biota (FIER)

References: Julshamn & Brækkan 1975; Julshamn 1977; Julshamn & Andersen 1983.

Abstract (Julshamn & Brækkan 1975; Julshamn 1977; Julshamn & Andersen 1983)

Representative samples are homogenised in a whirlmixer. 1 g of sample tissue is dried at 95°C for 24 hr. O.1 g sample is weighed into a Sovirel test-tube (20 mL). 2 mL conc. $HNO_3/HClO_4$ (9:1) is added and is boiled under pressure.

The solution is cooled down to room temperature and diluted to volume into a 10 mL volumetric flask with distilled water.

Concentrations are determined by graphite furnace atomic absorption electrothermal spectrometry or GFAAS, hollow cathode lamp (HCL), Perkin Elmer 5000 AAS, HGA 500 (Perkin Elmer graphite furnace), AS 50 (Perkin Elmer autosampler) and wavelength = 228.8 nm. Matrix modification reagent is $(NH_4)_2HPO_4$.

Quantification is based on standard addition to the digested samples: Amount added in the analyses: Cd 1 ng/mL. Detection limit for dry tissue sample: 0.5 ng/g.

403 Lead in biota (FIER)

(Same procedure as 402: par.#1 and #3-5).

Concentrations are determined by graphite furnace atomic absorption electrothermal spectrometry or GFAAS, EDL (electrodeless discharge lamp) Perkin Elmer 5000 AAS, HGA 500 (Perkin Elmer graphite furnace), AS 50 (Perkin Elmer autosampler) and wavelength = 283.3 nm. Matrix modification reagent is $(NH_4)_2HPO_4$.

Quantification is based on standard addition to the digested samples: amount added in the analysis Pb 10 ng/mL. Detection limit for wet tissue sample: 10 ng/g.

404 Copper in biota (FIER)

<u>with high Cu content (> 1.5 ppm d.w.)</u>

(Same procedure as 402: par.#1-5).

Concentrations are determined by flame AAS (atomic absorption spectrometry), HCL (hollow-cathode lamp, Perkin Elmer 370 AAS and wavelength = 324.7 nm without background correction.

<u>with low Cu content (< 1.5 ppm d.w.)</u>

(Same procedure as 402: par.#1-5).

Concentrations are determined by graphite furnace atomic absorption electrothermal spectrometry or GFAAS, HCL (hollow cathode lamp, Perkin Elmer 5000 AAS, HGA 500 (PERKIN ELMER graphite furnace), AS 50 (Perkin Elmer autosampler) and wavelength = 324.7 nm. No matrix modification reagent is used.

Quantification is based on standard addition to the digested samples: 10 ng/mL.

405 Zn in biota (FIER)

(Same procedure as 402: par.#1-5).

Concentrations are determined by flame AAS (atomic absorption spectrometry), HCL (hollow-cathode lamp, Perkin Elmer 370 AAS and wavelength = 213.9 nm without background correction.

Quantification is based on standard curves.

406 Arsenic in biota (FIER)

(Same procedure as 402: par.#4-5).

Concentrations are determined by graphite furnace atomic absorption electrothermal spectrometry or GFAAS, HCL (hollow- cathode lamp) Perkin Elmer 5000 AAS, HGA 500 (Perkin Elmer graphite furnace) with a conventional tube without platform, AS 50 (Perkin Elmer autosampler) and wavelength = 193.7 nm. Matrix modification reagent is a Ni-solution.

3.3.2 Organic determinations

code ***description***

110 PCB HCB DDTEP (p,p'DDE + p,p'DDT) HCHG (gHCH = gBHC) in fish and shellfish (SIIF)

Cleaning of chemicals and equipment

All solvents are distilled in a special room for this purpose. Distilled water is shaken twice with distilled cyclohexane before use. Sodium sulphate is washed twice with distilled cyclohexane and heated in the same way as the glass equipment.

Extraction

10 g wet, homogenised material is extracted twice with a mixture of cyclohexane/isopropanol (1:1 v/v). The two hour extraction is performed in a continuously shaken Erlenmeyer flask with 200 mL solvent mixture. The extraction is repeated with half solvent volume. The two extracts are combined and the cyclohexane phase separated by addition of 150+ mL distilled water (excess water relative to isopropanol). The isopropanol/water phase is decanted and the cyclohexane phase washed once with distilled water (several times if also determination of total persistent organic chlorine). The extract is dried over sodium sulphate and then weighed.

Determination of fat

A part of the cleaned and dried cyclohexane extract is evaporated in an oven to constant weight at 100°C.

Alternatively, the extract is evaporated to constant weight in a flask with Vigreux column in oil bath at 1 atm., 110°C and reflux or in vacuum, 50°C, reflux and weak N_2-stream.

The results are corrected for loss of cyclohexane. Cyclohexane output is calculated as sum cyclohexane extracts from first and second extraction (grams) minus fat in the same extract.

The precision of the fat determinations is roughly ±10%. Determinations are given to 0.1% fat. The two methods give comparable results.

Clean-up of extract

0.2 g fat is dissolved in 2 mL cyclohexane, shaken vigorously with 2 mL concentrated sulphuric acid and then centrifuged. For further clean-up about 1 mL of the sulphuric acid treated extract is treated with a solution of KOH.

Gas chromatographic condition

Hewlett-Packard 5730 A with ECD. Splitless injection at 60°C and then programmed temperature raise with 8°/min to 230°C. Column: 50mx0.3 mm (inner diameter), 0.15 µ SE-54 glass capillary column. Carrier gas: He, 20 psi.

Identification and quantification

By comparing the whole pattern with various commercial standard mixtures, it was found that Clophen A60 was in best accordance with the sample types. Some of the isomers in the PCB pattern were selected by comparison with standards of specific isomers and these were used for quantification:

SIIF code	CB code	Structure (-bifenyl)	name
3	**95**	2,3,6,2',5'	Pentachlorine
4	**101**	2,4,5,2',5'	Pentachlorine
9/	**149/**	2,4,5,2',3',6'/	Hexachlorine
10	**118**	2,4,5,3',4,	Pentachlorine
14	**138**	2,3,4,2',4',5'	Hexachlorine
15	**128**	2,3,4,2',3',4'	Hexachlorine
16	**180**	2,3,4,5,2',4',5'	Heptachlorine

By the GC conditions used it was not possible to separate isomers 9 and 10.

HCB, HCHG (gHCH=gBHC) and DDTEP (p,p'DDE + p,p'DDT) is determined by multi-level calibration curve. HCHG is identified and quantified by the breakdown product of HCHG (three trichlorobenzene peaks) after treatment with sodium hydroxide (NaOH)

111 PCB HCB DDTEP (p,p'DDE + p,p'DDT) HCHG (gHCH = gBHC) in fish and shellfish (SIIF)

Same procedure as 110, except that the organochlorine standard was Arochlor 1254 instead of Clophen A60 which is used earlier. The detection limit given for 1982 JMP data for this method is erroneously low. Corrected limits are given in the 1983 JMP data submitted.

The detection limit is dependant on sample quantity. For example the detection limit for HCHG is approximately: 0.1 ppb with 10 g dry weight material, 0.03 ppb with 25 g and 0.01 with 80 g.

Since 1991 CB204 has been used as an internal standard.

210 PCB, HCB, DDEPP in fish liver samples (VETN)

References: Bjerk & Sundby 1970; Norheim 1978.

Abstract (Norheim, 1978)

> Extraction: 0.5 g of sample is homogenised n a mortar with 2.5 g of anhydrous sodium sulphate and 2.5 g purified sand and allowed to stand overnight in the dark. After being mixed with 2 g magnesium sulphate, the dry powder is transferred to a short chromatographic column (20 mm x 10 cm) equipped with ground glass stoppers and elutriated with 2 x 10 mL diethyl ether. The column is carefully rotated to release air bubbles and the ether is allowed to stand for 2 hrs in the column before elutriation. The ether is evaporated in centrifuge tubes and the residue dissolved in 1.0 mL n-heptane. The extract is finally treated with 2.0 mL concentrated sulphuric acid for about 1 hour. 5 µl n-heptane is injected into the gas chromatograph.
>
> Quantification: Phenoclor DP6 is used as standard. The peak height of 2,4,5-2',4',5' hexachlorobiphenyl is used to quantify PCB.

211 PCB in fish filet samples (VETN)

Reference: Norheim & Økland 1980.

Abstract (Norheim & Økland, 1980)

> Apparatus: A Carlo Erba 2100 gas chromatograph equipped with a nickel-63 electron-capture detector and a 2 m x 3 mm (inner diameter) glass column is used. The column material is 1.5% SP-2250 - 15.9% SP-2401 on 100-120-mesh Supelcon AW DMCS. The column, injector and detector temperatures are 200, 250 and 275^0C, respectively. Argon
> -methane (95+5) is used as the carrier gas, the flow-rate being 55/mL/min. The electrometer attenuation is x128.
>
> Reagents: Sulphuric acid, 95-97%, was pro analysi grade (Merck). Heptane, was pro analysi grade (Merck). Hexachlorobenzene, was pract. grade (Fluka). Octachlorostyrene, was obtained as a gift from Norsk Hydro.
>
> Standard solutions: Amounts of 100 mg each of hexachlorobenzene and octachlorostyrene are dissolved in 100 mL of heptane and the mixture is diluted 1 + 50 000 with heptane.
>
> Procedure: A 0.5 g amount of sample is accurately weighed into a 10 mL Soveril glass tube fitted with a screw-cap, and 6 mL of concentrated sulphuric acid are measured into the tube. The tube is placed in a thermostatically controlled oven at 60°C for 4 hr, during which time it is shaken lightly a few times to ensure complete solubilisation of the sample. After cooling, 1.0 mL of heptane is pipetted into the tube, the screw-cap put on and the tube shaken for about 3 min. Finally, the tube is centrifuged with the screw-cap on, after which the sample is ready for gas chromatography. An injection volume of 5 µl is used.
>
> Quantification: The same standard and isomer as in 210 are used to quantify the sample.

309 PAH in biota (NIVA)

Extraction

Deuterated internal standards are added to about 10-20 g (dependent on available material) of homogenised wet sample, and the sample is then saponified with KOH/methanol. After filtering through a glass filter, the solution is extracted with n-pentane. The extract is sometimes then cleaned with partition with DMF:water, or by silica gel, or both, if the extraction requires it. All the filtrated extractions are rinsed with GPC, and the eluent is now dichloromethane. Afterwards we change the solvent back to cyclohexane, and finally, the sample is evaporated to a small volume before GC analysis. GPC was first introduced in 1992.

An aliquot if the homogenised sample is used for dry weight determination.

Determination by GC

PAHs are determined on GC coupled to mass-selective detector. The compounds are detected by their respective molecular ions and retention time and quantified by using National Institute for Standards and Technology (NIST) Certified Reference Material

(CRM) number 1491 and number SRM 2974 for blue mussel samples. Coronen and Dibenzopyrener are quantified with the help of in house standards.

340 PCB, QCB, OCS, HCB, DDTEP (p,p'DDE + p,p'DDT), HCHB, (b HCH), HCHG (g HCH = g BHC) in fish liver (NIVA)

Prior to 1991 (1987 JMP NIVA samples): Equivalent to SIIF method 111 with the following exception:

Determination of fat

The extract is evaporated to constant weight in a flask with Vigreux column in oil bath at 1 atm., 110°C and reflux or in vacuum, 50°C, reflux and weak N_2-stream.

The results are corrected for loss of cyclohexane. Cyclohexane output is calculated as sum cyclohexane extracts from first and second extraction (grams) minus fat in the same extract.

Since 1991 (1990 JAMP samples):

Cleaning of chemicals and equipment

The equipment is washed in soap and water, then rinsed in water and finally with acetone. The air-dried glass equipment is heated to 550°C.

All solvents are distilled in a special room for this purpose or if the quality is satisfactory commercial solutions are used. Sodium sulphate is washed twice with distilled cyclohexane and heated to 550°C.

Since 1995 all solvents and chemicals are commercial and used as delivered. Ion exchanged water is shaken with cyclohexane before use, if it is supposed to blend with the extraction solvent.

Extraction

About 2 g (depending on species/tissue) of wet, homogenised material is extracted twice by ultrasonic disintegration with a mixture of cyclohexane:acetone (20:15).

Determination of dry weight

The percent dry weight in sediments and biological material is determined by drying an accurately weighed sample (2-5 g) at 105 °C over night (until dryness). The sampled is cooled in a desiccator and weighed again.

Determination of fat

The cyclohexane extract is evaporated in an oven to constant weight at 105°C.

The precision of the fat determinations is roughly ±10%. Determinations are reported with two significant figures.

Clean-up of extract

About 0.1g fat is dissolved in 2 mL cyclohexane, shaken with 6 mL concentrated sulphuric acid and then centrifuged. For further clean-up about 1 mL of the sulphuric acid treated extract may be treated with a solution of KOH.

Since 1994
Internal standards is added to an exact amount of fat, then dissolved in dichloromethane, and the filtrated extract is rinsed with GPC. Afterwards the solvent is changed back to cyclohexane and the volume adjusted to 2 mL. The extract is then shaken twice by whirlmixer with concentrated sulphuric acid and centrifuged. Finally, the sample is evaporated to a small volume before GC analysis.

Gas chromatographic condition

Since 1992
Analysis is performed using a HP 5890 Series II gas chromatograph with electron-capture detector (ECD). Samples are injected in a splitless mode at 90°C and then the oven temperature is raised by 3°/min to 280°C. The column used is a 60 m x 0.25 mm ID fused silica column with 0.25 µm phase thickness, the phase is 5% phenyl 95% dimethyl siloxane. H_2 at a flow of 1-2 mL/min is used as carrier.

Identification and quantification

The individual PCB-congeners are identified by their retention times and quantified using internal standards and a eight-level calibration curve in the concentration range of the CBs in the solution to be analysed.

Detection limits: 1-5 µg/kg and somewhat higher than 0.05 µg/kg for fillet and 0.1 µg/kg for blue mussels (cf. no. 341)

341 PCB, QCB, OCS, HCB, DDTEP (p,p'DDE + p,p'DDT), HCHB, (b HCH), HCHG (g HCH = g BHC) in shellfish and fish fillet (NIVA)

Same procedure as 340: except that the internal standards are added before the extraction procedure, and the detection limits are different from fish liver samples.

Detection limits: 0.05 µg/kg for fillet and 0.1 µg/kg for blue mussels, and some what lower than 1-5 µg/kg for liver samples (cf. no. 340)

510 PCB, HCB,DDEPP (p,p'DDE), DDTPP (p,p'DDT), HCHG (g HCH = g BHC) in fish liver (NACE)

Pretreatment and fat determinations: Samples are homogenised in a Waring blender. Homogenised liver samples are ground in a mortar with sea sand and anhydrous sodium sulphate and allowed to stand overnight. The samples are mixed with magnesium-sulphate, transferred to a glass column with sintered glass fritt and extracted with diethyl ether. The ether is collected in pre-weighed tubes, evaporated and the amount of fat determined by weighing.

The fat extract is dissolved in hexane for pesticide analyses and treated with concentrated sulphuric acid with gentle agitation. After centrifugation the hexane phase is used for gas chromatography (GC) analysis for pesticides and PCBs. An aliquot of the hexane phase is

also treated with sodium alcoholate to convert p,p'DDT to p,p'DDE for the determination of DDT by the increase in DDE.

Moisture content: samples are dried in an oven overnight (16hr) at 105^0C, equilibrated in a desiccator for 1hr and re-weighed. Filet samples are also dried for 72hr at 45°C for later determination of mercury.

GC analyses: a Perkin Elmer 8500 GC equipped with an auto-sampler and an electron capture detector (Ni-63) and connected to a 7500 computer with Chrom 3 software is used. The column is a glass 2 m x 1/4", 2 mm (inner diameter) packed with 1.5% SP-2250/1.95% SP-2400 on Suplecoport 100/120. The carrier gas is argon with 5% methane at a flow rate of 40 mL/min. The oven temperature is 210^0C, with the injector at 250°C and the detector at 300°C. The amount of sample injected is 2 µl and the analysis takes 40 min.

Reference standards: commercially available Aroclor 1242, Aroclor 1254, Aroclor 1260 and Supelco's CP pesticide mix are used in addition to a special mixture containing Phenoclor DPG (60% chlorination), hexachlorobenzene (HCB), octachlorostyrene (OCS), p,p'-DDE and decachlorobiphenyl (DCB).

Quantification: response factors are calculated from the integrated areas for each component and the amount injected. The corresponding peaks for the samples are integrated and the concentrations calculated from the area and the response factor. A simplified method for the calculation of the concentrations of PCBs is used. This is based on using the area for the peak in the Phenoclor standard corresponding to 2,4,5,2',4',5'-hexachlorobiphenyl and the total amount of PCB components injected. The concentrations for samples are calculated from the area of the peak corresponding to that used in the standard. This requires that the pattern of PCB components in the sample corresponds to that of the Phenoclor standard.

Detection limits: the minimum detectable amount corresponds to 0.01 µg/g wet weight for liver samples. This gives minimum quantification limits of 0.04 µg/g for PCB.

511 PCB in fish filet (NACE)

Pretreatment: Homogenised filet samples are treated with concentrated sulphuric acid for 4hr at 60°C and PCBs extracted with hexane. After centrifugation the hexane phase is used for gas chromatography (GC) analysis.

(Same procedure as 510: par.#3-6).

Detection limits: the minimum detectable amount corresponds to 0.005 µg/g wet weight for liver samples. This gives minimum quantification limits of 0.02 µg/g.

605 EPOCl in shellfish (SIIF)

The cyclohexane extract from chlorinated hydrocarbon analysis is reduced in volume (by evaporation) and treated with concentrated H_2SO_4 until the extract is clear. An aliquot is sent to the Institute for Energy Technology (Kjeller, Norway) to be exposed to neutron bombardment in a JEEP II atomic reactor. The radioactivity of the persistent chlorine isotope is measured and quantified against a complete procedural blank.

The detection limit is 5 ppb wet weight.

610 EPOCl in fish liver (NACE)

Same procedure as 605 but higher detection limit.

The detection limit is 800 ppb wet weight.

615 EPOCl in fish liver (NIVA)

Same procedure as 605

The detection limit is 40 ppb wet weight.

320 TBT in biota (NIVA)

Reference: Følsvik *et al.* 1999.

Pretreatment: An internal standard is added to the samples which are mixed with the tissue solubilizer and left in the dark over night. Samples pH are then adjusted before derivatization with $NaBEt_4$, n-hexane is added simultaneously to extract the derivatized, lipophilic species. The derivatization/extraction procedure is repeated once and the combined organic phase is then dried with anhydrous Na_2SO_4 before clean-up by gel permeation chromatography.

Chemical analysis: Analysis of organotin compounds is carried out by means of a HP 5890A gas chromatograph equipped with a HP 5921A atomic emission detector. The samples are routinely analysed on a 30 m x 0.32 mm x 0.25 µm crosslinked 5 % phenyl methyl siloxane capillary column. The column is maintained at 50 °C for 5 min and the temperature is then increased by 15 °C/min to 230 °C. Emission intensities for tin (271 nm) and carbon (248 nm) are measured by the photodiode array detector and chromatograms recorded by a HP 35920A GC-AED ChemStation.

3.3.3 Fat determinations

code	*description*
A	Weight of extracted solids during chlorinated hydrocarbon determinations: procedure 110 (SIIF).
B	Weight of extracted solids during chlorinated hydrocarbon determinations: procedure 510 (NACE and VETN).
C	Weight of extracted solids from freeze dried material using ethyl acetate (FIER).
D	Weight of extracted solids during chlorinated hydrocarbon determinations: procedure 340 (NIVA).

4. References

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Appendix A
Abbreviations

Abbreviation[1]	English	*Norwegian*
ELEMENTS		
Al	aluminium	*aluminium*
As	arsenic	*arsen*
Cd	cadmium	*kadmium*
Co	cobalt	*kobolt*
Cr	chromium	*krom*
Cu	copper	*kobber*
Fe	iron	*jern*
Hg	mercury	*kvikksølv*
Li	lithium	*litium*
Mn	manganese	*mangan*
Ni	nickel	*nikkel*
Pb	lead	*bly*
Pb210	lead-210	*bly-210*
Se	selenium	*selen*
Ti	titanium	*titan*
Zn	zinc	*sink*
PAHs		
PAH	polycyclic aromatic hydrocarbons	*polysykliske aromatiske hydrokarboner*
ACNE	acenaphthene	*acenaften*
ACNLE	acenaphthylene	*acenaftylen*
ANT	anthracene	*antracen*
BAA [3]	benzo[*a*]anthracene	*benzo[a]antracen*
BAP [3]	benzo[*a*]pyrene	*benzo[a]pyren*
BBF [3]	benzo[*b*]fluoranthene	*benzo[b]fluoranten*
BBJKF [3]	benzo[*b,j,k*]fluoranthene	*benzo[b,j,k]fluoranten*
BBJKF [3]	benzo[b+j,k]fluoranthene	*benzo[b+j,k]fluoranten*
BBKF [3]	benzo[*b+k*]fluoranthene	*benzo[b+k]fluoranten*
BEP	benzo[*e*]pyrene	*benzo[e]pyren*
BGHIP	benzo[*ghi*]perylene	*benzo[ghi]perylen*
BIPN [2]	biphenyl	*bifenyl*
BJKF [3]	benzo[*j,k*]fluoranthene	*benzo[j,k]fluorantren*
BKF [3]	benzo[*k*]fluoranthene	*benzo[k]fluorantren*
CHR	chrysene	*chrysen*
CHRTR	chrysene+triphenylene	*chrysen+trifenylen*
COR	coronene	*coronen*
DBAHA [3]	dibenz[*a,h*]anthracene	*dibenz[a,h]anthracen*
DBA3A [3]	dibenz[*a,c/a,h*]anthracene	*dibenz[a,c/a,h]antracen*
DBP [3]	dibenzopyrenes	*dibenzopyren*
DBT	dibenzothiophene	*dibenzothiofen*
DBTC1	C_1-dibenzothiophenes	*C_1-dibenzotiofen*
DBTC2	C_2-dibenzothiophenes	*C_2-dibenzotiofen*
DBTC3	C_3-dibenzothiophenes	*C_3-dibenzotiofen*
FLE	fluorene	*fluoren*
FLU	fluoranthene	*fluoranten*

Abbreviation[1]	English	*Norwegian*
PAHs (cont.)		
ICDP [3]	indeno[*1,2,3-cd*]pyrene	*indeno[1,2,3-cd]pyren*
NAP [2]	naphthalene	*naftalen*
NAPC1 [2]	C_1-naphthalenes	*C_1-naftalen*
NAPC2 [2]	C_2-naphthalenes	*C_2-naftalen*
NAPC3 [2]	C_3-naphthalenes	*C_3-naftalen*
NAP1M [2]	1-methylnaphthalene	*1-metylnaftalen*
NAP2M [2]	2-methylnaphthalene	*2-metylnaftalen*
NAPD2 [2]	1,6-dimethylnaphthalene	*1,6-dimetylnaftalen*
NAPD3 [2]	1,5-dimethylnaphthalene	*1,5-dimetylnaftalen*
NAPDI [2]	2,6-dimethylnaphthalene	*2,6-dimetylnaftalen*
NAPT2 [2]	2,3,6-trimethylnaphthalene	*2,3,6-trimetylnaftalen*
NAPT3 [2]	1,2,4-trimethylnaphthalene	*1,2,4-trimetylnaftalen*
NAPT4 [2]	1,2,3-trimethylnaphthalene	*1,2,3-trimetylnaftalen*
NAPTM [2]	2,3,5-trimethylnaphthalene	*2,3,5-trimetylnaftalen*
NPD	Collective term for naphthalenes, phenanthrenes and dibenzothiophenes	*Sammebetegnelse for naftalen, fenantren og dibenzotiofens*
PA	phenanthrene	*fenantren*
PAC1	C_1-phenanthrenes	*C_1-fenantren*
PAC2	C_2-phenanthrenes	*C_2-fenantren*
PAM1	1-methylphenanthrene	*1-metylfenantren*
PAM2	2-methylphenanthrene	*2-metylfenantren*
PAMD1	3,6-dimethylphenanthrene	*3,6-dimetylfenantren*
PAMD2	9,10-dimethylphenanthrene	*9,10-dimetylfenantren*
PER	perylene	*perylen*
PYR	pyrene	*pyren*
DI-Σn	sum of "n" dicyclic "PAH"s (footnote 2)	*sum "n" disykliske "PAH" (fotnote 2)*
P-Σn	sum "n" PAH	*sum "n" PAH*
PK-Σn	sum carcinogen PAH's (footnote 3)	*sum kreftfremkallende PAH (fotnote 3)*
PAHΣΣ	DI-Σn + P-Σn etc.	*DI-Σn + P-Σn mm..*
SPAH	"total" PAH, specific compounds not quantified (outdated analytical method)	*"total" PAH, spesifikk forbindelser ikke kvantifisert (foreldret metode)*

Abbreviations (cont'd.)

Abbreviation[1]	English	*Norwegian*
PCBs		
PCB	polychlorinated biphenyls	*polyklorerte bifenyler*
CB	individual chlorobiphenyls (CB)	*enkelte klorobifenyl*
CB28	CB28 (IUPAC)	*CB28 (IUPAC)*
CB31	CB31 (IUPAC)	*CB31 (IUPAC)*
CB44	CB44 (IUPAC)	*CB44 (IUPAC)*
CB52	CB52 (IUPAC)	*CB52 (IUPAC)*
CB77 [4]	CB77 (IUPAC)	*CB77 (IUPAC)*
CB81 [4]	CB81 (IUPAC)	*CB81 (IUPAC)*
CB95	CB95 (IUPAC)	*CB95 (IUPAC)*
CB101	CB101 (IUPAC)	*CB101 (IUPAC)*
CB105	CB105 (IUPAC)	*CB105 (IUPAC)*
CB110	CB110 (IUPAC)	*CB110 (IUPAC)*
CB118	CB118 (IUPAC)	*CB118 (IUPAC)*
CB126 [4]	CB126 (IUPAC)	*CB126 (IUPAC)*
CB128	CB128 (IUPAC)	*CB128 (IUPAC)*
CB138	CB138 (IUPAC)	*CB138 (IUPAC)*
CB149	CB149 (IUPAC)	*CB149 (IUPAC)*
CB153	CB153 (IUPAC)	*CB153 (IUPAC)*
CB156	CB156 (IUPAC)	*CB156 (IUPAC)*
CB169 [4]	CB169 (IUPAC)	*CB169 (IUPAC)*
CB170	CB170 (IUPAC)	*CB170 (IUPAC)*
CB180	CB180 (IUPAC)	*CB180 (IUPAC)*
CB194	CB194 (IUPAC)	*CB194 (IUPAC)*
CB209	CB209 (IUPAC)	*CB209 (IUPAC)*
CB-Σ7	CB: 28+52+101+118+138+153+180	*CB: 28+52+101+118+138+153+180*
CB-ΣΣ	sum of CBs, includes CB-Σ7	*sum CBer, inkluderer CB-Σ7*
TECBW	Sum of CB-toxicity equivalents after WHO model, see **TEQ**	*Sum CB- toksitets ekvivalenter etter WHO modell, se **TEQ***
TECBS	Sum of CB-toxicity equivalents after SAFE model, see **TEQ**	*Sum CB-toksitets ekvivalenter etter SAFE modell, se **TEQ***

Abbreviations (cont'd.)

Abbreviation[1]	English	*Norwegian*
DIOXINs		
TCDD	2, 3, 7, 8-tetrachloro-dibenzo dioxin	*2, 3, 7, 8-tetrakloro-dibenzo dioksin*
CDDST	Sum of tetrachloro-dibenzo dioxins	*Sum tetrakloro-dibenzo dioksiner*
CDD1N	1, 2, 3, 7, 8-pentachloro-dibenzo dioxin	*1, 2, 3, 7, 8-pentakloro-dibenzo dioksin*
CDDSN	Sum of pentachloro-dibenzo dioxins	*Sum pentakloro-dibenzo dioksiner*
CDD4X	1, 2, 3, 4, 7, 8-hexachloro-dibenzo dioxin	*1, 2, 3, 4, 7, 8-heksakloro-dibenzo dioksin*
CDD6X	1, 2, 3, 6, 7, 8-hexachloro-dibenzo dioxin	*1, 2, 3, 6, 7, 8-heksakloro-dibenzo dioksin*
CDD9X	1, 2, 3, 7, 8, 9-hexachloro-dibenzo dioxin	*1, 2, 3, 7, 8, 9-heksakloro-dibenzo dioksin*
CDDSX	Sum of hexachloro-dibenzo dioxins	*Sum heksakloro-dibenzo dioksiner*
CDD6P	1, 2, 3, 4, 6, 7, 8-heptachloro-dibenzo dioxin	*1, 2, 3, 4, 6, 7, 8-heptakloro-dibenzo dioksin*
CDDSH	Sum of heptachloro-dibenzo dioxins	*Sum heptakloro-dibenzo dioksiner*
CDDO	Octachloro-dibenzo dioxin	*Oktakloro-dibenzo dioksin*
PCDD	Sum of polychlorinated dibenzo-p-dioxins	*Sum polyklorinaterte-dibenzo-p-dioksiner*
CDF2T	2, 3, 7, 8-tetrachloro-dibenzofuran	*2, 3, 7, 8-tetrakloro-dibenzofuran*
CDFST	Sum of tetrachloro-dibenzofurans	*Sum tetrakloro-dibenzofuraner*
CDFDN	1, 2, 3, 7, 8/1, 2, 3, 4, 8-pentachloro-dibenzofuran	*1, 2, 3, 7, 8/1, 2, 3, 4, 8-pentakloro-dibenzofuran*
CDF2N	2, 3, 4, 7, 8-pentachloro-dibenzofurans	*2, 3, 4, 7, 8-pentakloro-dibenzofuran*
CDFSN	Sum of pentachloro-dibenzofurans	*Sum pentakloro-dibenzofuraner*
CDFDX	1, 2, 3, 4, 7, 8/1, 2, 3, 4, 7, 9-hexachloro-dibenzofuran	*1, 2, 3, 4, 7, 8/1, 2, 3, 4, 7, 9-heksakloro-dibenzofuran*
CDF6X	1, 2, 3, 6, 7, 8-hexachloro-dibenzofuran	*1, 2, 3, 6, 7, 8-heksakloro-dibenzofuran*
CDF9X	1, 2, 3, 7, 8, 9-hexachloro-dibenzofuran	*1, 2, 3, 7, 8, 9-heksakloro-dibenzofuran*
CDF4X	2, 3, 4, 6, 7, 8-hexachloro-dibenzofuran	*2, 3, 4, 6, 7, 8-heksakloro-dibenzofuran*
CDFSX	Sum of hexachloro-dibenzofurans	*Sum heksakloro-dibenzofuraner*
CDF6P	1, 2, 3, 4, 6, 7, 8-heptachloro-dibenzofuran	*1, 2, 3, 4, 6, 7, 8-heptakloro-dibenzofuran*
CDF9P	1, 2, 3, 4, 7, 8, 9-heptachloro-dibenzofuran	*1, 2, 3, 4, 7, 8, 9-heptakloro-dibenzofuran*
CDFSP	Sum of heptachloro-dibenzofurans	*Sum heptakloro-dibenzofuraner*
CDFO	Octachloro-dibenzofurans	*Octakloro-dibenzofuran*
PCDF	Sum of polychlorinated dibenzo-furans	*Sum polyklorinated dibenzo-furaner*
CDDFS	Sum of PCDD and PCDF	*Sum PCDD og PCDF*
TCDDN	Sum of TCDD-toxicity equivalents after Nordic model, see **TEQ**	*Sum TCDD- toksitets ekvivalenter etter Nordisk modell, se **TEQ***
TCDDI	Sum of TCDD-toxicity equivalents after international model, see **TEQ**	*Sum TCDD-toksitets ekvivalenter etter internasjonale modell, se **TEQ***

Abbreviations (cont'd.)

Abbreviation[1]	English	*Norwegian*
PESTICIDES		
ALD	aldrin	*aldrin*
DIELD	dieldrin	*dieldrin*
ENDA	endrin	*endrin*
CCDAN	cis-chlordane (=α-chlordane)	*cis-klordan (=α-klordan)*
TCDAN	trans-chlordane (=γ-chlordane)	*trans-klordan (=γ-klordan)*
OCDAN	oxy-chlordane	*oksy-klordan*
TNONC	trans-nonachlor	*trans-nonaklor*
TCDAN	trans-chlordane	*trans-klordan*
OCS	octachlorostyrene	*oktaklorstyren*
QCB	pentachlorobenzene	*pentaklorbenzen*
DDD	ɔdiphenyldichloroethane	*diklordifenyldikloretan*
	1,1-dichloro-2,2-bis-(4-chlorophenyl)ethane	*1,1-dikloro-2,2-bis-(4-klorofenyl)etan*
DDE	dichlorodiphenyldichloroethylene (principle metabolite of DDT)	*diklordifenyldikloretylen (hovedmetabolitt av DDT)*
	1,1-dichloro-2,2-bis-(4-chlorophenyl)ethylene*	*1,1-dikloro-2,2-bis-(4-klorofenyl)etylen*
DDT	ɔdiphenyltrichloroethane	*diklordifenyltrikloretan*
	1,1,1-trichloro-2,2-bis-(4-chlorophenyl)ethane	*1,1,1-trikloro-2,2-bis-(4-klorofenyl)etan*
DDEOP	o,p'-DDE	*o,p'-DDE*
DDEPP	p,p'-DDE	*p,p'-DDE*
DDTOP	o,p'-DDT	*o,p'-DDT*
DDTPP	p,p'-DDT	*p,p'-DDT*
TDEPP	p,p'-DDD	*p,p'-DDD*
DDTEP	p,p'-DDE + p,p'-DDT	*p,p'-DDE + p,p'-DDT*
DD-nΣ	sum of DDT and metabolites, n = number of compounds	*sum DDT og metabolitter, n = antall forbindelser*
HCB	hexachlorobenzene	*heksaklorbenzen*
HCHG	Lindane	*Lindan*
	γ HCH = gamma hexachlorocyclohexane	*γ HCH = gamma heksaklorsykloheksan*
	(γ BHC = gamma benzenehexachloride, outdated synonym)	*(γ BHC = gamma benzenheksaklorid, foreldret betegnelse)*
HCHA	α HCH = alpha HCH	*α HCH = alpha HCH*
HCHB	β HCH = beta HCH	*β HCH = beta HCH*
HC-nΣ	sum of HCHs, n = count	*sum av HCHs, n = antall*
EOCl	extractable organically bound chlorine	*ekstraherbart organisk bundet klor*
EPOCl	extractable persistent organically bound chlorine	*ekstraherbart persistent organisk bundet klor*
NTOT	total organic nitrogen	*total organisk nitrogen*
CTOT	total organic carbon	*total organisk karbon*
CORG	organic carbon	*organisk karbon*
GSAMT	grain size	*kornfordeling*
MOCON	moisture content	*vanninnhold*

Abbreviations (cont'd.)

Abbreviation[1]	English	*Norwegian*
INSTITUTES		
IFEN	Institute for Energy Technology (IFE)	*Institutt for energiteknikk (IFE)*
FIER	Institute for Nutrition, Fisheries Directorate	*Fiskeridirektoratets Ernæringsinstitutt*
FORC	FORCE Institutes, Div. for Isotope Technique and Analysis [DK]	*FORCE Institutterne, Div. for Isotopteknik og Analyse [DK]*
IMRN	Institute of Marine Research (IMR)	*Havforskningsinstituttet*
NACE	Nordic Analytical Center	*Nordisk Analyse Center*
NILU	Norwegian Institute for Air Research	*Norsk institutt forluftforskning*
NIVA	Norwegian Institute for Water Research	*Norsk institutt for vannforskning*
SERI	Swedish Environmental Research Institute	*Institutionen för vatten- och luftvårdsforskning*
VETN	Norwegian Veterinary Institute	*Veterinærinstituttet*
SIIF	Fondation for Scientific and Industrial Research at the Norwegian Institute of Technology - SINTEF (a division, previously: Center for Industrial Research SI)	*Stiftelsen for industriell og teknisk forskning ved Norges tekniske høgskole- SINTEF (en avdeling, tidligere: Senter for industriforskning SI)*

1) After: ICES Environmental Data Reporting Formats. International Council for the Exploration of the Sea. July 1996 and supplementary codes related to non-ortho and mono-ortho PCB's and "dioxins" (ICES pers. comm.)

2) Indicates "PAH" compounds that are dicyclic and not truly PAH's typically identified during the analyses of PAH, include naphthalenes and "biphenyls".

3) Indicates PAH compounds potentially cancerogenic for humans according to IARC (1987), i.e., categories 2A+2B (possibly and probably carcinogenic).

4) Indicates non ortho- co-planer PCB compounds ie., those that lack Cl in positions 1, 1', 5, and 5'

*) The Pesticide Index, second edition. The Royal Society of Chemistry, 1991.

Other abbreviations *andre forkortelser*

	English	*Norwegian*
TEQ	"Toxicity equivalency factors" for the most toxic compounds within the following groups:	*"Toxisitetsekvivalentfaktorer" for de giftigste forbindelsene innen følgende grupper.*
	• polychlorinated dibenzo-p-dioxins and dibenzofurans (**PCDD/PCDFs**). Equivalents calculated after Nordic model (Ahlborg *et al.*, 1989) [1] or international model (Int./EPA, cf. Van den Berg *et al.*, 1998) [2]	• *polyklorerte dibenzo-p-dioksiner og dibenzofuraner (**PCDD/PCDF**). Ekvivalentberegning etter nordisk modell (Ahlborg et al., 1989) [1] eller etter internasjonal modell (Int./EPA, cf. Van den Berg et al. 1998) [2]*
	• non-ortho and mono-ortho substituted chlorobiphenyls after WHO model (Ahlborg *et al.*, 1994) [3] or Safe (1994, cf. NILU pers. comm.)	• *non-orto og mono-orto substituerte klorobifenyler etter WHO modell (Ahlborg et al., 1994) [3] eller Safe (1994, cf. NILU pers. medd.)*
ppm	parts per million, mg/kg	*deler pr. milliondeler, mg/kg*
ppb	parts per billion, µg/kg	*deler pr. milliarddeler, µg/kg*
ppp	parts per trillion, ng/kg	*deler pr. tusen-milliarddeler, ng/kg*
d.w.	dry weight basis	*tørrvekt basis*
w.w.	wet weight or fresh weight basis	*våtvekt eller friskvekt basis*

[1]) Ahlborg, U.G., 1989. Nordic risk assessment of PCDDs and PCDFs. Chemosphere 19:603-608.

[2]) Van den Berg, Birnbaum, L, Bosveld, A. T. C. and co-workers, 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environ Hlth. Perspect. 106:775-792.

[3]) Ahlborg, U.G., Becking G.B., Birnbaum, L.S., Brouwer, A, Derks, H.J.G.M., Feely, M., Golor, G., Hanberg, A., Larsen, J.C., J.C., Liem, A.K.G., Safe, S.H., Schlatter, C., Wärn, F., Younes, M., Yrjänheikki, E., 1994. Toxic equivalency factors for dioxin-like PCBs. Report on a WHO-ECEH and IPSC consultation , December 1993. Chemosphere 28:1049-1067.

Appendix B
Participation in intercalibration exercises

Participation in intercalibration exercises

General: NIVA which has participated in all QUASIMEME exercises relevant to the parameter and tissues monitored. The laboratories at NIVA, both the chemical, microbiological and the ecotoxicological laboratories, were accredited in 1993 for quality assurance system by the National Measurement Service - Norwegian Accreditation and based on European Standard EN45000. NIVA has reference number P009.

Sea water:

4H ICES/JMG Fifth Round Intercalibration on Trace Metals in Sea Water - Section 4, analysis for Hg - 1983 - (5/TM/SW:4).

4I JMG Sixth Intercalibration on Trace Metals in Estuarine Waters - 1986 - (6/TM/SW).

4Z Intercalibration exercise for SIIF/SERI (Cd) and NIVA/IAMK (IAMK=Chalmers Inst., Göteborg) - 1985.

Seabed sediment:

7E ICES, First Intercalibration Exercise on Trace metals in Marine Sediments - 1984 - (1/TM/MS).

8B ICES/OSPAR, First Intercomparison Exercise on Organochlorines (individual chlorobiphenyl congeners) in Marine Sediments - Phase 1, analysis of standard solutions - 1989 - (1/OC/MS:1).

8C ICES/OSPAR, First Intercomparison Exercise on Organochlorines (individual chlorobiphenyl congeners) in Marine Sediments - Phase 2, analysis of standard solutions - 1991 - (1/OC/MS:2).

8B ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 1 - (analysis of standard solutions) - 1989 - (1/OC/MS-1).

8C ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 2 - 1990 - (1/OC/MS-2).

8D ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 3a (1/OC/MS-3a) 1991.

8E ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 3b - (1/OC/MS-3b) 1992.

8F ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 4 - (1/OC/MS-4) 1993.

Marine biota:

1E ICES, Fifth Intercalibration Exercise on Trace Metals in Biological Tissues - 1978 - (5/TM/BT).

1F ICES, Sixth Intercalibration Exercise on Trace Metals (Cadmium and Lead only) in Biological Tissues - 1979 - (6/TM/BT).

1G ICES, Seventh Intercalibration Exercise on Trace Metals in Biological Tissues - Part A - 1983 - (7/TM/BT).

1H	ICES, Seventh Intercalibration Exercise on Trace Metals in Biological Tissues - Part B - 1985 - (7/TM/BT) (preliminary report 1987).
1Z VETN	Interlabcalibration exercise with VETN and SIIF 1983, mercury and cadmium in cod filet and liver.
1Z NIVA	Interlabcalibration exercise with VETN, NACE and NIVA 1986 (Hg, Cd, Cu, Pb and Zn in 6 samples).
2D	ICES Fourth Intercalibration Exercise on Organochlorines (mainly PCBs) in Biological Tissues (Sample No.5) - 1979 - (4/OC/BT).
2E	ICES Fifth Intercalibration Exercise on Organochlorines (PCBs only) in Biological Tissues - 1982 - (5/OC/BT).
2G	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 1 - (analysis of standard solutions) - 1989 - (7/OC/BT-1).
2H	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 2 - 1990 - (7/OC/BT-2).
2I	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 3a - (7/OC/BT-3a) 1991.
2J	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 3b - (7/OC/BT-3b) 1992.
2K	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 4 - (7/OC/BT-4) 1993.
2Z VETN	Interlabcalibration exercise with VETN among others, 1983, PCB and HCB in cod liver.
2Z NACE	Interlabcalibration exercise with NACE, VETNand SIIF 1986 (PCB (all labs), DDE, OCS, HCB and DCB (NACE and VETN).

Appendix C
Analytical overview - sediment

Sorted by:

- Contaminant, year, laboratory, intercalibration x

Contamin.	**Contaminant. Abbreviations are defined in Appendix A**
Mon. Year	**Monitoring year**
Lab.	**Analytical lab (cf.Appendix A)**
Intercalibr. +basis	**Intercalibration excercise (se Appendix B) and analytical basis where D = dry weight basis.**
Detect limit	**"Normal" analytical detection limit.**
Total value count	**Total number of analyses**
Count below d.lim	**Number of analyses below detection limit**
N (<) above d.lim	**Number of analyses with higher detection limit than "normal"**

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
ACNE	1994-NIVA		D	369	1	24	23	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
ACNLE	1994-NIVA		D	369	1	24	23	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
ANT	1994-NIVA		D	369	1	24	22	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
AS	1994-NIVA		D	354	500	12		
BAA	1994-NIVA		D	369	1	24	11	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
BAP	1994-NIVA		D	369	1	24	12	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
BBF	1994-NIVA		D	369	1	24	9	
BBJKF	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
BEP	1994-NIVA		D	369	1	24	8	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
BGHIP	1994-NIVA		D	369	1	24	9	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
BIPN	1994-NIVA		D	369	1	24	21	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
BJKF	1994-NIVA		D	369	1	24	11	
CB101	1994-NIVA	8Z	D	360	0.05	24		12
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CB105	1994-NIVA	8Z	D	360	0.05	24		24
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CB118	1994-NIVA	8Z	D	360	0.05	24		13
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	17		
CB138	1994-NIVA	8Z	D	360	0.05	24		12
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CB153	1994-NIVA	8Z	D	360	0.05	24		12
	1996-NIVA		D	360	0.05	10		
	1997-NIVA		D	360	0.05	18		
CB156	1994-NIVA	8Z	D	360	0.05	24		22
	1996-NIVA		D	360	0.2	10	1	
	1997-NIVA		D	360	0.2	18	2	
CB180	1994-NIVA	8Z	D	360	0.05	24		13
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CB209	1994-NIVA	8C	D	360	0.05	24		12
	1996-NIVA		D	360	0.2	10	1	
	1997-NIVA		D	360	0.2	18	1	
CB28	1994-NIVA	8Z	D	360	0.05	24		2
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CB52	1994-NIVA	8Z	D	360	0.05	24		2
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
CD	1994-NIVA		7Z	D	353	1	114		
	1996-NIVA			D	353	200	23	22	
	1997-NIVA			D	353	200	27	15	
CHRTR	1994-NIVA			D	369	0.5	24		
	1996-NIVA			D	369	0.5	10		
	1997-NIVA			D	369	0.5	18		
CORG	1994-NIVA			D	390	200000	114		
	1996-NIVA			D	390	200000	23		
	1997-NIVA			D	390	200000	27		
CR	1994-NIVA		7Z	D	353	5	12		
CTOT	1994-NIVA			D	390	1000000	12		
	1996-NIVA			D	390	1000000	23		
	1997-NIVA			D	390	1000000	27		
CU	1994-NIVA		7Z	D	351	10	114		
	1996-NIVA			D	351	10	23		
	1997-NIVA			D	351	10	27		
DBA3A	1994-NIVA			D	369	1	23	11	
	1996-NIVA			D	369	1	10		
	1997-NIVA			D	369	1	18		
DBT	1996-NIVA			D	369	1	10		
	1997-NIVA			D	369	1	18		
DDEPP	1994-NIVA		8Z	D	360	0.05	24		12
	1996-NIVA			D	360	0.05	10		
	1997-NIVA			D	360	0.05	18		
DDTPP	1996-NIVA			D	999	0.7	10		5
	1997-NIVA			D	999	0.7	18		3
FLE	1994-NIVA			D	369	1	24	23	
	1996-NIVA			D	369	1	10		
	1997-NIVA			D	369	1	18		
FLU	1994-NIVA			D	369	1	24	10	
	1996-NIVA			D	369	1	10		
	1997-NIVA			D	369	1	18		
GSAMT	1996-NIVA			D	miss	miss	31		
	1996-VKID			D	miss	miss	35		
	1997-NIVA			D	miss	miss	45		
	1997-VKID			D	miss	miss	47		
HCB	1994-NIVA		8Z	D	360	0.05	24		10
	1996-NIVA			D	360	0.1	10		
	1997-NIVA			D	360	0.1	18		
HCHA	1994-NIVA		8Z	D	360	0.05	24		23
	1996-NIVA			D	360	0.2	10	2	
	1997-NIVA			D	360	0.2	18	1	
HCHG	1994-NIVA		8Z	D	360	0.05	24		15
	1996-NIVA			D	360	0.2	10	1	
	1997-NIVA			D	360	0.2	18	1	
HG	1994-NIVA		7Z	D	350	10	114	2	
	1996-NIVA			D	350	10	23		
	1997-NIVA			D	350	10	27		
ICDP	1994-NIVA			D	369	1	24	12	
	1996-NIVA			D	369	1	10		
	1997-NIVA			D	369	1	18		
LI	1994-NIVA		7E	D	353	1	114		
	1996-NIVA			D	353	1	23		
	1997-NIVA			D	353	1	27		
MOCON	1994-NIVA			D	340	~1	62		
	1996-NIVA			D	340	~1	31		
	1996-VKID			D	340	~1	35		
	1997-VKID			D	340	~1	47		
NAP	1994-NIVA			D	369	1	24	18	

Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAP1M	1994-NIVA		D	369	1	24	19	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAP2M	1994-NIVA		D	369	1	24	17	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPD2	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPD3	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPDI	1994-NIVA		D	369	1	24	18	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPT2	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPT3	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPT4	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPTM	1994-NIVA		D	369	1	24	24	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NI	1994-NIVA	7Z	D	353	50	12		
NTOT	1994-NIVA		D	390	1000000	114		
	1996-NIVA		D	390	1000000	23		
	1997-NIVA		D	390	1000000	27		
OCS	1994-NIVA		D	360	0.05	24		24
	1996-NIVA		D	360	0.1	10		
	1997-NIVA		D	360	0.1	18	1	1
PA	1994-NIVA		D	369	1	24	11	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
PAM1	1994-NIVA		D	369	1	24	17	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
PAM2	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
PAMD1	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
PAMD2	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
PB	1994-NIVA	7Z	D	353	1	114		
	1996-NIVA		D	353	1	23		
	1997-NIVA		D	353	1	27		
PB210	1994-VKID		D	650	~1	62	25	
	1996-VKID		D	650	~1	11		
	1997-VKID		D	650	~1	21	3	
PER	1994-NIVA		D	369	1	24	3	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
PYR	1994-NIVA		D	369	1	24	12	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
QCB	1994-NIVA		D	360	0.05	24		22
	1996-NIVA		D	360	0.05	10		
	1997-NIVA		D	360	0.05	18		
TDEPP	1994-NIVA	8Z	D	360	0.05	24		21

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996	NIVA		D	360	0.2	10		
	1997	NIVA		D	360	0.2	18		
ZN	1994	NIVA	7Z	D	351	100	114		
	1996	NIVA		D	351	100	23		
	1997	NIVA		D	351	100	27		
Sum of counts							4219	422	260

~ > converting to ppb ignored, due to missing unit

Appendix D
Analytical overview - biota

Sorted by:

- Contaminant, year, laboratory, intercalibration

Contamin.	**Contaminant. Abbreviations are defined in Appendix A**
Mon. Year	**Monitoring year**
Lab.	**Analytical lab (cf.Appendix A)**
Intercalibr. +basis	**Intercalibration excercise (cf. Appendix B) and analytical basis where D = dry weight basis and W = wet weight basis.**
Detect limit	**"Normal" analytical detection limit.**
Total value count	**Total number of analyses**
Count below d.lim	**Number of analyses below detection limit**
N (<) above d.lim	**Number of analyses with higher detection limit than "normal"**

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
ACNE	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		20
	1996-NIVA		W						309	0.2	65		19
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
ACNLE	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		49
	1996-NIVA		W						309	0.2	65		42
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
AG	1996-NIVA		W						999	miss	3		
ANT	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		28
	1996-NIVA		W						309	0.2	65		30
	1997-NIVA		W						309	0.5	35		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA	EK	W						309	0.5	34		
AS	1996-NIVA		W						999	miss	3		
BAA	1992-NIVA		W	309	0.2	8			309	0.2	44		
	1995-NIVA		W						309	0.2	72		9
	1996-NIVA		W						309	0.2	65		8
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA	EK	W						309	0.5	34		
BAP	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		21
	1996-NIVA		W						309	0.2	65		26
	1997-NIVA	AL	W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA	EK	W						309	0.5	34		
BBF	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	59		9
	1996-NIVA		W						309	0.2	57		6
BBJKF	1995-NIVA		W						309	0.2	12		
	1996-NIVA		W						309	0.2	8		
	1997-NIVA		W						309	0.2	36		1
	1998-NIVA		W						309	0.2	39		
	1999-NIVA		W						309	0.2	34		
BEP	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		5
	1996-NIVA		W						309	0.2	65		6
	1997-NIVA		W						309	0.2	36		
	1998-NIVA		W						309	0.2	38		
	1999-NIVA	EK	W						309	0.2	34		
BGHIP	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		20
	1996-NIVA		W						309	0.2	65		10
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	35		
	1999-NIVA	EK	W						309	0.5	34		
BIPN	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		52

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996-NIVA		W						309	0.2	62		39
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39	1	
	1999-NIVA		W						309	0.5	34		
BJKF	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	24		21
	1996-NIVA		W						309	0.2	57		16
CB101	1987-SIIF		W						111	0.2	21	1	
	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169	1		341	0.05	58		
	1990-SIIF	2G	W						111	0.4	41	6	
	1991-NIVA	2H	W	340	1	179		8	341	0.05	62		
	1991-SIIF	2H	W						111	0.2	35		1
	1992-NIVA	2J	W	340	5	192	3		341	0.1	140		
	1993-NIVA	2K	W	340	4	212	12		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	3		341	0.05	165	39	
	1995-NIVA		W	340	3	318	10		341	0.05	225	10	
	1996-NIVA		W	340	3	332	14		341	0.05	237	9	
	1997-NIVA		W	340	3	260	24						
	1997-NIVA	AJ	W						341	0.05	221	4	
	1998-NIVA		W	340	3	284	19	1	341	0.05	197	1	3
	1999-NIVA		W	340	3	245	3						
	1999-NIVA	EG	W						341	0.05	222		12
CB105	1991-NIVA	2H	W	340	1	87		1	341	0.05	47		
	1992-NIVA		W	340	5	192	3		341	0.1	140		
	1993-NIVA	QM	W	340	4	212	21		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	8		341	0.05	165	53	
	1995-NIVA		W	340	3	318	13		341	0.05	224	34	
	1996-NIVA		W	340	3	332	22		341	0.05	231	23	
	1997-NIVA		W	340	3	260	24		341	0.05	221	3	1
	1998-NIVA		W	340	3	284	31	19	341	0.05	201	11	16
	1999-NIVA		W	340	3	245	14						
	1999-NIVA	EG	W						341	0.05	222	4	59
CB118	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169			341	0.05	58		
	1990-SIIF	2G	W						111	0.2	41	1	
	1991-NIVA	2H	W	340	1	179			341	0.05	62		
	1991-SIIF	2H	W						111	0.2	35		1
	1992-NIVA	2J	W	340	5	192	2		341	0.1	140		
	1993-NIVA	2K	W	340	4	212	10		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	2		341	0.05	165	25	
	1995-NIVA		W	340	3	318	2		341	0.05	225	2	
	1996-NIVA		W	340	3	332	6		341	0.05	237	4	
	1997-NIVA		W	340	3	260	5						
	1997-NIVA	AJ	W						341	0.05	221		
	1998-NIVA		W	340	3	284	6	1	341	0.05	203	3	1
	1999-NIVA		W	340	3	245							
	1999-NIVA	EG	W						341	0.05	222		6
CB126	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-04	18		

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
CB138	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	21		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169			341	0.05	58		
	1990-SIIF	2G	W						111	0.3	41		
	1991-NIVA	2H	W	340	1	179			341	0.05	62		
	1991-SIIF	2H	W						111	0.3	35		1
	1992-NIVA	2J	W	340	5	192			341	0.1	137		
	1993-NIVA	QM	W	340	4	212	3		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300			341	0.05	165	12	
	1995-NIVA		W	340	3	318	2		341	0.05	225		
	1996-NIVA		W	340	3	331	1		341	0.05	235		
	1997-NIVA		W	340	3	260	1						
	1997-NIVA	AJ	W						341	0.05	221		1
	1998-NIVA		W	340	3	284	3		341	0.05	203		
	1999-NIVA		W	340	3	245							
	1999-NIVA	EG	W						341	0.05	222		
CB153	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169			341	0.05	58		
	1990-SIIF	2G	W						111	0.3	41		
	1991-NIVA	2H	W	340	1	179			341	0.05	62		
	1991-SIIF	2H	W						111	0.5	35		1
	1992-NIVA	2J	W	340	5	192			341	0.1	140		
	1993-NIVA	2K	W	340	4	212	3		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300			341	0.05	165	9	
	1995-NIVA		W	340	3	318	1		341	0.05	225		
	1996-NIVA		W	340	3	332	1		341	0.05	237		
	1997-NIVA		W	340	3	260							
	1997-NIVA	AJ	W						341	0.05	221		
	1998-NIVA		W	340	3	284	1		341	0.05	203	1	1
	1999-NIVA		W	340	3	245							
	1999-NIVA	EG	W						341	0.05	222		
CB156	1991-NIVA	2H	W	340	1	87		15	341	0.05	47		5
	1992-NIVA		W	340	5	192	3		341	0.1	140		
	1993-NIVA	QM	W	340	4	212	31		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	24	1	341	0.05	162	70	
	1995-NIVA		W	340	3	317	27		341	0.05	225	67	
	1996-NIVA		W	340	3	332	48		341	0.05	237	62	
	1997-NIVA		W	340	3	260	46						
	1997-NIVA	AJ	W						341	0.05	221	9	10
	1998-NIVA		W	340	3	284	52	70	341	0.05	203	37	47
	1999-NIVA		W	340	3	245	35	2					
	1999-NIVA	EG	W						341	0.05	222	12	132
CB169	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-04	18	2	
CB180	1987-SIIF		W						111	0.2	21	6	
	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93	1						
	1989-SIIF		W						111	0.1	36		

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1990-NIVA	2G	W	340	1	169			341	0.05	58		
	1990-SIIF	2G	W						111	0.2	41	8	
	1991-NIVA	2H	W	340	1	179			341	0.05	62		
	1991-SIIF	2H	W						111	0.2	35		
	1992-NIVA	2J	W	340	5	192	3		341	0.1	140		
	1993-NIVA	2K	W	340	4	212	15		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	3		341	0.05	162	49	
	1995-NIVA		W	340	3	318	5		341	0.05	225	22	
	1996-NIVA		W	340	3	332	14		341	0.05	237	25	
	1997-NIVA		W	340	3	260	18						
	1997-NIVA	AJ	W						341	0.05	221	1	1
	1998-NIVA		W	340	3	284	20	14	341	0.05	203	18	44
	1999-NIVA		W	340	3	245	4	1					
	1999-NIVA	EG	W						341	0.05	222	2	76
CB209	1990-NIVA		W	340	2	169	24	11	341	0.05	58		
	1991-NIVA		W	340	2	179	11	88	341	0.05	62	5	7
	1992-NIVA		W	340	5	192	3		341	0.1	140		1
	1993-NIVA		W	340	4	212	46	14	341	0.1	133		
	1994-NIVA		W	340	3	300	29	24	341	0.05	165	91	
	1995-NIVA		W	340	3	318	36		341	0.05	225	92	5
	1996-NIVA		W	340	3	332	255		341	0.05	237	107	9
	1997-NIVA		W	340	3	260	196		341	0.05	221	30	14
	1998-NIVA		W	340	3	283	120	121	341	0.05	203	50	69
	1999-NIVA		W	340	3	242	162	17	341	0.05	222	19	171
CB28	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		1
	1990-NIVA	2G	W	340	1	169	2	2	341	0.05	58		
	1990-SIIF	2G	W						111	0.2	41	7	
	1991-NIVA	2H	W	340	1	179	2	52	341	0.05	62	5	1
	1991-SIIF	2H	W						111	0.3	35		
	1992-NIVA	2J	W	340	5	192	3		341	0.1	137		
	1993-NIVA	2K	W	340	4	212	44	5	341	0.1	133		
	1994-NIVA	2Z	W	340	3	282	18	4	341	0.05	163	73	
	1995-NIVA		W	340	3	313	27		341	0.05	225	75	
	1996-NIVA		W	340	3	332	107		341	0.05	236	70	
	1997-NIVA		W	340	3	260	81						
	1997-NIVA	AJ	W						341	0.05	221	22	14
	1998-NIVA		W	340	3	284	96	99	341	0.05	201	33	46
	1999-NIVA		W	340	3	245	92	18					
	1999-NIVA	EG	W						341	0.05	222	14	140
CB52	1987-SIIF		W						111	0.2	20	1	
	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169	2	6	341	0.05	58		
	1990-SIIF	2G	W						111	0.4	41	7	
	1991-NIVA	2H	W	340	1	179	1	37	341	0.05	62	5	1
	1991-SIIF	2H	W						111	0.3	35		
	1992-NIVA	2J	W	340	5	192	3		341	0.1	137		
	1993-NIVA	2K	W	340	4	212	40		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	9		341	0.05	165	64	

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1995-NIVA		W	340	3	312	19		341	0.05	214	28	
	1996-NIVA		W	340	3	332	49		341	0.05	235	31	
	1997-NIVA		W	340	3	260	116						
	1997-NIVA	AJ	W						341	0.05	221	25	10
	1998-NIVA		W	340	3	281	47	44	341	0.05	168	12	17
	1999-NIVA		W	340	3	245	49	11					
	1999-NIVA	EG	W						341	0.05	212	7	70
CB77	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-04	18		
CB81	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-04	18		
CD	1981-SIIF	1E	W	130	10	28			130	5	27		
	1981-SIIF	1F	W						130	10	7		
	1982-SIIF	1F	W						130	10	18		
	1982-VETN		W	230	10	54							
	1983-SIIF	1F	W						130	10	17		
	1983-VETN	1Z	W	230	10	46							
	1984-FIER	1H	W	402	1	23							
	1984-SIIF	1G	W						130	10	27		
	1984-VETN	1Z	W	230	10	66							
	1985-SIIF	1G	D						130	10	35		
	1985-VETN	1Z	W	230	10	45		3					
	1986-NIVA	1H	D	312	30	56	1		312	30	20		
	1987-FIER	1G	W	402	1	37							
	1987-NIVA	1H	D	312	30	57		4	312	30	37		
	1988-NIVA	1H	D	312	30	61	11	1	312	30	55		
	1989-NIVA	1H	D	312	30	135	11	8					
	1989-NIVA	1H	W						312	30	36		
	1990-NIVA	1H	W	312	10	189	9	2	312	30	77	5	
	1991-NIVA	1H	W	312	10	190	29	2	312	10	67		
	1992-NIVA	1H	W	312	10	191	4		312	10	111		
	1993-NIVA	1H	W	312	50	221	98		312	50	79		
	1994-NIVA	1Z	W	312	50	302	134		312	50	81		
	1995-NIVA		W	312	50	318	129		312	50	139	2	
	1996-NIVA	V1	W						312	50	125		
	1996-NIVA	V2	W	312	50	368	128						
	1997-NIVA		W	312	50	287	90						
	1997-NIVA	AH	W						312	50	107		
	1998-NIVA		W	312	50	285	101		312	50	93		
	1999-NIVA		W	312	50	233	79						
	1999-NIVA	EF	W						312	50	132	15	
CDD1N	1995-NILU		W						841	2E-05	6	1	1
	1996-NILU		W						841	1E-05	18		2
CDD4X	1995-NILU		W						841	2E-05	6	3	1
	1996-NILU		W						841	2E-05	18		1
CDD6P	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	4E-05	18		
CDD6X	1995-NILU		W						841	2E-05	6		1
	1996-NILU		W						841	2E-05	18		1
CDD9X	1995-NILU		W						841	2E-05	6	2	1
	1996-NILU		W						841	2E-05	18		1
CDDO	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-04	18		
CDDSN	1995-NILU		W						841	2E-05	5		

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996-NILU		W						841	1E-05	18		3
CDDSP	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	4E-05	18		
CDDST	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-05	18		
CDDSX	1995-NILU		W						841	2E-05	5		
	1996-NILU		W						841	2E-05	18		2
CDF2N	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-05	18		1
CDF2T	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-05	18		
CDF4X	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	2E-05	18		1
CDF6P	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	4E-05	18	2	1
CDF6X	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	2E-05	18		1
CDF9P	1995-NILU		W						841	2E-05	6	2	1
	1996-NILU		W						841	8E-05	17	3	1
CDF9X	1995-NILU		W						841	2E-05	6	3	1
	1996-NILU		W						841	2E-05	18		1
CDFDN	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-05	18		1
CDFDX	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	2E-05	18		1
CDFO	1995-NILU		W						841	2E-05	6		1
	1996-NILU		W						841	1E-04	18	3	1
CDFSN	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-05	18		1
CDFSP	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	8E-05	18	6	1
CDFST	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-05	18		
CDFSX	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	2E-05	18		1
CHR	1992-NIVA		W	309	0.2	8			309	0.2	44		
	1995-NIVA		W						309	0.2	56		
	1996-NIVA		W						309	0.2	65		3
CHRTR	1995-NIVA		W						309	0.2	15		2
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
CO	1996-NIVA		W						999	miss	3		
COR	1992-NIVA		W	309	0.2	8			309	0.2	46		
CR	1992-NIVA		W						312	10	6		
	1996-NIVA		W						999	miss	3		
CU	1983-SIIF	1G	W						130	10	12		
	1984-SIIF	1G	W						130	10	27		
	1986-NIVA	1H	D	311	150	56			311	150	20		
	1987-FIER	1G	W	404	50	37							
	1987-NIVA	1H	D	311	150	57			311	150	37		
	1988-NIVA	1H	D	311	150	61			311	150	55		
	1989-NIVA	1H	D	311	150	135							

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1989-NIVA	1H	W						311	150	36		
	1990-NIVA	1H	W	311	150	189			311	150	77		
	1991-NIVA	1H	W	311	50	193	2		311	50	67		
	1992-NIVA	1H	W	311	10	191			311	10	111		
	1993-NIVA	1H	W	311	10	221			311	10	79		
	1994-NIVA	1Z	W	311	10	302			311	10	81		
	1995-NIVA		W	311	10	318			311	10	124		
	1996-NIVA	V1	W						311	10	113		
	1996-NIVA	V2	W	311	10	368							
	1997-NIVA		W	311	5000a	287	1						
	1997-NIVA	AH	W						311	10	96		
	1998-NIVA		W	311	10	285			311	10	51		
	1999-NIVA		W	311	10	233							
	1999-NIVA	EF	W						311	10	99		
DBA3A	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	71		48
	1996-NIVA		W						309	0.2	65		53
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
DBP	1992-NIVA		W	309	0.2	8			309	0.2	46		
DBT	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
DBTC1	1995-NIVA		W						309	0.2	57		14
	1996-NIVA		W						309	0.2	65		9
DBTC2	1995-NIVA		W						309	0.2	56		9
	1996-NIVA		W						309	0.2	62		11
DBTC3	1995-NIVA		W						309	0.2	57		4
	1996-NIVA		W						309	0.2	65		5
DBTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15		
	1999-NIVA		D						320	5	13		
DBTIO	1997-NIVA		W						309	0.5	34		
DDEPP	1982-VETN		W	210	50	53							
	1983-VETN	2E	W	210	50	48			211a	50	48		
	1984-VETN	2E	W	210	50	66							
	1985-VETN	2E	W	210	50	45							
	1986-NACE	2Z	W	510	20	56							
	1987-NACE	2Z	W	510	40	53							
	1988-NACE	2Z	W	510	40	61							
	1989-NACE	2Z	W	510	20	93							
	1990-NIVA		W	340	1	169			341	0.05	58		
	1991-NIVA		W	340	1	179			341	0.05	62		
	1992-NIVA		W	340	5	192	2		341	0.1	140		
	1993-NIVA		W	340	4	212	3		341	0.1	133		
	1994-NIVA	2Z	W	340	4	300			341	0.1	165	27	
	1995-NIVA		W	340	4	318	2		341	0.1	225	30	
	1996-NIVA		W	340	4	332	2		341	0.1	237	47	
	1997-NIVA		W	340	4	260	3		341	0.1	221	1	
	1998-NIVA		W	340	4	284	6		341	0.1	203	4	
	1999-NIVA		W	340	4	245							
	1999-NIVA	EG	W						341	0.1	222	2	
DDTEP	1983-SIIF		W						111	0.5	12		
	1984-SIIF		W						111	0.5	24		1

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1985-SIIF		W						111	0.5	27	1	5
	1986-SIIF		W						111	0.5	21		
	1987-SIIF		W						111	0.5	21	1	
	1988-SIIF		D						111	0.5	6		
	1988-SIIF		W						111	0.5	22	1	
	1989-SIIF		W						111	0.5	36	1	
	1990-SIIF		W						111	0.2	41	1	
	1991-SIIF		W						111	0.3	35		
DDTPP	1986-NACE		W	510	40	56							
	1987-NACE		W	510	40	53							
	1988-NACE		W	510	40	61							
	1989-NACE		W	510	20	93							
	1995-NIVA		W						340	0.05	72		
	1996-NIVA		W	340	0.05	54		4	340	0.05	45		
	1997-NIVA		W	340	2	32							
	1997-NIVA	AJ	W						340	0.05	48		
	1998-NIVA		W	340	2	37	1	8	340	0.05	68		24
	1999-NIVA		W	340	2	29		4	340	0.05	93		7
DPTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15	9	
	1999-NIVA		D						320	5	13	12	
EOCL	1989-SIIF		W						605	170	5		
EPOCL	1986-NACE		W	610	800	56							
	1986-SIIF		W						605	5000	21	21	
	1987-NACE		W	610	800	53							
	1987-SIIF		W						605	40	20		
	1988-NACE		W	610	800	60							
	1988-SIIF		W						605	40	27		
	1989-NACE		W	610	800	89	1						
	1989-SIIF		W						605	40	35		
	1990-NIVA		W	615	40	117		3					
	1990-SIIF		W						605	40	41		
	1991-NIVA		W	615	40	116		12					
	1991-SIIF		W						605	130	35		
	1997-IFEN		W						607	50	6		
	1998-IFEN		W						607	1	6		
FLE	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		22
	1996-NIVA		W						309	0.2	65		6
	1997-NIVA	AL	W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
FLU	1992-NIVA		W	309	0.2	8			309	0.2	44		
	1995-NIVA		W						309	0.2	72		
	1996-NIVA		W						309	0.2	65		
	1997-NIVA	AL	W						309	0.2	36		
	1998-NIVA		W						309	0.2	39		
	1999-NIVA	EK	W						309	0.2	34		
HCB	1983-SIIF		W						111	0.5	12		
	1983-VETN	2Z	W	210	10	48			211a	10	48		
	1984-SIIF		W						111	0.2	24		1
	1984-VETN	2Z	W	210	10	66							
	1985-SIIF		W						111	0.2	30	6	2
	1985-VETN	2Z	W	210	10	45		4					

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1986-NACE	2Z	W	510	10	56							
	1986-SIIF	2Z	W						111	0.2	21	3	
	1987-NACE	2Z	W	510	40	53							
	1987-SIIF	2Z	W						111	0.2	21	4	
	1988-NACE	2Z	W	510	40	61							
	1988-SIIF	2Z	D						111	0.2	6		
	1988-SIIF	2Z	W						111	0.2	22	2	
	1989-NACE	2Z	W	510	20	93							
	1989-SIIF	2Z	W						111	0.05	36		
	1990-NIVA		W	340	1	169	2		341	0.05	58		
	1990-SIIF	2Z	W						111	0.05	41	3	
	1991-NIVA		W	340	1	179	4	13	341	0.05	62	5	
	1991-SIIF	2Z	W						111	0.1	35		
	1992-NIVA		W	340	5	189	3		341	0.1	140		
	1993-NIVA		W	340	4	212	31		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	24	1	341	0.05	165	33	
	1995-NIVA		W	340	3	317	37		341	0.05	225	30	
	1996-NIVA		W	340	3	332	52		341	0.05	237	37	
	1997-NIVA		W	340	2	260	39						
	1997-NIVA	AJ	W						341	0.05	221	7	
	1998-NIVA		W	340	2	284	48	13	341	0.05	203	67	2
	1999-NIVA		W	340	2	245	18						
	1999-NIVA	EG	W						341	0.05	222	18	8
HCHA	1990-NIVA		W	340	1	168			341	0.05	58		
	1991-NIVA		W	340	1	179	2	111	341	0.05	62	5	10
	1992-NIVA		W	340	5	192	3		341	0.1	140		
	1993-NIVA		W	340	4	212	45	22	341	0.1	133		
	1994-NIVA	2Z	W	340	3	296	32	3	341	0.05	165	85	
	1995-NIVA		W	340	3	318	45		341	0.05	225	98	
	1996-NIVA		W	340	3	332	111		341	0.05	231	100	
	1997-NIVA		W	340	0.5	260	2	10	341	0.05	221	20	11
	1998-NIVA		W	340	0.5	284	8	208	341	0.05	202	25	121
	1999-NIVA		W	340	0.5	245	17	75	341	0.05	222	23	147
HCHG	1986-NACE		W	510	30	56	1						
	1986-SIIF		W						111	3	21		
	1987-NACE		W	510	40	53							
	1987-SIIF		W						111	5	21		1
	1988-NACE		W	510	40	61							
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	50	36		
	1990-NIVA		W	340	1	169	1	9	341	0.05	58		
	1990-SIIF		W						111	0.1	41		
	1991-NIVA		W	340	1	179	3	18	341	0.05	62	5	1
	1991-SIIF		W						111	0.3	35		
	1992-NIVA		W	340	5	192	3		341	0.1	140		
	1993-NIVA		W	340	4	212	42	17	341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	24	1	341	0.05	165	46	
	1995-NIVA		W	340	3	313	31		341	0.05	213	29	
	1996-NIVA		W	340	3	330	68		341	0.05	220	8	
	1997-NIVA		W	340	2	260	47						
	1997-NIVA	AJ	W						341	0.05	221	3	9
	1998-NIVA		W	340	2	284	25	63					
	1998-NIVA	AJ	W						341	0.05	203	10	23
	1999-NIVA		W	340	2	245	51	3	341	0.05	222	19	61

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
HG	1981-SIIF	1E	W	120	10	15		1	120	10	35		
	1982-SIIF	1E	W						120	10	18		
	1982-VETN		W	220	10	51			220	10	54		
	1983-SIIF	1E	W						120	10	17		
	1983-VETN	1Z	W						220	10	48		
	1984-FIER	1G	W						401	10	39		
	1984-SIIF	1G	W						120	10	27	6	
	1984-VETN	1Z	W						220	10	66		
	1985-SIIF	1G	D						120	10	30		
	1985-VETN	1Z	W						220	10	90		
	1986-NIVA	1H	D						310	10	74		
	1987-FIER	1G	W						401	10	38		
	1987-NIVA	1H	D						310	10	93		14
	1988-NIVA	1H	D						310	10	116		
	1989-NIVA	1H	D						310	100	134		
	1989-NIVA	1H	W						310	10	36	5	
	1990-NIVA	1H	W						310	10	266		
	1991-NIVA	1H	W						310	100a	264	126	
	1992-NIVA	1H	W						310	100a	303	122	
	1993-NIVA	1H	W						310	5	300		
	1994-NIVA	1Z	W						310	5	381		
	1995-NIVA		W						310	5	442	1	
	1996-NIVA	V1	W						310	5	481		
	1997-NIVA	AH	W						310	5	383		
	1998-NIVA		W						310	5	381	6	
	1999-NIVA		W	310	5	3							
	1999-NIVA	EF	W						310	5	382		
ICDP	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		29
	1996-NIVA		W						309	0.2	65		23
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	37	2	
	1999-NIVA	EK	W						309	0.5	34		
MBTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15		
	1999-NIVA		D						320	5	13		
MN	1984-SIIF		W						132	40	27		
	1985-SIIF		D						132	40	35		
MPTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15	9	
	1999-NIVA		D						320	5	13	13	
NAP	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	70		21
	1996-NIVA		W						309	0.2	61		11
	1997-NIVA		W						309	0.2	34		1
	1998-NIVA		W						309	0.2	37		
	1999-NIVA		W						309	0.2	34		1
NAP1M	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	15		13
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	37		
	1999-NIVA		W						309	0.5	34		
NAP2M	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	15		13

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	37		
	1999-NIVA		W						309	0.5	34		
NAPC1	1995-NIVA		W						309	0.2	55		6
	1996-NIVA		W						309	0.2	61		
NAPC2	1995-NIVA		W						309	0.2	57		6
	1996-NIVA		W						309	0.2	60		
NAPC3	1995-NIVA		W						309	0.2	57		5
	1996-NIVA		W						309	0.2	60		
NAPD2	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
NAPD3	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
NAPDI	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	15		6
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
NAPT2	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
NAPT3	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
NAPT4	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
NAPTM	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	15		11
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
NI	1983-SIIF	1G	W						130	20	12		
	1992-NIVA		W						312	10	6		
	1996-NIVA		W						999	miss	3		
OCS	1990-NIVA		W	340	2	169	31	24	341	0.05	58		1
	1991-NIVA		W	340	2	179	14	81	341	0.05	62	5	8
	1992-NIVA		W	340	5	192	3		341	0.1	140		
	1993-NIVA		W	340	4	212	51	16	341	0.1	133		
	1994-NIVA		W	340	3	300	39	22	341	0.05	165	96	
	1995-NIVA		W	340	3	318	44		341	0.05	225	102	
	1996-NIVA		W	340	3	332	287		341	0.05	237	114	
	1997-NIVA		W	340	2	260	100		341	0.05	221	30	14
	1998-NIVA		W	340	2	277	132	101	341	0.05	203	182	1
	1999-NIVA		W	340	2	245	144	2	341	0.05	222	80	23
PA	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		
	1996-NIVA		W						309	0.2	65		
	1997-NIVA	AL	W						309	0.2	36		
	1998-NIVA		W						309	0.2	39		
	1999-NIVA	EK	W						309	0.2	34		
PAC1	1995-NIVA		W						309	0.2	57		1

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996-NIVA		W						309	0.2	65		
PAC2	1995-NIVA		W						309	0.2	56		
	1996-NIVA		W						309	0.2	65		2
PAD10	1999-NIVA		W						309	0.2	34		21
PAD36	1999-NIVA		W						309	0.2	34		3
PAH	1987-NIVA		W	309	0.02	1							
PAM1	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	15		2
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
PAM2	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
PAMD1	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
PAMD2	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
PB	1983-SIIF	1G	W						130	20	12		
	1984-SIIF	1G	W						130	20	27		2
	1985-SIIF	1G	D						130	20	35		
	1986-NIVA	1Z	D	312	150	56	4		312	150	20		
	1987-FIER	1G	W	403	10	37	1						
	1987-NIVA	1Z	D	312	150	57		12	312	150	37		
	1988-NIVA	1Z	D	312	150	61	17	3	312	150	55		
	1989-NIVA	1Z	D	312	150	135	9	9					
	1989-NIVA	1Z	W						312	150	36		
	1990-NIVA	1Z	W	312	50	187	3	1	312	150	77	3	
	1991-NIVA	1Z	W	312	50	193	14		312	50	67		
	1992-NIVA	1Z	W	312	50	191	119		312	50	111	2	
	1993-NIVA	1H	W	312	30	221	40		312	30	79		
	1994-NIVA	1Z	W	312	30	302	3		312	30	81		
	1995-NIVA		W	312	30	318	162	30	312	30	124		
	1996-NIVA	V1	W						312	30	110		
	1996-NIVA	V2	W	312	30	368		109					
	1997-NIVA		W	312	40	287	10	28	312	40	92		
	1998-NIVA		W	312	40	285	126	2	312	40	90		
	1999-NIVA		W	312	40	233	118	11					
	1999-NIVA	EF	W						312	40	129	10	
PCB	1981-SIIF	2D	W	110	10	27			110	10	35		
	1982-SIIF	2D	W						111	5	17		
	1982-VETN		W	210	50	53			211	50	54		
	1983-SIIF	2E	W						111	5	14		
	1983-VETN	2E	W						211	50	48		
	1983-VETN	2Z	W	210	50	48							
	1984-SIIF	2E	W						111	5	24		
	1984-VETN	2E	W						211	50	66		
	1984-VETN	2Z	W	210	50	66							
	1985-SIIF	2E	W						111	5	32		6
	1985-VETN	2E	W						211	50	90		1
	1985-VETN	2Z	W	210	50	45							
	1986-NACE	2Z	W	511a	40a	56			511	20	56		
	1986-SIIF	2E	W						111	5	21		
	1987-NACE	2Z	W	510	40	53			511	20	54		

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1987-NIVA		W	340	0.1	2							
	1987-SIIF	2E	W						111	5	21		
	1988-NACE	2Z	W	510	40	61			511	20	13		
	1988-SIIF	2E	D						111	5	6		
	1988-SIIF	2E	W						111	5	22	4	
	1989-NACE	2Z	W	510	20	93			511	20	17		
	1989-SIIF	2E	W						111	5	36	6	
	1990-SIIF	2E	W						111	5	41		
	1991-SIIF	2E	W						111	5	35		
PCC26	1996-NILU		W						842	0.001	6		
PCC32	1996-NILU		W						842	0.003	6		4
PCC50	1996-NILU		W						842	0.001	6		
PCC62	1996-NILU		W						842	0.025	6		6
PCDD	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-04	18		
PCDF	1995-NILU		W						841	2E-05	6		
	1996-NILU		W						841	1E-04	18		
PER	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		32
	1996-NIVA		W						309	0.2	65		40
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA	EK	W						309	0.5	34		
PYR	1992-NIVA		W	309	0.2	8			309	0.2	44		
	1995-NIVA		W						309	0.2	72		4
	1996-NIVA		W						309	0.2	65		1
	1997-NIVA	AL	W						309	0.2	36		
	1998-NIVA		W						309	0.2	39		
	1999-NIVA	EK	W						309	0.2	34		
QCB	1990-NIVA		W	340	2	169	33	39	341	0.05	58		
	1991-NIVA		W	340	2	178	13	97	341	0.05	57	5	7
	1992-NIVA		W	340	5	192	3		341	0.1	125		
	1993-NIVA		W	340	4	212	52	24	341	0.1	133		
	1994-NIVA		W	340	3	299	38	23	341	0.05	165	93	
	1995-NIVA		W	340	3	318	45		341	0.05	225	103	
	1996-NIVA		W	340	3	332	306		341	0.05	237	109	
	1997-NIVA		W	340	2	260	79		341	0.05	221	27	10
	1998-NIVA		W	340	2	284	121	101	341	0.05	203	171	1
	1999-NIVA		W	340	2	238	181	2	341	0.05	222	81	14
SE	1982-VETN		W	240	10	46			240	10	54		
TBTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15		
	1999-NIVA		D						320	5	13		
TCDD	1995-NILU		W						841	2E-05	6	1	
	1996-NILU		W						841	1E-05	18		
TDEPP	1991-NIVA		W	340	1	138		1	341	0.05	62		
	1992-NIVA		W	340	5	191	3		341	0.1	140		
	1993-NIVA		W	340	4	212	24	3	341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	17	5	341	0.05	165	47	
	1995-NIVA		W	340	3	318	36		341	0.05	222	51	
	1996-NIVA		W	340	3	332	23		341	0.05	237	16	
	1997-NIVA		W	340	3	260	23						
	1997-NIVA	AJ	W						341	0.05	221	11	
	1998-NIVA		W	340	3	278	19	26	341	0.05	203	1	44

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Lab. Year	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1999-NIVA		W	340	3	245	5	1					
	1999-NIVA	EG	W						341	0.05	222	2	69
TPTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15		5
	1999-NIVA		D						320	5	13		
V	1996-NIVA		W						999	miss	3		
ZN	1983-SIIF	1G	W						131	400	12		
	1984-SIIF	1G	W						132	400	27		
	1985-SIIF	1G	D						132	400	35		
	1986-NIVA	1H	D	311	3000	56			311	3000	20		
	1987-FIER	1G	W	405	20	37							
	1987-NIVA	1H	D	311	3000	57			311	3000	37		
	1988-NIVA	1H	D	311	3000	61			311	3000	55		
	1989-NIVA	1H	D	311	3000	135		1					
	1989-NIVA	1H	W						311	3000	36		
	1990-NIVA	1H	W	311	3000	189			311	3000	77		
	1991-NIVA	1H	W	311	1000	193			311	1000	67		
	1992-NIVA	1H	W	311	1000	191			311	1000	111		
	1993-NIVA	1H	W	311	1000	221			311	1000	79		
	1994-NIVA	1Z	W	311	1000	302			311	1000	81		
	1995-NIVA		W	311	1000	318			311	1000	142		
	1996-NIVA	V1	W						311	1000	131		
	1996-NIVA	V2	W	311	1000	368							
	1997-NIVA		W	311	1000	287							
	1997-NIVA	AH	W						311	1000	110		
	1998-NIVA		W	311	1000	285			311	1000	51		
	1999-NIVA		W	311	1000	233							
	1999-NIVA	EF	W						311	1000	99		
Sum of counts						57072	6470	2083			49497	4057	2563

a(7) > ambigous value (Maximum value displayed)