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TNO report

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**Priority Action Substances in the South Eastern
River Basin District Project: Summary report no 1**

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- 2 Procedure CC-SERBD, “Sample requirements for Carlow County SERBD Project”
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- 4 Full results of all sediment samples, series 1 to 8
- 5 Full results of all biota samples, series 1 to 4

Summary

Nowadays a large number of man-made chemicals are being used while other chemicals are released to the environment due to industrial, agricultural and other human activities. As a consequence their widespread presence in the environment is becoming increasingly well documented. The increasing demand by citizens and environmental organisations for cleaner rivers and lakes, groundwater and coastal beaches has been evident for considerable time. For this reason the European Commission has made water protection one of the priorities of its work. This resulted in the European Water Framework Directive 2000/60/EC (WFD) as an operational tool for setting the objectives for water protection in the future. In Ireland a National Dangerous Substances Expert Group was established to design a substances screening monitoring programme as part of the implementation of the WFD and to assist with developing lists of priority action pollutants, candidate relevant pollutants and candidate general components for surface waters.

The South Eastern River Basin District Project (SERBD) was carried out by the Carlow County Council as part of a National Programme to test for relevance of all the candidate parameters and to provide data towards the further requirements to establish Environmental Quality Standards (EQS) levels for Irish waters. SERBD was an 18 month monitoring programme which incorporated sites downstream of major towns, sites associated with agriculture, mining and forestry activities and rural households, groundwater sites and two discharge effluent sites. Phase 1 of this programme was executed during the second half of 2005 and the analytical results were reported in TNO report B&O-A R 2005/378, "Priority Action Substances in the South Eastern River Basin District Project: Report on Phase 1".

Phase 2 of this programme was executed during the first half of 2006 and the analytical results were reported in TNO report B&O-A R 2006/231, "Priority Action Substances in the South Eastern River Basin District Project: Report on Phase 2".

Phase 3 of this programme was executed during the second half of 2006 and the analytical results were reported in TNO report B&O-A R 1140/B, "Priority Action Substances in the South Eastern River Basin District Project: Report on Phase 3".

In this summary report no 1 the results from all 23 sites are listed. This consists of the results of the water samples from series 1 to 24, of the sediment samples from series 1 to 8 and of the biota samples from series 1 to 4.

The results for the Priority Action Substances in aqueous samples show that 47 of the 51 compounds are found in one or more of the samples, 18 compounds are found in 10% of the samples and only 3 compounds are found in more than 50% of the samples. The latter include naphthalene, fluoranthene and nickel. The median concentrations of these compounds range from 0.009 µg/l for the fluoranthene to 1.4 µg/l for nickel. Concentrations up to 5 µg/l for naphthalene, 7.4 µg/l for dichloromethane and 152 µg/l for nickel have been found, but generally these high concentrations are present in just one or a limited number of samples.

In the 17 sediment samples 21 of the Priority Action Substances are not found at all while only 12 of the 51 compounds are found in more than 50% of the samples. As in water, these are mainly the polycyclic aromatic hydrocarbons and metals.

In the biota samples 20 of the Priority Action substances were not found at all, while only 18 of the 51 compounds are found in more than 50% of the samples. The latter include polycyclic aromatic hydrocarbons, pesticides and metals.

The concentrations found in the aqueous samples as well as in the sediments and biota samples don't differ substantially from concentrations that may be found in other non-suspected locations. The pesticides form an exception since the number of pesticides detected as well as their concentrations appear to be lower than in countries with more agriculture such as The Netherlands.

Of the 156 Relevant Pollutants 106 parameters were found in one or more of the aqueous samples, 34 parameters were found in 10% of the samples and only 10 parameters in 50% of the samples. These 10 parameters are PCB's (only background concentrations) but mostly metals followed by the hormone disturbing compounds, volatiles and the anions fluoride and chloride, than poly aromatic hydrocarbons and pesticides. Well known toxic compounds as the dioxins are found only in a very limited number of samples and in low concentrations. The most found pesticides are dichlobenil, mecoprop, epoxiconazole and glyphosate. Estrogens were not found in any of the samples.

In the sediment samples 70 of the parameters were found in one or more samples and 29 of them in at least 50% of the samples. As in the water samples, these 29 parameters are mainly PCB's, especially metals, methyl-t-butyl ether (MTBE), dibutyltin and a number of phthalates, including the "newer" di-isononyl phthalate.

Of the Relevant Pollutants 65 compounds were identified in the biota samples, 37 compounds are found in more than 50% of the samples. There are mainly PCB's and metals.

In general, no extraordinary concentrations are found for the Relevant Pollutants in water, sediment or biota.

1 Introduction

Nowadays a large number of man-made chemicals are being used while other chemicals are released to the environment due to industrial, agricultural and other human activities. As a consequence their widespread presence in the environment is becoming increasingly well documented. The increasing demand by citizens and environmental organisations for cleaner rivers and lakes, groundwater and coastal beaches has been evident for considerable time. For this reason the European Commission has made water protection one of the priorities of its work. This resulted in the European Water Framework Directive 2000/60/EC (WFD) as an operational tool for setting the objectives for water protection in the future.

The intention of the WFD is to get polluted waters clean again, and ensure clean waters are kept clean. A key objective of the WFD is that all waters achieve a “good status” by 2015. The best model for a single system of water management is management by river basin - the natural geographical and hydrological unit - instead of according to administrative or political boundaries. Initiatives of Member States concerned for the Maas, Schelde and Rhine river basins have served as positive examples of this approach, with their cooperation and joint objective-setting across Member State borders, or in the case of the Rhine even beyond the EU territory. Within the WFD for each river basin district a "river basin management plan" will need to be established and updated every six years.

While Ireland largely enjoys cleaner waters than much of the rest of Europe, due, at least in part, to its less industrialised history, the usage of chemicals throughout all sectors of society has become increasingly widespread during the past century. Examples of potential sources of substances include everyday household products, which contain substances that could, if present at sufficient levels, potentially adversely impact on water quality. Commercial activities such as construction, agriculture, forestry, mining, pharmaceutical, food processing and manufacturing processes also use potentially dangerous substances. Substances are also produced and emitted as the by-products of other processes, for example emissions from vehicle combustion engines can contaminate runoff from transportation routes. Similarly, inappropriate disposal of materials presents a risk of contamination of surfacewaters and/or groundwaters.

In Ireland a National Dangerous Substances Expert Group was established to design a substances screening monitoring programme as part of the implementation of the WFD and to assist with developing lists of priority action pollutants, candidate relevant pollutants and candidate general components for surface waters. This National Substances Screening Programme is to be undertaken to test for relevance of all the candidate parameters and to provide data towards the further requirements to establish Environmental Quality Standards (EQS) levels for Irish waters. This will involve water quality monitoring of both ground and surface waters, including saline and freshwater, tissue and sediment. It is intended that the findings of this monitoring programme will help to refine the list of candidate relevant pollutants.

The South Eastern River Basin District Project is carried out by the Carlow County Council as part of the National Programme, and is a 18 month monitoring programme which incorporates sites downstream of major towns, sites associated with agriculture, mining and forestry activities and rural households and some groundwater sites and two

discharge effluent sites, a total of 23 sites. The laboratory of TNO Environment and Geosciences in The Netherlands has been selected by the Carlow County Council to provide the laboratory services in support of this monitoring programme. While the sampling and a number of field analysis are carried out by employees of the South Eastern River Basin District Laboratory in Kilkenny, TNO has provided training in sampling methods for water, biota and sediments. Within the programme about 223 parameters, including metals, pesticides, organics and inorganics are determined and the following groups can be distinguished:

- Priority Action : 41 parameters
- Relevant Pollutants : 156 parameters
- General Components : 20 parameters for water, 2 for biota and 4 for sediments

In the duration of the project 3 phases of each 6 month can be distinguished:

- **Phase 1:** During the first 6 months water samples are collected from 23 sites. While the initial intention was to do the sampling on a monthly basis, the maximum holding periods of samples and the sampling logistics made it necessary to do this on a bi-weekly basis. The samples are analysed for the Priority Action, Relevant Pollutants and General Components parameters. Apart from water samples, one sediment sample was collected from 17 of the 23 sampling sites and analysed for all parameters. No biota samples were collected during this phase.
- **Phase 2:** During the second 6 months water samples will continue to be collected and analysed for the Priority Action and General Components parameters. Which Relevant Pollutants will be determined depends on the evaluation of the results of phase 1. Additional new target sites may be included during this phase. Also biota samples are collected and analysed at least for the Priority Action and General Components parameters. Again, the choice of the Relevant Pollutants parameters depends on the outcome of phase 1.
- **Phase 3:** During the 6 months of phase 3 only water samples from target sites will be collected and analysed for the Priority Action and General Components parameters. Which Relevant Pollutants parameters will be analysed depends on the outcome of phase 1. Also biota and sediment samples are sampled during this phase.

This summary report describes the results of the water samples series 1 to 24, the results of the sediment sample, series 1 to 8 and the results from the biota samples series 1 to 4 of all of the 23 selected sites. It includes the results itself, summary listings as well as the full results, a brief description of the methods used for the determination of the parameters, a discussion about the findings in phase 1 and the results of the QA/QC samples.

2 Samples and Chemical Parameters

2.1 Sampling and samples

All samples were collected by the South Eastern River Basin District Laboratory in Kilkenny. Procedures for sampling and conservation of samples, sampling equipment, sample containers and some equipment for on-site analysis were provided by the TNO laboratory. It should be mentioned that the TNO samplers did not function satisfactory and were replaced by SERBD samplers. The procedures used and supplied for this project are a general TNO procedure for sampling:

- Procedure ORG-220, “Guidelines for sampling surface water, sediment and tissue”, version 1, date 2004/08/01, TNO Environment, Energy and Process Innovation, Department of Environmental Quality (see appendix 1)

and a dedicated procedure for sample requirements within this project:

- Procedure CC-SERBD, “Sample requirements for Carlow County SERBD Project”, version 1, date 2005/02/10, TNO Environment, Energy and Process Innovation, Department of Environmental Quality (see appendix 2)

Each water sample consisted of the following sub-samples:

- W-A: 3 samples in 1-l green glass bottles, refrigerated at 4°C
- W-B: 1 sample in 100-ml brown glass bottle, without headspace and refrigerated at 4°C
- W-C: 1 sample in 100-ml PE bottle, filtered over 0.45 µm, pH<2 using ultra-pure HNO₃ and refrigerated at 4°C or frozen
- W-D: 1 sample in 1-l green glass bottle, addition of 1 ml of glacial acetic acid, refrigerated at 4°C
- W-E: 1 sample in 250-ml PE bottle, refrigerated at 4°C
- W-F: 1 sample in 500-ml PE bottle, refrigerated at 4°C
- W-G: 1 sample in 100-ml PE bottle, pH<2 using H₂SO₄, refrigerated at 4°C
- W-H: 1 sample in 100-ml PE bottle, pH>8 using NaOH, refrigerated at 4°C

Each sediment sample consisted of the following sub-samples:

- S-A: 1 sample appr. 500 g in a white glass jar, frozen
- S-B: 1 sample appr. 100 g in a brown glass jar, no headspace or as small as possible, frozen
- S-C: 1 sample appr. 100 g in a PE jar, frozen

The laboratory in Kilkenny was instructed to store the collected samples at 4°C until transport. For transportation to The Netherlands the cooled samples were packed in boxes, suitable for the transportation of samples, and additional cooling elements were added to the boxes. A TNO representative was present during the packing of the samples and the shipment to The Netherlands. To maintain a chain of custody a filled out Sample Registration Form was included with each shipment of samples. The sample transport from the laboratory in Kilkenny, Ireland to the TNO laboratory in The

Netherlands was carried out by Streng International Logistic Services, Apeldoorn, the Netherlands.

In total 287 water samples, 17 sediment samples and 17 biota samples were received from the South Eastern River Basin District Laboratory in Kilkenny. Table 1, 2 and 3 provide an overview of the different series/shipments and the associated codes.

Table 4 Overview of the 41 Priority Action Substances determined in this study.

No.	Parameter	CAS Number	Target EQS Water µg/l	Analysis technique ^A
1	Alachlor	15972-60-8	0.035	P1
2	Anthracene	120-12-7	0.01	P2
3	Atrazine	1912-24-9	0.1	P1
4	Benzene	71-43-2	1	P3
5	Brominated diphenylethers	n.a.		P4
	Bis(pentabromo-phenyl)ether	1163-19-5		
	Diphenyl ether, octabromo derivate	323536-52-0		
	Diphenyl ether, pentabromo derivate	32534-81-9	0.53	
6	Cadmium and it's compounds	7440-43-9	0.4	P5
7	Carbon Tetrachloride	56-23-5		P3
8	C10-13-Chloralkanes	85535-84-8	0.1	P4
9	Chlorfenvinphos	470-90-6	0.1	P1
10	Chlorpyrifos	2921-88-2	0.1	P1
11	DDT			
	4,4'-isomer	50-29-3	0.01	P1
	2,4'-isomer	789-02-6	0.01	P1
12	1,2-Dichloroethane	107-06-2	2	P3
13	Dichloromethane	75-09-2	10	P3
14	Di (2-ethylhexyl) phthalat (DEHP)	117-81-7	0.5	P2
15	Diuron	330-54-1	0.05	P6
	Drins	n.a		
16	Aldrin	309-00-2	0.01	P1
17	Endrin	60-57-1	0.005	P1
18	Dieldrin	72-20-8	0.005	P1
19	Isodrin	465-73-6	0.005	P1
20	Endosulfan	115-29-7	0.1	P1

^A: code refers to method descriptions in section 3

Table 4 Overview of the 41 Priority Action Substances (continued).

No.	Parameter	CAS Number	Target EQS Water µg/l	Analysis technique ^A
21	Fluoranthene	206-44-0	0.025	P2
22	Hexachlorobenzene	118-74-1	0.01	P1
23	Hexachlorobutadiene	87-68-3	0.1	P1
24	Hexachlorocyclohexane (Lindane)	608-73-1 (58-89-9)	0.01	P1
25	Isoproturon	34123-59-6	0.1	P6
26	Lead and it's compounds	7439-92-1	2	P5
27	Mercury and it's compounds	7439-97-6	0.2	P5
28	Naphthalene	91-20-3	1	P2
29	Nickel and it's compounds	7440-02-0	1.8	P5
30	Nonylphenols	25154-52-3	0.3	P7
	4-(para)-nonylphenol (4-nonylphenol, branched)	104-40-5 (84852-15-3)	0.3	P7
31	Octylphenols (para-tert-octylphenol)	1806-26-4 (140-66-9)	1	P7
32	Pentachloro-benzene	608-93-5	1	P1
33	Pentachlorophenol	87-86-5	0.1	P1
34	Perchloroethylene	127-18-4		P3
35	Polyaromatic Hydrocarbon (PAH)	n.a		
	(benzo-a-pyrene)	(50-32-8)	0.01	P2
	(benzo-b-fluoranthene)	(205-99-2)		P2
	(benzo-g,h,i-perylene)	(191-24-2)	0.03	P2
	(benzo-k-fluoranthene)	(207-08-9)	0.04	P2
	(indeno(1,2,3-cd)pyrene)	(193-39-5)	0.04	P2
36	Simazine	122-34-9	0.02	P1
37	Tributyltin compounds (TBT-ion)	688-73-3 (36643-28-4)	0.014	P8
38	Trichlorobenzene	12002-48-1		
	(1,2,3-trichlorobenzene)	87-61-6	0.1	P3
	(1,2,4-trichlorobenzene)	120-82-1	0.1	P3
	(1,3,5-trichlorobenzene)	108-70-3	0.1	P3
39	Trichloroethylene	79-01-6		P3
40	Trichloromethane (Chloroform)	67-66-3	1	P3
41	Trifluarin	1582-09-8	0.037	P1

^A: code refers to method descriptions in section 3

Table 5 Overview of the Relevant Pollutants determined in this study.

No.	Parameter	CAS Number	Target EQS water (µg/l)	Analysis technique ^A
1	Antimony	7440-36-0	0,4	P5
2	Amitraz	33089-61-1		P1
3	Arsenic and its mineral compounds	7440-38-2	1	P5
4	Barium	7440-39-3	75	P5
5	Bentazone	25057-89-0	0,1	P1
6	Benzidine	92-87-5	0,1	R1
7	Benzylchloride (Alpha-chlorotoluene)	100-44-7	10	R1
8	Benzylidenechloride (Alpha, alpha-dichlorotoluene)	98-87-3	10	R1
9	Beryllium	7440-41-7	0,2	P5
10	Biphenyl	92-52-4	1	R1
11	Bisphenol-A (4,4'-isopropylidenediphenol)	80-05-7		P7
12	Boron	7440-42-8	6,5	P5
13	Bromoxynil	1689-84-5	100	P1
14	Butylbenzylphthalate	85-68-7		P2
15	Captan	133-06-2	0,1	P1
16	Carbendazim	10605-21-7	0,11	P6
17	Carbofuran	1563-66-2	0,1	P6
18	Carbon Disulphide	75-15-0		P3
19	Chloridazon (Pyrazon)	1698-60-8	0,1	P1
20	Chloride	16887-00-6	250000	R5
21	Chlormequat	7003-89-6		R8
22	2-Chloroaniline	95-51-2	3	R1
23	1-Chloro-2,4-dinitrobenzene	97-00-7	5	R1
24	4-Chloro-3-methylphenol	59-50-7	10	R2
25	1-Chloronaphthalene	90-13-1	0,77	R1
26	Chloronaphthalenes (technical mixture)	n/a	0,77	R1
27	4-Chloro-2-nitroaniline	89-63-4	3	R1
<u>Chloro-Nitrobenzene</u>				
28	1-Chloro-2-nitrobenzene	89-21-4	10	R1
29	1-Chloro-3-nitrobenzene	88-73-3	1	R1
30	1-Chloro-4-nitrobenzene	121-73-3	10	R1
31	4-Chloro-2-nitrotoluene	89-59-8	4	R1
32	nitrotoluene)	25567-68-4	1	R1
33	Chloroprene (2-Chloro-1,3-butadiene)	126-99-8	10	P3
34	3-Chloropropene (Allyl chloride)	107-05-1	10	P3
<u>Chlorotoluene</u>				
35	2-Chlorotoluene	95-49-8	1	P3
36	3-Chlorotoluene	108-41-8	1	P3
37	4-Chlorotoluene	106-43-4	1	P3
38	Chlorotoluron	15545-48-9	0,4	P6
39	Chlorpropham	101-21-3	10	P1
40	Chromium	7440-47-3	0,3	P5
41	Cobalt	7440-48-4	0,2	P5
42	Copper	7440-50-8	0,5	P5
43	Cyanide	57-12-5	1	
44	Cyanuric chloride (2,4,6-Trichloro-1,3,5-triazine)	108-77-0	0,1	P1
45	Cyfluthrin	68359-37-5		P1
46	Cypermethrin	52315-07-8/ 66841-24-5	0,1	P1
47	2,4-D (including 2,4-D-salts and 2,4-D-esters)	94-75-7	0,1	P1
48	Deltamethrin	52918-63-5		P1

^A: code refers to method description in section 3

Table 5 Overview of the Relevant Pollutants determined in this study (continued).

No.	Parameter	CAS Number	Target EQS water (µg/l)	Analysis technique ^A
49	Diazinon	333-41-5		P1
50	1,2-Dibromoethane	106-93-4	2	P3
51	Di-2-ethylhexyl adipate	103-23-1		P2
52	Dibutyltin (DBT)	n/a	0,01	P8
53	Dichlobenil	1194-65-6		P1
54	Dichloroanilines	n/a	0,5	R1
55	Dichlorobenzene	n/a	10	P3
56	Dichlorobenzidines	1331-47-1	10	R1
57	Dichloro-di-isopropyl ether	108-60-1	10	P3
58	Dichloronitrobenzenes	27900-75-0	1,4	R1
59	1,1-Dichloroethane	75-34-3	10	P3
60	1,1-Dichloroethylene (Vinylidene chloride)	75-35-4	10	P3
61	1,2-Dichloroethylene	540-59-0	10	P3
62	2,4-Dichlorophenol	120-83-2	10	R2
63	Dichlorprop	120-36-5	0,4	P1
64	1,2-Dichloropropane	78-87-5	0,1	P3
65	1,3-Dichloropropene	542-75-6	0,1	P3
66	2,3-Dichloropropene	78-88-6	10	P3
67	Diethylamine	109-89-7	10	R3
68	Diflubenzuron	35367-38-5	0,015	P6
69	Di-isononyl phthalate (DINP)	28533-12-0		P2
70	Dimethoate	60-51-5	0,1	P1
71	Dimethylamine	124-40-3	7,5	R3
72	Di-n-butylphthalate (DBP)	84-74-2	0,1	P2
73	Epichlorohydrin	106-89-8	0,1	P3
74	Epoxiconazole	135319-73-2	0,1	P1
75	Ethinyl Oestradiol	57-63-6		R9
76	Ethofumesate	26225-79-6	0,1	P1
77	Ethoprophos	13194-48-4		P1
78	Ethylbenzene	100-41-4	10	P3
79	Fenitrothion	122-14-5	0,01	P1
80	Fenpropimorph	67306-03-0/ 67564-91-4	0,1	P1
81	Fluoride	16984-48-8	1	R5
82	Glyphosate	1071-83-6	1	R6
83	Glyphosate trimesium	81591-81-3	0,1	see R6
84	HBCD (hexabromocyclododecane)	25637-99-4		P4
85	Hexachloroethane	118-74-1	10	P3
86	Ioxynil	1689-83-4	10	P1
87	Isopropyl benzene	87-68-3	4,2	P3
88	Kresoxim methyl	143390-89-0	0,1	P1
89	Linuron	330-55-2	0,1	P6
90	Malathion	121-75-5	0,01	P1
91	Mancozeb	8018-01-7		R7
92	Maneb	124727-38-2		R7
93	MCPA	94-74-6	0,1	P1
94	Mecoprop	93-65-2, 7085-19-0	0,02	P1
95	Metamitron	41394-05-2	0,1	P6
96	Metazachlor	67129-08-2	0,34	P6
97	Methiocarb	2032-65-7	0,01	P6
98	Methylbromide (bromomethane)	74-83-9	0,1	P3

^A: code refers to method description in section 3

Table 5 Overview of the Relevant Pollutants determined in this study (continued).

No.	Parameter	CAS Number	Target EQS water (µg/l)	Analysis technique ^A
99	Methyl-t-butyl ether (MTBE)	1634-04-4		P3
100	Molybdenum	7439-98-7	4,3	P5
101	Mono-Chlorobenzene	108-90-7	1	P3
102	Mono-Chlorophenol	n/a	10	R2
103	Mono-Chlorotoluidines	n/a	10	R1
104	Monolinuron	1746-81-2	0,1	P6
105	Nitrobenzene	98-95-3	0,1	R1
106	4-Nitrotoluene	99-99-0		R1
107	Nonyl-Phenol Ethoxylate	37340-60-6	0,1	P7
108	4-tert-Octylphenol	140-66-9		P7
109	Oestradiol	50-28-2		R9
110	Oestrone	53-16-7		R9
111	Oxamyl	23135-22-0	1,8	P6
112	Oxydemeton-methyl	301-12-2	0,5	P1
113	Paraquat	1910-42-5	0,1	R8
114	PCB (including PCT)	n/a	0,5	R4
115	PCDD	n/a		R4
116	PCDF	n/a		R4
117	Pendimethalin	40487-42-1	1,5	P1
118	Permethrin	52645-53-1	0,01	P1
119	Phenols	n/a	30	R2
120	Pirimicarb	23103-98-2	0,09	P1
121	Pirimiphos-methyl	29232-93-7	0,05	P1
122	Prochloraz	67747-09-5	4	P1
123	Progesterone	n/a		R9
124	Propachlor	1918-16-7	1,3	P1
125	Propyzamide	23950-58-5	100	P1
126	Selenium	7782-49-2	5,3	P5
127	Silver	7440-22-4	1,2	P5
128	Styrene	100-42-5	50	P3
129	Tellurium	1349-80-9	100	P5
130	Tetrabromobisphenol A (TBBP-A)	79-94-7		P4
131	Tetrabutyltin	1461-25-2	0,016	P8
132	Thallium	7440-28-0	1,6	P5
133	Thiabendazole	148-79-8	5	P1
134	Thiram	137-26-8	0,032	P6
135	Tin	7440-31-5	0,2	P5
136	Titanium	7440-32-6	20	P5
137	Tolclofos-methyl	57018-04-9	0,8	P1
138	Toluene	108-88-3	10	P3
139	Tri-allate	2303-17-5	0,019	P1
140	Tribenuron-methyl	101200-48-0	0,1	P1
141	Trichlorfon	52-68-6		P1
142	1,2,4,5-Tetrachlorobenzene	95-94-3	1	P3
143	1,1,2,2-Tetrachloroethane	79-34-5	10	P3
144	1,1,1-Trichloroethane	71-55-6	10	P3
145	1,1,2-Trichloroethane	79-00-5	10	P3
146	1,1,2-Tri-chloro-tri-fluoro-ethane	76-13-1	3,7	P3
147	Trichlorophenols	95-95-4	1	R2

^A: code refers to method description in section 3

Table 5 Overview of the Relevant Pollutants determined in this study (continued).

No.	Parameter	CAS Number	Target EQS water (µg/l)	Analysis technique ^A
148	Triclopyr	55335-06-3		P1
149	Tri-n-propyltin (TPrT)	2279-76-7		P8
150	Triphenyltin	n/a	0,005	P8
151	Uranium	7440-61-1	0,1	P5
152	Vanadium	7440-62-2	0,9	P5
153	Vinyl chloride (Chloroethylene)	75-01-4	0,5	P3
154	Xylenes (technical mixture of isomers)	1330-20-7	10	P3
155	Zinc	7440-66-6	2,3	P5
156	Zineb	12122-67-7	0,1	R7

^A: code refers to method description in section 3

Table 1 Overview of shipments of water samples from Ireland to The Netherlands.

shipment no.	SERBD sample code 05(6)97-x-	date sent from Ireland	date received by TNO	TNO sample code 52005008-	condition shipment °C
1	1675-1686	09/05/2005	10/05/2005	001 - 012	7.1
2	1716-1721; 1725; 1728; 1736; 1739-1741	24/05/2005	27/05/2005	013 - 024	10.1
3	1801-1810; 1812-1813	14/06/2005	17/06/2005	025 - 036	9.3
4	1814-1821; 1824-1827	28/06/2005	01/07/2005	037 - 048	9.3
5	1829-1840	19/07/2005	22/07/2005	049 - 060	9.2
6	1841-1852	26/07/2005	29/07/2005	061 - 072	9.8
7	1863-1874	23/08/2005	25/08/2005	073 - 084	7.5
8	1875-1881; 1883-1887	30/08/2005	02/09/2005	085 - 096	8.2
9	1889-1900	13/09/2005	15/09/2005	097 - 108	8.6
10	1903-1914	27/09/2005	28/09/2005	109 - 120	6.8
11	1916-1925	25/10/2005	28/10/2005	121 - 130	9.9
12	1926-1939	02/11/2005	04/11/2005	131 - 144	8.7
13	1940-1944; 1948-1954	17/11/2005	18/11/2005	145 - 156	8.0
14	1955-1966	29/11/2005	02/12/2005	157 - 168	8.7
15	1975-1986	17/01/2006	20/01/2006	194 - 205	7.5
16	1987-1998	24/01/2006	26/01/2006	206 - 217	8.3
17	1999-2002 and 2006-2013	14/02/2006	16/02/2006	218 - 229	5.8
18	2014-2025	28/02/2006	02/03/2006	230 - 241	2.8
19	2026-2037	08/03/2006	10/03/2006	242 - 253	6.0
20	2038-2049	28/03/2006	30/03/2006	254 - 265	7.5
21 ^A	2050; 2051; 2053-2056, 2060 and 2063-2068	11/04/2006	13/04/2006	266 - 278	4.9
22	2069-2071; 2073; 2076-2083	25/04/2006	27/04/2006	282 - 296	8.0
23	2086-2090 and 2092-2093	22/05/2006	24/05/2006	297 - 305	6.6
24 ^A	2091, 2094-2099; 2102-2107 and 2112-2114	30/05/2006	01/06/2006	306 - 324	7.6

^A: Note that these series each contained three samples 2061-2062 and 2108-2110 (TNO code 279-281 and 325-327)

from the forestry and sheep dipping target sites. The results of the analysis of these samples are reported in summary report no 2

Table 2 Overview of shipments of sediment samples from Ireland to The Netherlands.

shipment no.	SERBD sample code 0597-x-	date sent from Ireland	date received by TNO	TNO sample code 52005008-	condition shipment °C
1	1837-1840	19/07/2005	22/07/2005	169 - 171	frozen
2	1847; 1850-1851	26/07/2005	29/07/2005	172 - 174	frozen
3	1869-1870; 1872	23/08/2005	25/08/2005	175 - 177	frozen
4	1876; 1879	30/08/2005	02/09/2005	178 - 179	frozen
5	1889-1891; 1897	13/09/2005	15/09/2005	180 - 182	frozen
6	1909	27/09/2005	30/09/2005	183	frozen
7	1922	25/10/2005	28/10/2005	184	frozen
8	1953	17/11/2005	18/11/2005	185	frozen

Table 3 Overview of shipments of biota samples from Ireland to the Netherlands.

shipment no.	SERBD sample code 0957-x-	date sent from Ireland	date received by TNO	TNO sample code 52005008-	condition shipment °C
1 ^A	1967-1974	1/4/2006	06/01/2006	186 - 193	frozen
2	2128-2132; 2142-2144; 2162	25/07/2006	28/07/2006	346 - 354	frozen

^A: Note: Additional amounts of samples 1972 and 1973 were received on resp. 20/01/2006 and 20/03/2006

2.2 Chemical parameters

For the 23 sites reported in this summary report no 1 about 223 parameters are determined in the samples. These parameters are divided in three groups:

- Priority Action : 41 parameters
- Relevant Pollutants : 156 parameters
- General Components : 20 parameters for water, 4 for sediments and 2 for biota

A alphabetic listing of these parameters is given in tables 4 to 6. Apart from the name of the parameter the tables also list the CAS number, the target Environmental Quality Standard (EQS, if determined by Carlow County) and the method that was used in this study to determine the parameter. Please note most General Components in water should be determined in the field or in the laboratory shortly after sampling. With a few exception most of the 20 parameters were therefore determined by the SERBD laboratory in Kilkenny, in some cases using equipment supplied by the TNO laboratory. All Priority Action Substances are determined in water as well as in sediment. For the Relevant Pollutants there are two exceptions, paraquat and glyphosate, which are determined in water but not in sediment since they adsorb strongly to sediment and show poor and irreproducible recoveries.

Table 6 Overview of the General Components determined in this study.

No.	Parameters in water	Analysis technique	Determined by
2	Temperature (°C)	field measurement	SERBD
3	Dissolved oxygen (% sat.)	field measurement	SERBD
4	Salinity (‰)	field measurement	SERBD
5	Electrical conductivity (µS/cm at 25°C)	field measurement	SERBD
6	pH	field measurement	SERBD
7	Alkalinity (mg/l CaCO ₃)	spectrophotometry	SERBD
8	Total Hardness (mg/l CaCO ₃)	spectrophotometry	SERBD
9	Soluble reactive phosphorus (mg/l P)	filtration and spectrophotometry	SERBD
10a	Nitrate (mg/l N)	spectrophotometry	SERBD
10b	Nitrate in saline samples (mg/l N)	ISO 13395	TNO
11	Nitrite (mg/l N)	spectrophotometry	SERBD
12	Ammonia (mg/l N)	spectrophotometry	SERBD
13	Sulphate (mg/l SO ₄)	spectrophotometry	SERBD
14	Suspended solids (mg/l)	filtration and gravimetrically	SERBD
15	Turbidity (NTU)	nephelometry	SERBD
16	Biochemical oxygen demand (mg/l O ₂)	5-day incubation at 20°C	SERBD
17	Chemical oxygen demand (mg/l O ₂)	digestion at 150°C and spectrophotometry	SERBD
18	Colour (Hazen)	colorimetry	SERBD
19	Total nitrogen (mg/l N)	ISO 5663	TNO
20	Total organic carbon (mg/l TOC)	NEN-EN 1484	TNO
21	Total phosphorus (mg/l P)	AA + UV-destr.	TNO

No.	Parameters in biota	Analysis technique	Determined by
1	Lipid content	extraction and gravimetrically	TNO
2	Moisture content	drying and gravimetrically	TNO

No.	Parameters in sediment	Analysis technique	Determined by
1	Aluminium	ICP/MS (P5)	TNO
2	Moisture Content	gravimetrically	TNO
3	Particle Size Distribution	laser diffraction	TNO
	%>2		
	%<2		
	%>63µm		
	%<63µm		
4	Total Organic Carbon	gravimetrically	TNO

3 Materials and methods

The chemical parameters determined in this study are, where possible, combined in groups. The method used for each parameter is indicated in the tables in paragraph 2.2 with a letter and number, for instance P1. In this section a brief description of each method is given.

3.1 Sample preparation

Upon receipt the samples are checked for integrity and their condition. For water samples the temperature of a number of samples is measured. Biota samples are visually checked whether these are still frozen.

The sub-samples of each water sample are divided for the individual analysis and are spiked with internal standards prior to analysis. For a number of determinations these are isotopic labelled standards, for instance dioxins, PCBs and PAHs, while for other parameters such as the volatiles and the pesticides surrogate internal standards are used. All samples are stored at 4°C until analysis.

Biota samples were allowed to thaw before collection of a sub-sample for the determination of the volatiles. The biota samples for the determination of the non-volatile organic compounds and metals were freeze-dried before further sub-sampling took place. The freeze dried samples were grinded and sub-samples were prepared. As with the water samples these were spiked with isotopic labelled and surrogate internal standards before further analysis.

Sediment samples were allowed to thaw and after homogenization sub-samples were collected for the determination of volatiles, metals and particle size determination. The sediment sample for the determination of the non-volatile organic compounds was freeze-dried before further sub-sampling took place. After homogenization these samples were sieved over a 2 mm sieve and sub-samples were prepared. As with the water samples these were spiked with isotopic labelled and surrogate internal standards before further analysis.

QA/QC samples within each series were prepared from actual samples or by combining residues of actual samples. Analytes to be determined were added to these samples in a concentration of 5 to 20 10 times the expected limit of detection (LOD). The QA/QC samples were processed in the same way as the actual samples and the method blanks.

3.2 Methods for the General Components

3.2.1 *Field measurements of water samples*

The majority of the General Components parameters for water samples are parameters that were determined in the field or shortly after sampling in the laboratory. In discussions with the SERBD laboratory it was decided which parameters would be determined there and which would be done by the TNO laboratory. Some equipment for the field measurements was sent by TNO to the SERBD laboratory in Kilkenny. The

parameters that are measured by the SERBD laboratory are given in table 6 in paragraph 2.2.

3.2.2 *General Components for water*

The parameters determined by the TNO laboratory are nitrate, total nitrogen, total organic carbon and total phosphorus. The following methods were used:

Nitrate is determined according to NEN-EN-ISO 13395, “Water quality – Determination of nitrate nitrogen and nitrite nitrogen and the sum of both by flow analysis (CFA and FIA) and spectrometric detection”. The sample is injected in an auto-analyser and nitrate is reduced to nitrite, which is then reacted to an azo-complex, which is measured photometrically.

Total nitrogen is determined according to NEN 6646, “Water – Photometric determination of the content of ammonium nitrogen and the sum of the contents of ammoniacal and organically bound nitrogen according to Kjeldahl by continuous flow analysis”. The sample is injected in an auto-analyser and is heated and digested under acidic conditions using UV-irradiation. The formed ammonium is measured photometrically.

Total organic carbon is determined according to NEN-EN 1484, “Water analysis – Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC)”. For TOC the non-filtered and acidified sample is injected in an auto-analyser and heated and digested under acidic conditions using UV-irradiation. The formed carbon dioxide is measured with an infra-red detector.

Total phosphorus is determined according to NEN-EN-ISO 15681-1, “Water quality – Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) – Part 1: Method by flow injection analysis (FIA)”. The sample is injected in an auto-analyser and is heated and digested under acidic conditions using UV-irradiation. The formed phosphate is measured photometrically.

3.2.3 *General Components for sediments*

The parameters determined by the TNO laboratory are aluminium, moisture content, particle size distribution and total organic carbon. The following methods were used:

Aluminium was determined with inductively coupled plasma with mass spectrometry (ICP/MS) as described in paragraph 3.3.4.2.

The moisture content was determined gravimetrically from the dried residue. A sub-sample was dried at 105°C until constant weight was observed. The moisture content was calculated from the weight loss of the sample.

The particle size distribution was determined with a laser diffraction method using a Malvern 2000 master sizer. A sub-sample was put in an ultrasonic bath, which is connected to a measuring cell in front of the laser. The suspension is cycled through the measuring cell and the scattered light is detected. Particle size distribution is calculated according to Fraunhofer method.

The total organic carbon content (TOC) was determined gravimetrically from the ash residue. A sub-sample was dried at 105°C and then heated at 750°C to oxidise any organic material in the sample until constant weight was observed. The TOC content was calculated from the weight loss of the sample.

3.2.4 *General Components for biota*

The parameters determined by the TNO laboratory are total lipid content and moisture content. The following methods were used:

The total lipid content was determined gravimetrically after extraction of the freeze-dried sample. A sub-sample was extracted overnight. The extract was dried, concentrated to remove the solvent and finally dried at 105°C until constant weight was observed to remove any residual solvent. The lipid content was determined from the weight of the extracted lipids.

The moisture content was determined gravimetrically from the dried residue. A sub-sample was dried at 105°C until constant weight was observed. The moisture content was calculated from the weight loss of the sample.

3.3 **Methods for the Priority Action Substances**

3.3.1 *Method P1, P2: Pesticides (GC), Polycyclic Aromatic Hydrocarbons and Phthalates*

3.3.1.1 *Water samples*

After receipt of the samples the following surrogate standards were added:

- ¹³C-Polychlorinated benzenes
- ²D-Ethylparathion and -2,4D
- 6-Methylchrysene
- ²D-Polyaromatic hydrocarbons, 16 EPA PAH

The sample was homogenized by shaking and the sample pH was adjusted to 4. The sample was extracted using solid phase extraction (SPE) and the isolated compounds were eluted from the SPE cartridge using methyl-t-butyl ether (MTBE). A saturated diazomethane solution is added to the extract for the derivatization of compounds with acidic properties. The resulting extract is purified using a column clean-up procedure resulting in fractions for the instrumental analysis of the pesticides and the PAHs. The fractions are concentrated to a small volume and analysed using gas chromatography in combination with mass spectrometry (GC/MS) after the addition of a syringe standard. The MS is used in the selected ion-monitoring mode (SIM).

Identification of the pesticides and phthalates is based on retention times and ion ratios. Quantification is based on external standards and a correction for the added syringe standard. The recovery of the added surrogate standards is used to evaluate the performance of the method. The results are not corrected for this recovery.

Identification of PAH is based on retention times and ion ratios. Quantification is based on an external standard and the recovery of the added labelled internal standards. The latter means that the results are corrected for the recovery of the internal standards

3.3.1.2 *Sediment samples*

A sub-sample is collected from the freeze-dried sediment samples and spiked with the same internal standards as the water samples. The sample is extracted using accelerated solvent extraction with a mixture of hexane/diethyl ether. The raw extract is further processed in the same way as the extract from the SPE cartridge.

3.3.1.3 *Biota samples*

A sub-sample is collected from the freeze-dried biota samples and spiked with the same internal standards as the water samples. The sample is extracted using soxhlett extraction with a mixture of hexane/diethyl ether. For the determination of the pesticides gel permeation chromatography (GPC) was used to remove lipids from the raw extracts. For the polycyclic aromatic hydrocarbons and the phthalates a hexane-acetonitril partitioning followed by a column chromatography over silica was applied to remove lipids from the extracts. The purified extracts were further processed in the same way as the extract from the SPE cartridge.

3.3.2 *Method P3: Volatiles*

3.3.2.1 *Water samples*

After receipt the samples for the determination of the volatiles sub-sample are prepared in SPME vials and spiked with the following surrogate standards:

- Monofluorobenzene
- ²D-Dichlorobenzene

The extraction and on-line analyses is performed using a GC/MS equipped with an SPME extraction device with a Supelco Carboxen coated SPME fiber. The extracted volatiles are on-line analysed with a GC/MS. The MS is used in the scanning mode (SCAN).

Identification is based on retention time and full-scan mass spectra. Quantification is based on external standards prepared in organic-free Milli-Q water. The surrogate standards are used to evaluate the performance of the method. The results are not corrected for this recovery.

3.3.2.2 *Sediment samples*

Sub-samples are collected from a field wet sediment sample and placed in a purge vessel. Organic-free MilliQ water is added followed by the above mentioned surrogate standards. The purged volatiles are isolated on Tenax adsorption tubes and analysed off-line using a GC/MS. The MS is used in the scanning mode (SCAN).

Identification is based on retention time and full-scan mass spectra. Quantification is based on external standards prepared in organic-free Milli-Q water and with the addition of purified sea-sand as a substitute matrix. The surrogate standards are used to evaluate the performance of the method. The results are not corrected for this recovery.

3.3.2.3 *Biota samples*

Sub-samples, collected after receipt of the samples, were allowed to thaw and the shells were removed. The samples were cut into smaller pieces, cryogenically grinded, and a sub-sample was placed in a purge vessel. Organic-free MilliQ water is added followed by the above mentioned surrogate standards. The purged volatiles are isolated on Tenax adsorption tubes and analysed off-line using a GC/MS. The MS is used in the scanning mode (SCAN).

Identification is based on retention time and full-scan mass spectra. Quantification is based on external standards prepared in organic-free Milli-Q water. The surrogate standards are used to evaluate the performance of the method. The results are not corrected for this recovery.

3.3.3 *Method P4: Brominated Flame Retardants and Polychlorinated Aliphatics*

3.3.3.1 *Water samples*

To the sample the following internal surrogate standards were added:

- ^{13}C -Decabrominated diphenyl ether
- ^{13}C -PCB-209

The sample is extracted at neutral pH using hexane and the resulting extract is split into equal parts. One part is purified using a column clean-up procedure with sulphuric acid impregnated silica, the extracts are concentrated to a small volume and a syringe standard is added. The extracts are analysed for polybrominated diphenyl ethers (PBDE) with GC/MS in the SIM mode.

Identification of PBDEs is based on retention times and ion ratios. Quantification is based on external standards and a correction for the added syringe standard. The recovery of the internal surrogate standards is used to evaluate the performance of the method. The results are not corrected for this recovery.

The second part of the extract is purified with column chromatography on florisil to isolate the short-chain polychlorinated aliphatics (PCA). The purified extract is concentrated to a small volume and analysed using GC/MS with negative chemical ionisation (NCI). Identification of PCA is based on specific ions and pattern recognition (i.e. technical mixture composition). Quantification is based on external standards of technical PCA mixtures.

3.3.3.2 *Sediment*

Sub-samples of the freeze-dried sediment samples are Soxhlett extracted with a mixture of hexane/diethylether after the addition of the above listed internal standards. The raw extract is split into equal parts and analysed in the same way as the extracts resulting from the extraction of the water samples.

3.3.3.3 *Biota samples*

Sub-samples of the freeze-dried biota samples are Soxhlett extracted with a mixture of hexane/diethylether after the addition of the above listed internal standards. The organic

extract is concentrated and purified over a multi-layer silica column impregnated with sulphuric acid, sodium hydroxide and silver nitrate. The purified extract is split in two parts, which are processed further as described above.

3.3.4 *Method P5: Metals*

3.3.4.1 *Water samples*

The sub-sample for dissolved metals was already filtered over a 0.45 µm filter and the solute acidified to pH 2 with nitric acid by the SERBD laboratory in Kilkenny. Metal concentrations are determined using inductively coupled plasma interfaced to a mass spectrometer (ICP/MS) in the SIM mode.

Identification is based on correct ion ratios, quantification on a calibration graph produced in the samples by standard addition. Mercury is measured with cold vapour atomic fluorescence spectrometry (CV-AFS).

3.3.4.2 *Sediment samples*

A sub-sample of the freeze-dried material is digested with nitric acid in a microwave prior to measurement. After dilution the metals are determined in the acid extract as described above.

3.3.4.3 *Biota samples*

A sub-sample of the freeze-dried material is digested with nitric acid in a microwave prior to measurement. After dilution the metals are determined in the acid extract as described above.

3.3.5 *Method P6, P7: Pesticides (LC), Alkylphenols and Alkylphenols Ethoxylates*

3.3.5.1 *Water samples*

The following surrogate standards are added for the determination of the pesticides and phenols:

- ²D-Diuron
- ²D-Bisphenol-A

The sample is extracted at neutral pH using solid phase extraction (SPE) and the SPE cartridge is eluted with MTBE. The extract is concentrated and solvent-exchanged into a mixture of MilliQ water/acetonitrile (80/20). The extract is analysed using liquid chromatography in combination with mass spectrometry (LC/MS), in the positive SIM mode for the pesticides and the alkylphenols, and in the negative SIM mode for the alkylphenol ethoxylates. In the latter case 30 ions are monitored to cover the possible range of ethoxylate fragments.

Identification of the pesticides, alkylphenols and alkylphenol ethoxylates is based on retention times and ion ratios. Quantification is based on external standards. The surrogate standards are used to evaluate the performance of the procedure. The results are not corrected for the recovery of these standards.

3.3.5.2 *Sediment samples*

Sub-samples of the freeze-dried sediment samples are sonicated with acetonitril after the addition of the above listed surrogate standards. The extract is concentrated to a small volume and diluted with MilliQ water. This aqueous sample is extracted on a SPE cartridge in the same way as the water samples and the extracts are processed and analysed similar to the extracts from the water samples.

3.3.5.3 *Biota samples*

Sub-samples of the freeze-dried biota samples are soxhlet extracted overnight after the addition of the above listed surrogate standards. Gel permeation chromatography (GPC) was used to remove lipids from the raw extracts. Two fractions were collected, the first containing the alkylphenols and ethoxylates was solvent exchanged into methanol for the instrumental analysis. The second fraction is solvent exchanged into a mixture of MilliQ water/acetonitrile for the instrumental analysis of the pesticides. The instrumental analyses are as described above.

3.3.6 *Method P8: Organotin Compounds*

3.3.6.1 *Water samples*

The following surrogate standards are added to the water samples:

- Monohexyltin chloride
- Dihexyltin chloride
- Tetrapropyltin

The water samples are acidified to pH 5 and potassium bromide (KBr) is added followed by sodium tetraethylborate (NaBEt_4) is added for the in-situ derivatization of the organotin analytes. The sample is extracted with hexane. The extract is dried, concentrated and purified using a silica column clean-up procedure. After addition of a syringe standard the extract is analysed with GC/MS in the SIM mode.

Identification of the organotin analytes is based on retention times and ion ratios. Quantification is based on external standards. The recovery of the added surrogate standards is used to evaluate the performance of the method. The results are not corrected for the recovery of the added internal standards.

3.3.6.2 *Sediment samples*

A field wet sediment sample is digested by hydrochloric acid for 30 min after the addition of the above mentioned surrogate standards. An acetate buffer (HAc/NaAc , pH 4.5) is added and the resulting mixture is extracted with hexane. The combined extracts are concentrated and derivatization of the organotin analytes is achieved by shaking the extract with sodium tetraethylborate in an acetate buffer at pH 4.5. The hexane extract is recovered, dried and concentrated to a small volume. Clean-up and further analysis of the extract is similar to that for the water samples.

3.3.6.3 *Biota samples*

Sub-samples of the freeze-dried material is overnight digested by hydrochloric acid in methanol after the addition of the above mentioned surrogate standards. The resulting mixture is centrifuged and an acetate buffer (HAc/NaAc, pH 4.5) is added to the methanol extract. Sodium tetraethylborate (NaBEt₄) is added for the in-situ derivatization of the organotin analytes and the resulting mixture is extracted with hexane. Clean-up and further analysis of the extract is similar to that for the water samples.

3.4 **Additional Methods for the Relevant Pollutants**

3.4.1 *Method R1: Polychlorinated Benzenes and Industrial Chemicals*

3.4.1.1 *Water samples*

For the first 14 series the water samples were treated as follows:
The following surrogate standards are added to the samples followed by homogenisation of the sample:

- ¹³C-polychlorinated benzenes
- 6-methylchrysene

The sample pH is adjusted to pH 2 and sodium chloride (NaCl) is added to improve the extraction efficiency. The sample is extracted with dichloromethane and the extract recovered and dried. Next, the pH of the aqueous sample is adjusted to pH 11 and the sample is extracted again. The extracts are dried and combined with the extracts of the previous extraction. Following a florisil column clean-up procedure, the extract is concentrated and analysed with GC/MS in the SIM mode after the addition of a syringe standard.

Identification of the analytes is based on retention times and ion ratios. Quantification is based on external standards and correction for the syringe standard. The recovery of the surrogate standards is used to evaluate the performance of the method. The results are not corrected for this recovery.

For the water samples of series 15 to 24 the determination of the polychlorinated benzenes in water was combined with the determination of the pesticides (P2). Industrial chemicals were not determined in the water samples of these series.

3.4.1.2 *Sediment samples*

Sub-samples of the freeze-dried sediment samples are Soxhlett extracted with hexane/diethyl ether after the addition of the above listed internal standards. The resulting extract is purified and analysed in the same way as described above.

3.4.1.3 *Biota samples*

The determination of the polychlorinated benzenes and industry chemicals was combined with the determination of the pesticides (P2). Gel permeation chromatography (GPC) was used to remove lipids from the raw extracts. The resulting

extract is further purified using a column clean-up procedure. The purified extracts are concentrated to a small volume and analysed using gas chromatography in combination with mass spectrometry (GC/MS) after the addition of a syringe standard. The MS is used in the selected ion-monitoring mode (SIM).

Identification of is based on retention times and ion ratios. Quantification is based on external standards and a correction for the added syringe standard. The recovery of the added surrogate standards is used to evaluate the performance of the method. The results are not corrected for this recovery.

3.4.2 *Method R2, R4: Polychlorinated Biphenyls, Polychlorinated Phenols and Dioxins*

3.4.2.1 *Water samples*

In the water samples of series 1 to 14 dioxines were determined. In these series the following internal standards are added to the aqueous samples:

- ^{13}C -Polychlorinated biphenyls
- ^{13}C -Polychlorinated phenols
- ^{13}C -2,3,7,8-Substituted dioxin congeners

The samples are acidified to pH 4 and extracted using liquid-liquid extraction with hexane. The raw extract is washed with an aqueous potassium carbonate (K_2CO_3) solution. This aqueous extract (containing the phenolic compounds) is set aside for later analysis. The organic extract is concentrated and purified over a multi-layer silica column impregnated with sulphuric acid, sodium hydroxide and silver nitrate. The purified extract is split in two parts.

The first part is concentrated and analysed for PCBs after the addition of a syringe standard. The extract is analysed using GC/MS in the SIM mode. Identification of PCB's is based on retention times and ion ratios. Quantification is based on external standards and the added labelled standards. The PCB results are corrected for the recovery of this internal standard.

The second part of the extract is purified further for dioxins using planar chromatography and a clean-up over an aluminium oxide column to separate the dioxins from the co-planar PCB's. After the addition of a syringe standard the final extract is analysed with gas chromatography in combination with high-resolution mass spectrometry (GC/HRMS).

Identification of dioxins is based on retention times and ion ratios. Quantification is based on external standards and the added labelled standards. The results of dioxins are corrected for the recovery of the added internal standards.

Acetic anhydride ($(\text{CH}_3\text{CO})_2\text{O}$) is added to the aqueous phase that was set aside after the primary extraction of the sample to achieve the acetylation of the chlorinated phenols. The acetylated phenols are then isolated from this aqueous phase by an extraction with hexane. After addition of a syringe standard the extract is analysed using GC/MS in the SIM mode.

Identification of the chlorinated phenols is based on retention times and ion ratios. Quantification is based on external standards and the added labelled standards. The

results of the PCP are corrected for the recovery of these compound-specific internal standards.

In the water samples of series 15 to 24 dioxins were not determined in the water samples. As a consequence only the following internal standards are added to the aqueous samples:

- ^{13}C -Polychlorinated biphenyls
- ^{13}C -Polychlorinated phenols

The samples are acidified to pH 4 and extracted using liquid-liquid extraction with hexane. The raw extract is washed with an aqueous potassium carbonate (K_2CO_3) solution. This aqueous extract (containing the phenolic compounds) is set aside for later analysis. The organic extract is concentrated and purified over a multi-layer silica column impregnated with sulphuric acid, sodium hydroxide and silver nitrate. The extract is analysed using GC/MS in the SIM mode. Identification of PCB's is based on retention times and ion ratios. Quantification is based on external standards and the added labelled standards. The PCB results are corrected for the recovery of this internal standard.

Acetic anhydride ($(\text{CH}_3\text{CO})_2\text{O}$) is added to the aqueous phase that was set-aside after the primary extraction of the sample to achieve the acetylation of the chlorinated phenols. The acetylated phenols are then isolated from this aqueous phase by an extraction with hexane. After addition of a syringe standard the extract is analysed using GC/MS in the SIM mode.

Identification of the chlorinated phenols is based on retention times and ion ratios. Quantification is based on external standards and the added labelled standards. The results of the PCP are corrected for the recovery of these compound-specific internal standards.

3.4.2.2 *Sediment samples*

Sub-samples of the freeze-dried sediment samples are Soxhlett extracted after the addition of the in paragraph 3.4.2.2 listed internal standards with a mixture of hexane/diethyl ether. The raw extract is analysed in the same way as the extract resulting from the liquid-liquid extraction of the aqueous samples.

3.4.3 *Method R3: Alkylamines*

Alkylamines were determined only in water and sediment samples.

3.4.3.1 *Water samples*

To the aqueous samples the following surrogate standard is added:

- Monoethylamine

A small sub-sample of the aqueous samples is filtered through a $0.45\ \mu\text{m}$ filter and the pH of the solute is adjusted to pH 9 with a potassium carbonate (K_2CO_3) solution. Finally, an aliquot of an N-alpha-(9-fluorenylmethyl oxycarbonyl (Fmoc) solution in acetonitril is added to the solute. The sample is then directly analysed with LC/MS in the positive SIM mode.

Identification of the alkylamines is based on retention times and ion ratios. Quantification is based on external standards. The recovery of the added surrogate standard is used to evaluate the performance of the method. The results of the alkylamines are not corrected for this recovery.

3.4.3.2 *Sediment samples*

Field wet sediment samples are extracted with Milli-Q water at pH 4. The aqueous extract is then treated and analysed as the aqueous samples in paragraph 3.4.3.1.

3.4.3.3 *Biota samples*

Sub-samples of the freeze-dried biota samples are Soxhlett extracted after the addition of the following internal standards:

- ^{13}C -Polychlorinated biphenyls
- ^{13}C -Polychlorinated phenols
- ^{13}C -2,3,7,8-Substituted dioxin congeners

The raw extract is washed with an aqueous potassium carbonate (K_2CO_3) solution. This aqueous extract (containing the phenolic compounds) is set aside for later analysis. The organic extract is split into two parts.

The first part is concentrated and analysed for PCBs after the addition of a syringe standard. The extract is analysed using GC/MS in the SIM mode. Identification of PCB's is based on retention times and ion ratios. Quantification is based on external standards and the added labelled standards. The PCB results are corrected for the recovery of this internal standard.

The second part of the extract is purified further for dioxins using planar chromatography and a clean up over an aluminium oxide column to separate the dioxins from the co-planar PCB's. After the addition of a syringe standard the final extract is analysed with gas chromatography in combination with high-resolution mass spectrometry (GC/HRMS).

Identification of dioxins is based on retention times and ion ratios. Quantification is based on external standards and the added labelled standards. The results of dioxins are corrected for the recovery of the added internal standards.

Acetic anhydride ($(\text{CH}_3\text{CO})_2\text{O}$) is added to the aqueous phase that was set aside after the primary extraction of the sample to achieve the acetylation of the chlorinated phenols. The acetylated phenols are then isolated from this aqueous phase by an extraction with hexane. After addition of a syringe standard the extract is analysed using GC/MS in the SIM mode.

Identification of the chlorinated phenols is based on retention times and ion ratios. Quantification is based on external standards and the added labelled standards. The results of the PCP are corrected for the recovery of these compound-specific internal standards.

3.4.4 *Method R5: Fluoride, Chloride, Cyanide and Phenols*

Fluoride, chloride, cyanide and total phenols were determined only in water and sediment samples.

3.4.4.1 *Water samples*

Fluoride was determined according to NEN 6483, “Water – Potentiometric determination of the total fluoride content”. A sub-sample is stabilized by the addition of a buffer solution and the concentration of fluoride is measured with an ion-selective electrode.

Chloride was determined according to NEN-EN-ISO 15682, “Water quality – Determination of chloride by flow analysis (CFA and FIA) and photometric or potentiometric detection”. The sample is injected in an auto-analyser and chloride is reacted with mercury thiocyanate to form a red complex that is measured photometrically.

Cyanide was determined according to NEN-EN-ISO 14403, “Water quality – Determination of total cyanide and free cyanide by continuous flow analysis”. The filtered sample is injected in an auto-analyser and on-line acidified while UV-irradiation is used to break down complex cyanides. The sample flow is heated to vaporize the released cyanide, which is then measured photometrically.

Total (water soluble) phenols was determined according to NEN-EN-ISO 14402, “Water quality – Determination of phenol index by flow analysis (FIA and CFA)”. The sample is injected in an auto-analyser and heated to achieve a steam distillation of the phenols across a semi-permeable membrane. After condensation of the distillate the phenol content is determined photometrically.

3.4.4.2 *Sediment samples*

Fluoride and chloride are measured following an extraction of the freeze-dried sediment samples with Milli-Q water. The extracts are filtered through a 0.45 µm filter and the concentration of fluoride and chloride in the aqueous extracts is determined using ion chromatography.

Total cyanide is determined by the extraction of the freeze-dried sediment samples with a 10% sodium hydroxide (NaOH) solution in Milli-Q water. The aqueous extract is diluted with Milli-Q water and the total cyanide content is measured as in the water samples in 3.4.4.1.

3.4.5 *Method R6: Glyphosate*

Glyphosate is determined only in water samples.

A sub-sample is collected and filtered through a 0.45 µm filter. The pH is adjusted to 9 with potassium carbonate (K₂CO₃) and an aliquot of an Fmoc solution in acetonitril is added to the solute. The sample is then directly analysed with LC/MS in the positive SIM mode.

Identification is based on retention time and ion ratios. Quantification is based on external standards and standard addition to the sample. It is expected (but not confirmed) that glyphosate trimesium is derivatised in the same procedure and measured as glyphosate. The result is therefore the sum of glyphosate and glyphosate trimesium and both analytes cannot be distinguished by this method.

3.4.6 *Method R7: Dithiocarbamates (Maneb, Mancozeb and Zineb)*

Dithiocarbamates are determined only in water and sediment samples.

3.4.6.1 *Water*

The aqueous sample is purged to remove any free carbon disulfide in the sample. Concentrated hydrochloric acid (HCl), tin(II)chloride (SnCl₂) and the following surrogate standard are added:

- Dichloromethane

The vial with the aqueous sample and reagents is closed, heated at 80°C and carbon disulfide liberated by the thioureas is measured in the headspace using a direct injection of part of the headspace. The headspace is analysed using GC/MS in the SIM mode. Identification is based on retention time and ion ratios. Quantification is based on external standards and standard addition to samples. The recovery of the surrogate standard is used to evaluate the performance of the method. The results are not corrected for this recovery. Note that maneb, mancozeb and zineb all produce carbon disulfide and can therefore not be distinguished by this method.

3.4.6.2 *Sediment*

Field wet sediment samples are mixed with organic-free Milli-Q water. This sample is treated with hydrochloric acid and tin(II)chloride in the same way as the aqueous samples and analysed as such.

3.4.7 *Method R8: Chlormequat and Paraquat*

Chlormequat and paraquat are only analysed in water samples.

The pH of the aqueous samples is adjusted to pH 2 and the sample is concentrated on a cation-exchange type SPE column. The SPE column is eluted, the extract diluted in a sodium octanesulfonate solution, and analysed with ion-pair chromatography with UV detection.

Identification is based on retention time. Quantification is based on external standards and standard addition to samples.

3.4.8 *Method R9: Estrogens*

Estrogens are only analysed in water samples of the series 1 to 14. The following internal standards are added to the aqueous samples:

- ²D-Ethinestradiol
- ²D-β-Estradiol

A sub-sample is concentrated on an Oasis HLB type SPE column. The SPE column is eluted and the extract is evaporated until dryness. The residue is derivatized with hexafluorobutyric acid (HFBA). Following completion of the reaction, the extract is solvent exchanged and analysed with gas chromatography in combination with high-resolution mass spectrometry (GC/HRMS). Identification is based on retention time and ion ratio's. Quantification is based on external standards. The recovery of the added surrogate standard is used to evaluate the performance of the method. The results of the estrogens are not corrected for this recovery.

3.5 Identification, limits of detection, calculation and expression of results

As mentioned in the previous sections identification of analytes is always based on retention times, and if the instrumental analyses was carried out with mass spectrometry (which is the case for most analytes), on qualifier ion ratios. Retention times and qualifier ion ratios are determined using external standards of the analytes. Quantification is based on relative response factors obtained from external standards analysed together with the sample extracts. The recovery of the added internal standards was used to evaluate the performance of the analysis in the case of surrogate standards. In the case of isotopic labelled internal standards the recovery is not only used to evaluate the performance of the method, but since the recovery is compounds specific, also used to correct the results of the target compounds. This type of correction was applied in the analysis of the dioxins, PCB, PCBz, PCP and PAH.

Typically, the limit of detection (LOD) is defined as that concentration in a sample that produces a signal-to-noise (S/N) ratio of three in the analysis. In the same way the limit of quantitation (LOQ) is defined as the concentration that produces a signal with an S/N ratio of ten. The LOD of parameters has been determined in validation studies and is part of the standard operating procedure for these parameters. Actual "sample specific" LOD value may vary to some extent from the procedural LOD depending on the composition of the sample. During the analysis of actual samples intermediate LOD values are calculated from the signals of internal and external standards and the noise in the measurement for a particular parameter. If the intermediate LOD is equal or below the procedural LOD, the procedural LOD value is used whenever a parameter is not detected. If the intermediate LOD is above the procedural LOD value the intermediate LOD value is used. In this report only LOD values are used. LOQ values can be calculated by multiplying the LOD with a factor of three.

Unless stated otherwise, the results of the analyses are expressed in µg/l for water samples and µg/kg dry weight (dw) for biota samples. When reading the tables in section 4 and the appendix of this report please note that while results are rounded to the correct decimal number, they are not always rounded to the correct number of significant units. In general no more than two significant numbers apply. Non-rounded numbers are used throughout the report because of the traceability of the numbers in the different tables and the text.

In the summary tables in section 4, percentiles (25th, 50th, 75th and 90th) are given to provide additional information about the distribution of the results. Percentiles are used instead of averages because the distribution of the results is not a normal distribution (many results are below the detection limit) and percentiles give in that case a more realistic estimate. The 50th percentile is the median concentration. The percentiles are calculated on the results of all samples. Results that are below the

detection limit are set to zero. If the calculated percentile is smaller than the method detection limit, it is replaced by the method detection limit.

4 Results

4.1 Priority Action Substances

The Priority Action Substances form a group of 41 parameters. Due to the fact that some parameters consist of more than one compound (for instance the parameter “drins” contains 4 individual compounds) there are 51 individual compounds in the group of Priority Action Substances. In this section the findings for these compounds are summarised and briefly discussed. For the benefit of clarity compounds are grouped per compound type, e.g.; volatiles, metals, pesticides etc. which is different from the order used in appendix 3 where the complete results of all parameters are listed according to their parameter number. Appendix 3 can be found in a separately published document accompanying this report, Appendices 1 to 5.

4.1.1 *Polycyclic aromatic hydrocarbons*

Polycyclic aromatic hydrocarbons (PAH) enter the environment from the incomplete combustion of organic compounds via acetylene intermediates. The sources include coal tar, creosote, industrial and private incinerators, and motorised vehicle exhausts. The Priority Action Substances contain 8 of the 16 EPA PAH and the results are summarized in table 7a, 7b and 7c at the end of this section.

4.1.1.1 *Water*

The results show that all PAH were identified in one or more of the water samples. Naphthalene, found in 57% of the water samples with a maximum concentration of 5.0 µg/l, and fluoranthene, found in 79% of the water samples with a maximum concentration of 5.0 µg/l, are the most prominent. Although not all 16 EPA PAH are determined, the general pattern of the relative concentrations of the PAH (but also the frequency of their detection) points in the direction of combustion as the probable source, possibly with an additional source for naphthalene emissions (for instance the use of coal tar or creosote for impregnations). The 50-percentile concentrations are comparable or lower than those found for instance in The Netherlands. The average recoveries of the added internal standards in the samples ranges from 66% for naphthalene to 106% for benzo[b]fluoranthene, indicating a good performance of the method. Note that the results are corrected for these compound-specific internal standards. Blank values were found for naphthalene and fluoranthene. The 75-pct of the blank levels equalled the LOD indicating that about 25% of the method blanks contained naphthalene and fluoranthene. Results were not corrected for these blank values.

4.1.1.2 *Sediment*

The results for PAH in the sediment samples are listed in table 7b. As expected PAH are found in all sediment samples, including the less volatile and less water soluble 4 and 5 ring PAH's. The concentrations and the pattern of the relative concentrations are similar to what is found in sediments in the Netherlands and other countries. The recoveries of the added internal standards range from 50% for naphthalene to 120% for benzo[b]fluoranthene. The results are corrected for these recoveries. No blank values were found in method blank samples.

4.1.1.3 *Biota*

The results for PAH in the biota samples are listed in table 7c. As expected PAH are found in all biota samples, including the less volatile and less water soluble 4 and 5 ring PAH's that bio-accumulate in biota. The concentrations and the pattern of the relative concentrations are comparable to what is regularly found in biota in non-contaminated sites. The recoveries of the added internal standards range from 76% for naphthalene to 113% for fluoranthene. The results are corrected for these recoveries. The 75-pct of the blank levels of naphthalene were 10 times the LOD. Results were not corrected for the blank value.

4.1.2 *Pesticides and polychlorobenzenes*

Agro-chemicals, more commonly known as pesticides, are widely used against insects (insecticides), hazardous fungi (fungicides) and weeds (herbicides). The most prominent chemical representatives are organo-chlorides, ureatic derivatives, triazines, carbamates and organo-phosphates. Well known compounds such as DDT, lindane, aldrin and dieldrin belong to the organo-chloride group which, in the past, was widely used over the world. Although their manufacture and application are now largely prohibited or restricted they can still be found due to their persistent nature. The results for the pesticides and polychlorobenzenes within the group of Priority Action Substances are summarized in table 8a, 8b and 8c for respectively water, sediment and biota.

4.1.2.1 *Water*

From the results it is clear that with a few exceptions pesticides and polychlorobenzenes are found only in a limited number of samples. The exceptions are the 1,3,5-triazines simazine and atrazine, diuron and pentachlorophenol. The triazines are highly active herbicides that are widely used in agriculture. For simazine the 75-percentile equals the target EQS value. Since simazine was found in 38% of the samples this means that if simazine is found it often is above the target EQS value. For atrazine and pentachlorophenol the 90-percentile is still well below the target EQS value, while the 90-percentile value for diuron more or less equals the target EQS. Isodrin which was found in 11% of the samples with a 90-percentile above the target EQS. The recovery of added internal standards ranges from 81% to 112% indicating a good method performance. The recoveries of the individual compounds in the spiked QC samples also indicate good recoveries, generally above 76%.

4.1.2.2 *Sediment*

As in water, only a few pesticides are detected in sediments, generally in low concentrations. The highest concentrations were found for the DDT's, up to 164 µg/kg for 4,4-DDT. The presence of this compounds may be expected because of its persistent nature and global distribution. As in the water samples recoveries of added internal standards and QC samples were generally above 70%. An exception was diuron for which the recovery from spiked sediment was 60%.

4.1.2.3 *Biota*

As in water, only a few pesticides are detected in the biota, generally in low concentrations. Lindane was found in only one sample at a concentration of 42 µg/kg dw, the highest concentration found in a sample for these parameters. In all other samples lindane was not found. The highest concentrations were found for the DDT's, up to 25 µg/kg for 2,4-DDT. The presence of these compounds and that of hexachlorobenzene may be expected because of its persistent nature and global distribution. As in the water samples recoveries of added internal standards and QC samples were generally above 77%. An exception was isoproturon, hexachlorobutadiene and trifluralin for which the recovery from a spiked biota sample was only 46, 52% and 27% respectively.

4.1.3 *Volatiles*

Industry has a very heavy consumption of volatile solvents of all kinds. In addition many solvents are used in cleaning processes such as perchloroethylene in dry-washing, in products like paints and lacquers, and in various common household products. Through industrial waste-water emissions, but also more diffuse domestic emissions, volatiles will enter the environment. The results for the volatiles within the group of Priority Action Substances are summarized in table 9a, 9b and 9c for respectively water, sediment and biota.

4.1.3.1 *Water*

These compounds are found only in a limited number of samples with tri- and dichloromethane being the most prominent. Trichloromethane was found in 39% of the samples with a maximum concentration of 7.2 µg/l, which is above the target EQS value. The fact that the 90-percentile for this compound is 0.53 µg/l indicates that the maximum concentration is only an incidental sample. The recoveries of the added internal standards and the spiked volatiles in the QC samples were all well above 94%. No blanks were found in the method blank samples.

4.1.3.2 *Sediment*

As expected only a few volatiles were found and only in limited concentrations. The recoveries of the added internal standards and the spiked volatiles in the QC samples were all well above 84%. No blanks were found in the method blank samples.

4.1.3.3 *Biota*

With the exception of benzene, di- and trichloromethane no other volatiles were found. Dichloromethane was found in 2 of the samples in concentrations 13 and 16 µg/kg dw. Trichloromethane was found in only 1 sample. Benzene was found in 3 samples in concentrations close to the detection limit. The recoveries of the added internal standards are 65% while that of the spiked volatiles in the QC sample ranges from 64% to 97%. No blanks were found in the method blank samples.

4.1.4 *Metals*

Metals are widely distributed in our environment and their accumulation can cause health damage. This is particularly true for lead, mercury and cadmium. Not surprisingly they are therefore part of the Priority Action Substances as is nickel. The results for the metals are summarized in table 10a, 10b and 10c for respectively water, sediment and biota.

4.1.4.1 *Water*

As expected the presence of nickel is fairly common and it is found in 54% of the samples in concentrations ranging from 0.96 to 152 µg/l. Again the 90-percentile result of 5.0 µg/l indicates that the maximum concentration is an exception. Nevertheless, also the 90-percentile result exceeds the target EQS with a factor of 2. While lead is found in 12% of the samples, cadmium and mercury are found in less than 6% of the samples. For lead the 90-percentile value almost equals the target EQS value indicating that in about 14 samples the target EQS will be exceeded. For cadmium all results are below the target EQS while most of the results for mercury exceed the target EQS. Duplicate instead of spiked samples were analysed as QC samples. The results show that differences between duplicates are generally less than 6% indicating good method repeatability.

4.1.4.2 *Sediment*

Cadmium, lead and nickel were found in all sediment samples in concentrations up to 80 mg/kg dw for lead. Mercury was found in only 3 of the 17 samples in concentrations up to 0.33 mg/kg dw. The results of the QC samples were comparable to those for the water samples. The results show that differences between duplicates are generally less than 6% indicating good method repeatability.

4.1.4.3 *Biota*

The results for biota are summarized in table 10c. **Please notice that these results are expressed in mg/kg dw and not in µg/kg dw.** Cadmium, lead, mercury and nickel were found in almost all samples in concentrations up to 7.7 mg/kg dw for lead and up to 33 mg/kg dw for nickel. Low concentrations were found for cadmium and mercury. The results of duplicate analysis of samples show that differences between duplicates are generally less than 5% indicating good method repeatability.

4.1.5 *Hormone-disrupting compounds*

Over recent decades, disruptions in reproduction of a number of species have been shown. These disruptions are ascribed to the influence of particular compounds in the aquatic environment on the hormone systems of exposed animals or their offspring. This last group of compounds within the Priority Action Substances group are compounds with potential or suspected hormone-disrupting effects. Well known examples are organotin compounds (TBT) used in anti-fouling paints on ships. A series of “new” chemicals are suspected to have hormone-disrupting properties. These include phthalates, alkylphenols and brominated flame retardants. The results for these compounds are summarized in table 11a, 11b and 11c for respectively water, sediment and biota.

4.1.5.1 *Water*

Of the brominated flame retardants the pentabromo diphenyl ether (penta-BDE) are found in 46% of the samples in concentrations ranging from 0.001 to 0.036 µg/l, while the octa-BDE is found in only 1 of the samples. In manufacturing the so-called Penta-mix and, Octa-mix are commercially used with the Penta-mix being used most. This, combined with the much lower water solubility of the octa-BDE, and the lesser detection limits for these compounds, makes that the penta-BDE dominates in the results. The concentrations found compare well with concentrations found in rainwater and surface water in The Netherlands. However, concentrations in waste water can be much higher due to the higher levels of suspended matter or DOC in such waters.

Short-chain polychlorinated aliphatics, that are used as cutting oils in the metal industry were found in about 7% of the samples. Nonyl- and octylphenols were found in respectively 5 and 14% of the samples in concentrations ranging from 0.010 to 0.22 µg/l. This is a normal figure for surface waters while concentrations in waste waters and municipal effluents may go up to 1 µg/l. Finally, di-(2-ethylhexyl) phthalate (DEHP) was found in 19 of the 287 samples in concentrations ranging from 0.20 to 11 µg/l with a 90-percentile value of 1.3 µg/l. This is comparable with the situation in The Netherlands where DEHP concentrations in surface waters vary between 0.2 and 1.0 µg/l with excursions up to 5 µg/l.

The recoveries of added internal standards and of individual compounds in the QC samples were above 70%. Exceptions are DEHP for which irregular recoveries were found in the QC samples and BDE-209 with a recovery of 60%. In addition blank values for DEHP were found in all method blank samples with a 75-pct value of 1.6 µg/l. This is a consequence of the use of DEHP in many materials. Although such materials were avoided in the analysis, blank values for this compound are often unavoidable. Based on the method blank level and its variance the LOD for DEHP in water samples should be raised to 1 µg/l after correction for the blank value. Note that the results for DEHP are corrected for the actual method blank in each series.

4.1.5.2 *Sediment*

In sediments DEHP and the brominated flame retardant penta-BDE are the most often found. The results are summarized in table 11b. The recoveries of internal standards and compounds in QC samples are above 90%. The recovery for DEHP was 116%, probably as a result of the blank values in the analysis. A method blank of about 25 µg/kg dw was found for DEHP in the analysis of the sediments. Based on this the LOD was raised to 50 µg/kg dw. Results are corrected for the actual method blank.

4.1.5.3 *Biota*

Pentabromo diphenylethers were found in all biota samples with a maximum concentration of 25 µg/kg dw. Tributyltin was found in 41% of all biota samples in concentrations up to 8.8 µg/kg dw. Di-(2-ethylhexyl) phthalate (DEHP) was found in all samples but in a similar concentration in the method blank. Due to the blank result the detection limit for this compound had to be raised to 500 µg/kg dw. Concentrations that were found in food samples (including fish) normally are below this value. Short-chain polychlorinated aliphatics and alkylphenols were found in none of the samples.

The recovery of the internal standard ranged from 82 to 96%. The recovery for DEHP could not be determined as a consequence of the blank level.

Table 7a Priority Action Substances: Polycyclic aromatic hydrocarbons in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
naphthalene	P001	1.0	0.010	µg/l	165	0.022	5.0	<	0.044	0.075	0.11
anthracene	P006	0.010	0.002	µg/l	111	0.0020	3.2	<	<	0.0031	0.011
fluoranthene	P007	0.025	0.005	µg/l	228	0.005	5.0	0.0054	0.0090	0.016	0.027
benzo[b]fluoranthene	P011	n/a	0.005	µg/l	69	0.0050	4.4	<	<	<	0.010
benzo[k]fluoranthene	P012	0.040	0.005	µg/l	23	0.0038	3.4	<	<	<	<
benzo[a]pyrene	P013	0.010	0.005	µg/l	58	0.0051	4.1	<	<	<	0.0087
indeno[1,2,3-cd]pyrene	P014	0.040	0.005	µg/l	27	0.0039	1.5	<	<	<	<
benzo[g,h,i]perylene	P016	0.030	0.005	µg/l	42	0.0040	2.1	<	<	<	0.0062

Table 7b Priority Action Substances: Polycyclic aromatic hydrocarbons in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
naphthalene	P001	n/a	1.0	µg/kg dw	17	2.1	140	4.3	9.6	12	87
anthracene	P006	n/a	0.50	µg/kg dw	16	1.6	397	4.2	9.5	21	247
fluoranthene	P007	n/a	0.50	µg/kg dw	17	2.1	2742	21	61	143	1252
benzo[b]fluoranthene	P011	n/a	0.50	µg/kg dw	17	1.2	1859	15	57	109	837
benzo[k]fluoranthene	P012	n/a	0.50	µg/kg dw	16	1.5	539	7.2	29	58	450
benzo[a]pyrene	P013	n/a	0.50	µg/kg dw	17	0.89	1144	11	44	84	758
indeno[1,2,3-cd]pyrene	P014	n/a	0.50	µg/kg dw	17	0.67	599	7.7	27	56	479
benzo[g,h,i]perylene	P016	n/a	0.50	µg/kg dw	17	0.79	659	7.2	26	51	464

Table 7c Priority Action Substances: Polycyclic aromatic hydrocarbons in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
naphthalene	P001	n/a	1.0	µg/kg dw	12	1.5	163	5.2	78	88	96
anthracene	P006	n/a	0.50	µg/kg dw	14	0.90	35	1.3	4.9	21	30
fluoranthene	P007	n/a	0.50	µg/kg dw	17	2.3	436	3.6	14	82	127
benzo[b]fluoranthene	P011	n/a	0.50	µg/kg dw	10	0.59	274	14	34	74	116
benzo[k]fluoranthene	P012	n/a	0.50	µg/kg dw	9	0.58	87	5.4	17	27	45
benzo[a]pyrene	P013	n/a	0.50	µg/kg dw	9	1.6	73	10	11	24	48
indeno[1,2,3-cd]pyrene	P014	n/a	0.50	µg/kg dw	9	0.77	35	3.3	9.8	16	22
benzo[g,h,i]perylene	P016	n/a	0.50	µg/kg dw	9	0.94	53	5.7	16	26	35

Table 8a Priority Action Substances: Pesticides in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
pentachlorophenol	P041	0.10	0.010	µg/l	121	0.0083	1.9	<	<	0.014	0.023
1,3,5-trichlorobenzene	P048	0.10	0.010	µg/l	2	0.019	0.044	<	<	<	<
1,2,4-trichlorobenzene	P049	0.10	0.010	µg/l	15	0.010	0.20	<	<	<	<
1,2,3-trichlorobenzene	P050	0.10	0.010	µg/l	2	0.011	0.026	<	<	<	<
pentachlorobenzene	P053	1.0	0.002	µg/l	19	0.0023	0.018	<	<	<	<
hexachlorobenzene	P054	0.010	0.002	µg/l	27	0.0023	0.0081	<	<	<	<
hexachlorobutadiene	P202	0.10	0.002	µg/l	0	<	<	<	<	<	<
trifluralin	P214	0.037	0.005	µg/l	0	<	<	<	<	<	<
atrazine	P218	0.10	0.010	µg/l	93	0.010	2.2	<	<	0.012	0.023
lindane	P219	0.010	0.005	µg/l	2	0.011	0.15	<	<	<	<
alachlor	P225	0.035	0.010	µg/l	8	0.015	0.17	<	<	<	<
aldrin	P232	0.010	0.005	µg/l	0	<	<	<	<	<	<
chlorpyrifos(-ethyl)	P233	0.10	0.010	µg/l	2	0.012	0.016	<	<	<	<
isodrin	P238	0.005	0.005	µg/l	34	0.0054	0.15	<	<	<	0.012
chlorfenvinphos	P241	0.10	0.010	µg/l	6	0.011	0.044	<	<	<	<
endosulfan-alpha	P243	0.10	0.010	µg/l	2	0.083	0.45	<	<	<	<
dieldrin	P244	0.005	0.005	µg/l	18	0.006	1.5	<	<	<	<
endrin	P246	0.005	0.005	µg/l	2	0.026	0.027	<	<	<	<
endosulfan-beta	P247	0.10	0.010	µg/l	2	0.030	0.68	<	<	<	<
2,4'-DDT	P248	0.010	0.002	µg/l	3	0.0041	0.008	<	<	<	<
4,4'-DDT	P250	0.010	0.002	µg/l	16	0.0022	0.25	<	<	<	<
simazine	P306	0.020	0.010	µg/l	109	0.011	0.33	<	<	0.026	0.042
isoproturon	P308	0.10	0.010	µg/l	28	0.010	0.13	<	<	<	<
diuron	P309	0.050	0.010	µg/l	87	0.010	0.25	<	<	0.012	0.030

Table 8b Priority Action Substances: Pesticides in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
pentachlorophenol	P041	n/a	1.0	µg/kg dw	6	1.1	2.8	<	<	1.1	1.9
1,3,5-trichlorobenzene	P048	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
1,2,4-trichlorobenzene	P049	n/a	1.0	µg/kg dw	1	3.4	3.4	<	<	<	<
1,2,3-trichlorobenzene	P050	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
pentachlorobenzene	P053	n/a	0.20	µg/kg dw	1	3.9	3.9	<	<	<	<
hexachlorobenzene	P054	n/a	0.20	µg/kg dw	3	0.42	1.3	<	<	<	0.45
hexachlorobutadiene	P202	n/a	0.20	µg/kg dw	0	<	<	<	<	<	<
trifluralin	P214	n/a	0.50	µg/kg dw	0	<	<	<	<	<	<
atrazine	P218	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
lindane	P219	n/a	0.50	µg/kg dw	0	<	<	<	<	<	<
alachlor	P225	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
aldrin	P232	n/a	0.50	µg/kg dw	0	<	<	<	<	<	<
chlorpyrifos(-ethyl)	P233	n/a	1.0	µg/kg dw	8	1.1	2.0	<	<	1.2	1.6
isodrin	P238	n/a	0.50	µg/kg dw	0	<	<	<	<	<	<
chlorfenvinphos	P241	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
endosulfan-alpha	P243	n/a	1.0	µg/kg dw	1	19	19	<	<	<	<
dieldrin	P244	n/a	0.50	µg/kg dw	2	5.0	5.2	<	<	<	2.0
endrin	P246	n/a	0.50	µg/kg dw	0	<	<	<	<	<	<
endosulfan-beta	P247	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
2,4'-DDT	P248	n/a	0.20	µg/kg dw	3	3.3	24	<	<	<	9.6
4,4'-DDT	P250	n/a	0.20	µg/kg dw	6	1.9	164	<	<	2.2	4.0
simazine	P306	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
isoproturon	P308	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
diuron	P309	n/a	1.0	µg/kg dw	2	1.2	2.9	<	<	<	0.47

Table 8c Priority Action Substances: Pesticides in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured min	max	25-pct	50-pct	75-pct	90 pct
pentachlorophenol	P041	n/a	1.0	µg/kg dw	8	2.9	6.9	<	1.4	3.9	5.2
1,3,5-trichlorobenzene	P048	n/a	1.0	µg/kg dw	11	1.0	2.7	1.0	1.1	1.6	2.0
1,2,4-trichlorobenzene	P049	n/a	1.0	µg/kg dw	17	1.1	6.5	2.4	4.3	4.9	5.5
1,2,3-trichlorobenzene	P050	n/a	1.0	µg/kg dw	8	1.0	3.2	1.1	1.1	1.4	2.0
pentachlorobenzene	P053	n/a	0.20	µg/kg dw	4	0.22	0.66	<	<	0.23	0.31
hexachlorobenzene	P054	n/a	0.20	µg/kg dw	17	0.21	3.1	0.23	0.88	1.1	1.6
hexachlorobutadiene	P202	n/a	0.20	µg/kg dw	0	<	<	<	<	<	<
trifluralin	P214	n/a	0.50	µg/kg dw	2	0.54	0.82	<	<	<	0.60
atrazine	P218	n/a	1.0	µg/kg dw	1	1.3	1.3	<	<	<	<
lindane	P219	n/a	0.50	µg/kg dw	1	42	42	<	<	<	<
alachlor	P225	n/a	1.0	µg/kg dw	1	7.0	7.0	<	<	<	<
aldrin	P232	n/a	0.50	µg/kg dw	0	<	<	<	<	<	<
chlorpyrifos(-ethyl)	P233	n/a	1.0	µg/kg dw	2	2.3	7.8	<	<	<	2.9
isodrin	P238	n/a	0.50	µg/kg dw	0	<	<	<	<	<	<
chlorfenvinphos	P241	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
endosulfan-alpha	P243	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
dieldrin	P244	n/a	0.50	µg/kg dw	2	15	65	<	<	<	20
endrin	P246	n/a	0.50	µg/kg dw	0	<	<	<	<	<	<
endosulfan-beta	P247	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
2,4'-DDT	P248	n/a	0.20	µg/kg dw	14	2.9	25	3.3	4.6	7.7	16
4,4'-DDT	P250	n/a	0.20	µg/kg dw	14	0.80	19	1.7	2.5	4.4	6.4
simazine	P306	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
isoproturon	P308	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
diuron	P309	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<

Table 9a Priority Action Substances: Volatiles in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured min max	25-pct	50-pct	75-pct	90 pct
dichloromethane	P103	10	0.10	µg/l	55	0.10 7.4	<	<	<	0.32
trichloromethane	P109	1.0	0.10	µg/l	111	0.10 7.2	<	<	0.18	0.53
tetrachloromethane	P111	n/a	0.10	µg/l	12	0.15 0.38	<	<	<	<
1,2-dichloroethane	P112	2.0	0.10	µg/l	13	0.20 7.1	<	<	<	<
benzene	P113	1.0	0.10	µg/l	21	0.10 6.5	<	<	<	<
trichloroethene	P114	n/a	0.10	µg/l	6	0.12 0.30	<	<	<	<
tetrachloroethene	P120	n/a	0.10	µg/l	22	0.10 1.5	<	<	<	<

Table 9b Priority Action Substances: Volatiles in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured min max	25-pct	50-pct	75-pct	90 pct
dichloromethane	P103	n/a	1.0	µg/kg dw	1	4.2 4.2	<	<	<	<
trichloromethane	P109	n/a	1.0	µg/kg dw	0	< <	<	<	<	<
tetrachloromethane	P111	n/a	1.0	µg/kg dw	0	< <	<	<	<	<
1,2-dichloroethane	P112	n/a	1.0	µg/kg dw	0	< <	<	<	<	<
benzene	P113	n/a	1.0	µg/kg dw	1	9.9 9.9	<	<	<	<
trichloroethene	P114	n/a	1.0	µg/kg dw	1	15 15	<	<	<	<
tetrachloroethene	P120	n/a	1.0	µg/kg dw	0	< <	<	<	<	<

Table 9c Priority Action Substances: Volatiles in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured min max	25-pct	50-pct	75-pct	90 pct
dichloromethane	P103	n/a	10	µg/kg dw	2	13 16	<	<	<	14
trichloromethane	P109	n/a	10	µg/kg dw	1	77 77	<	<	<	<
tetrachloromethane	P111	n/a	10	µg/kg dw	0	< <	<	<	<	<
1,2-dichloroethane	P112	n/a	10	µg/kg dw	0	< <	<	<	<	<
benzene	P113	n/a	10	µg/kg dw	3	10 16	<	<	11	13
trichloroethene	P114	n/a	10	µg/kg dw	0	< <	<	<	<	<
tetrachloroethene	P120	n/a	10	µg/kg dw	0	< <	<	<	<	<

Table 10a Priority Action Substances: Metals in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
cadmium	P500	0.40	0.10	µg/l	9	0.10	0.52	<	<	<	<
lead	P501	2.0	1.0	µg/l	34	0.34	16	<	<	<	1.3
mercury	P502	0.20	0.10	µg/l	17	0.10	7.1	<	<	<	<
nickel	P503	1.8	1.0	µg/l	155	0.96	152	<	1.4	2.4	5.0

Table 10b Priority Action Substances: Metals in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
cadmium	P500	n/a	0.10	mg/kg dw	17	0.12	1.6	0.18	0.27	0.60	1.0
lead	P501	n/a	0.10	mg/kg dw	17	4.2	80	12	17	31	61
mercury	P502	n/a	0.10	mg/kg dw	3	0.11	0.33	<	<	<	0.19
nickel	P503	n/a	0.10	mg/kg dw	17	4.9	41	12	19	21	29

Table 10c Priority Action Substances: Metals in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
cadmium	P500	n/a	0.010	mg/kg dw	15	0.10	0.71	0.13	0.31	0.53	0.68
lead	P501	n/a	0.010	mg/kg dw	17	0.52	7.7	0.60	1.9	4.7	5.7
mercury	P502	n/a	0.010	mg/kg dw	17	0.058	1.5	0.11	0.21	0.48	0.88
nickel	P503	n/a	0.010	mg/kg dw	17	1.1	33	3.5	4.0	7.3	14

Table 11a Priority Action Substances: Hormone-disrupting compounds in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
di-(2-ethylhexyl)-phthalate (DEHP)	P251	0.50	1.00	µg/l	55	0.20	11	<	<	<	1.3
nonylphenols	P358	n/a	0.010	µg/l	15	0.010	0.087	<	<	<	<
4-tert-octylphenol	P357	0.30	0.010	µg/l	41	0.011	0.22	<	<	<	0.016
C10-C13 (PCA)	P917	n/a	0.10	µg/l	19	0.0038	7.5	<	<	<	<
BDE-209	P914	n/a	0.020	µg/l	0	<	<	<	<	<	<
sum diphenyl ether, pentabromo derivate	P920	0.53	0.001	µg/l	132	0.0010	0.036	<	<	0.0023	0.0040
sum diphenyl ether, octabromo derivate	P921	n/a	0.002	µg/l	1	0.0034	0.0034	<	<	<	<
tributyltin	P930	0.014	0.005	µg/l	4	0.0075	0.018	<	<	<	<

Table 11b Priority Action Substances: Hormone-disrupting compounds in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
di-(2-ethylhexyl)-phthalate (DEHP)	P251	n/a	20	µg/kg dw	13	23	366	<	29	50	136
4-tert-octylphenol	P357	n/a	1.0	µg/kg dw	2	1.4	1.6	<	<	<	0.54
nonylphenol	P358	n/a	1.0	µg/kg dw	1	1.1	1.1	<	<	<	<
C10-C13 (PCA)	P917	n/a	10	µg/kg dw	0	<	<	<	<	<	<
BDE-209	P914	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
sum diphenyl ether, pentabromo derivate	P920	n/a	0.10	µg/kg dw	8	0.12	4.6	<	<	1.1	2.4
sum diphenyl ether, octabromo derivate	P921	n/a	0.20	µg/kg dw	0	<	<	<	<	<	<
tributyltin	P930	n/a	0.500	µg/kg dw	1	1.7	1.7	<	<	<	<

Table 11c Priority Action Substances: Hormone-disrupting compounds in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
di-(2-ethylhexyl)-phthalate (DEH)	P251	n/a	500	µg/kg dw	0	<	<	<	<	<	<
nonylphenols	P358	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
4-tert-octylphenol	P357	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
BDE-209	P914	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
C10-C13 (PCA)	P917	n/a	10	µg/kg dw	0	<	<	<	<	<	<
sum diphenyl ether, pentabromo	P920	n/a	0.10	µg/kg dw	17	0.69	25	4.6	6.7	16	20
sum diphenyl ether, octabromo	P921	n/a	0.20	µg/kg dw	0	<	<	<	<	<	<
tributyltin	P930	n/a	0.50	µg/kg dw	7	0.96	8.8	<	1.1	1.6	2.2

4.2 Relevant Pollutants

4.2.1 PCB, PCP and PCBz

Polychlorinated biphenyls were once marketed as cooling or insulating fluids for transformers, as softeners in varnish and adhesive industries, and as hydraulic fluids. Because of their persistence, PCB are widely spread in the environment and although their use has been restricted and prohibited in many countries, PCB are still found in the environment.

4.2.1.1 Water

The results for PCB, but also for polychlorinated terphenyls (PCT) and polychlorinated naphthalenes (PCN) are summarized in table 12a. As expected mainly the more volatile PCBs, especially PCB-28 and -52 are found in the aqueous samples in concentrations ranging from 0.002 µg/l to a maximum of 0.064 µg/l for PCB-28. It should be noted however that 75% of the PCB-28 and 90% of the PCB-52 values are smaller than three times the LOD value. PCB-28 and PCB-52 were also found in a limited number of the method blank samples in concentrations from the LOD value up to three times the LOD value but because they were found in less than 50% of the method blanks no correction was applied. However, this means that PCB-28 and -52 concentrations lower than three times the LOD value, e.g. the LOQ value, should be interpreted with caution, and that PCB-28 and -52 may be present in no more than 25%, respectively 10% of the samples. PCTs en PCNs were only found in respectively 2 samples in concentrations up to 0.21 µg/l and 6 samples in concentrations up to 4.9 µg/l. Only for the sum PCN's the target value was exceeded in one sample.

Chlorinated phenols, especially pentachlorophenol (see Priority Action Substances), were used as pesticides (mainly as insecticides) and disinfectants. All the chlorinated phenols in this study were found in one or more samples but less frequently than pentachlorophenol. Trichlorophenols were found in 17% of the samples, the others in 7% or less. Concentrations did not exceed the target EQS values. Mono-, di- and tetrachlorobenzenes were also found in some samples in concentrations ranging from 0.1 to 11 µg/l. The latter concentration was found for monochlorobenzene and did exceed the target EQS for that compound.

The recoveries of the added internal standards of the PCB, PCP and PCBz in the water samples were above 86% and in most cases around 100% with the exception of monochlorophenol for which the average recoveries of the labelled internal standards were 60%. The recoveries of these native compounds in the QC samples were around 100% (after correction for the labelled standard) as was the case for the other analytes in the QC samples. Note that the results for PCB, PCP and PCBz are corrected for the recoveries of the compound specific internal standards. Blank values were found for PCB-28 and PCB-52 in water, but no correction was applied. Other compounds were not detected in the method blank samples.

4.2.1.2 *Sediment*

The results for sediments are summarized in table 12b. All PCB's were found in sediment samples in concentrations up to 138 µg/kg dw for the sum-PCB and 35 µg/kg dw for individual PCB's. Polychlorinated terphenyls (PCT) and polychloronaphthalenes (PCN) were not found. The same is true for the more water soluble chlorophenols and chlorobenzenes that were found in a few samples only.

In sediment recoveries were comparable to the recoveries in the water samples with the exception of dichlorobenzenes for which a recovery of 55% was found. Blank values were found for PCB-28 in sediment but no correction was applied. Other compounds were not detected in the method blank samples.

4.2.1.3 *Biota*

The results for biota are summarized in table 12c. All PCB's were found in the biota samples in concentrations up to 126 µg/kg dw for the sum-PCB and 42 µg/kg dw for individual PCB's.

Polychlorinated terphenyls (PCT) were not found. Polychloronaphthalenes (PCN) were found in all samples in concentrations up to 47 µg/kg dw.

Surprisingly, monochlorophenol was found in the samples of serie 1. Chlorinated phenols are more often found in biota but this is mostly pentachlorophenol which was not found in these samples. Furthermore trichlorophenols were found in one sample. Of the chlorinated benzenes only dichlorobenzene was found in a few samples.

The recoveries of the internal standards in the biota samples ranged from 116% to 125% for the PCB's, from 60% to 106% for the chlorophenols and from 85% to 106% for the chlorobenzenes. With the exception of PCB-28, PCB-52 and dichlorobenzenes no blank values were observed in the method blank sample.

4.2.2 *Pesticides*

In addition to the pesticides in the Priority Action Substances a large number other pesticides were determined as Relevant Pollutants.

4.2.2.1 *Water*

The results are summarized in table 13a. Many of these pesticides were found but generally only in a very limited number of samples, mostly in less than 4% of the samples. Exceptions are epiconazole, glyphosate, dichlobenil, the thioureas, tribenuron-methyl, mecoprop, MCPA and carbendazim that were all found in 18% to 6% of the samples. Note that the thioureas maneb/zineb/mancozeb can not be differentiated by the analytical method and are reported as a sum which also includes thiram since this will produce CS₂ in the analysis of the thioureas. The highest concentrations found were 35 µg/l for the thioureas, 31 µg/l for mecoprop and 4.0 µg/l for glyphosate. While the results in general are different from countries with a larger agricultural industry, the results for glyphosate and the thioureas show some resemblance for frequency of detection as well as concentrations. For about one-third of the pesticides the maximum concentrations do exceed the target EQS. This is especially the case for glyphosate and mecoprop were the 90-pct also exceeds the target EQS.

The recoveries of the internal standard and the individual compounds in the spiked QC samples were generally above 70%, in water.

4.2.2.2 *Sediment*

The results of the pesticides in the sediment are summarized in table 13b. Captan, a compound that adsorbs strongly to particles, is found in 2 of the 17 samples in a concentration of 71 and 139 µg/kg dw. The concentrations of mecoprop, dimethoate and triallate all exceed the target EQS for these compounds.

The recoveries of the internal standard and the individual compounds in the spiked QC samples were generally above 70%, in sediment. Notable exceptions are MCPA and dichlorprop for which the recoveries in sediment were respectively 53% and 39%.

4.2.2.3 *Biota*

The results of the pesticides in the biota samples are summarized in table 13c. In general only a few pesticides were found in a limited number of samples. Dichlobenil was found in 25% of the samples in concentrations ranging from 4.7 up to 24 µg/kg dw. This pesticide is also detected in 14% of the water samples. Mecoprop was detected in some samples with a maximum concentration of 22 µg/kg dw. Biphenyl was found a few times at a highest concentration of respectively 6.3 µg/kg dw and pendimethalin and deltamethrin were found once at respectively a concentration of 82 and 59 µg/kg dw. The average recovery for these pesticides in the QC-samples was 85% ± 19%. Detailed information for most components can be found in table 21.

The recoveries of the internal standard and the individual compounds in the spiked QC samples were generally above 70% in biota. Notable exceptions are tribenuron-methyl, fenpropimorf, carbendazim, chloridazon and monolinuron. No pesticides were detected in the blank samples.

4.2.3 *Volatiles*

4.2.3.1 *Water*

The results of the volatiles in the Relevant Pollutants group in water are summarized in table 14a. Not surprisingly the highest frequency and concentration is found for toluene. This compound was found in 22% of the samples in concentrations up to 60 µg/l. However, the 90-pct value for toluene indicates that this high concentration is an exception, and the same seems to be true for the maximum concentrations of ethylbenzene and the xylenes. Apart from these volatile aromatic hydrocarbons, methyl-t-butyl ether (MTBE) was found in about 10% of the samples.

The recoveries of the internal standard in the samples and the recoveries of the compounds in the spiked QC samples indicate a good performance of the method and a good recovery of the individual compounds. Method blanks were not found in water.

4.2.3.2 *Sediment*

The results of the volatiles in the Relevant Pollutants group for sediment are summarized in table 14b. As expected only a few volatiles are found in sediments, in this case MTBE and toluene. MTBE was found in more than half of the samples in concentrations up to 170 µg/kg dw. Toluene was found in only three samples in concentrations up to 164 µg/kg dw. The recoveries of the individual compounds in the spiked QC samples indicate good recoveries, generally above 69%.

4.2.3.3 *Biota*

The results of the volatiles in the Relevant Pollutants group for biota are summarized in table 14c. Toluene was found in only 1 of the samples at a concentration of 12 µg/kg dw. Other components were not found.

The recoveries of the individual compounds in the spiked QC samples indicate good recoveries, generally above 71%. Exceptions are hexachloroethane and 1,1,2 trichloro-1,2,2 trifluoroethane with a recovery of respectively 46% and 32%. No method blanks were observed in the biota analysis.

4.2.4 *Metals*

In addition to the metals in the Priority Action Substances, 18 metals were determined as Relevant Pollutants. The results of these metals are summarized in table 15a, 15b and 15c. The results for the QA/QC can be found in table 21. Please note that for biota and sediment the results of QA/QC-samples are expressed as the differences between duplicates.

4.2.4.1 *Water*

All these metals were found in one or more samples with barium and boron in virtually every sample. The concentrations range from 5.9 µg/l up to 4300 µg/l for boron. It is interesting that for boron even the 25-pct exceeds the target EQS. In general the 90-pct value of half of the metals in table 15a exceeds the target EQS value, while only in two cases, zinc and boron, the 50-pct also exceeds the target EQS.

Duplicate samples were analysed to check the performance of the method. In general differences between duplicates were below 10%, often even below 5% indicating a good repeatability of the method. No metals were detected in the method blanks.

4.2.4.2 *Sediment*

The results of the metals in the Relevant Pollutants group in sediment samples are summarized in table 15c. **Please notice that these results are expressed in mg/kg dw and not in µg/kg dw.**

Metals are widely found in almost all sediment samples with the exception of selenium, and tellurium.

Boron could not be analysed in the sediment samples because of evaporation of this element during the digestion step. In more than half of the samples the concentrations of cobalt and barium exceed the EQS value for these elements.

Duplicate samples were analysed to check the performance of the method. In general differences between duplicates were below 10%, often even below 5% indicating a good repeatability of the method. No metals were detected in the method blanks.

4.2.4.3 *Biota*

The results of the metals in the Relevant Pollutants group in biota are summarized in table 15c. **Please notice that these results are expressed in mg/kg dw and not in µg/kg dw.** Metals are widely found in all biota samples with the exception of thallium that was found in only 1 of the samples. The highest concentrations were found for zinc, 137 mg/kg dw.

Duplicate samples were analysed to check the performance of the method. In general differences between duplicates were below 5.5%, with exception of molybdenum (12%), beryllium (22%) and vanadium (11%), indicating a good repeatability of the method. No metals were detected in the method blanks.

4.2.5 *Hormone-disrupting compounds*

Another set of (potentially or suspected) hormone-disrupting compounds is determined as Relevant Pollutants. The results for these compounds are summarized in table 16a, 16b and 16c for respectively water, sediment and biota samples.

4.2.5.1 *Water*

In the water samples as expected di-n-butyl and butylbenzyl phthalates are most often found, in 24% and 27% of the samples. While the concentrations of butylbenzyl phthalate are comparable to those in Dutch surface waters, the concentrations of di-n-butyl phthalate appear to be somewhat higher. All results for DBP exceed the target EQS value of 0.1 µg/l. The “newer” di-isononyl phthalate was found in about 11% of the samples in concentration up to 15 µg/l. Di-(2-ethylhexyl) adipate, used as a plasticizer in foil for food packaging, was not found.

Bisphenol-A, a monomer used for the production of polycarbonate plastics, is found in 15% of the samples in concentrations that range from 0.010 to 0.38 µg/l. These concentrations are about half of those found in Dutch surface waters. The same is true for nonylphenol ethoxylates that were found in concentrations ranging from 0.050 to 2.0 µg/l. Tetrabromobisphenol-A (TBBPA) and hexabromocyclododecane (HBCD) are both used as flame retardants, HBCD mainly as a replacement for the PBDE's and TBBPA as a reactive flame retardant in printed circuit boards. Both are found in a few samples in concentrations up to 0.17 µg/l for HBCD.

Of the additional organotin compounds only dibutyltin, a degradation product of tributyltin, and tri-n-propyltin were found in a few samples in concentrations up to 0.049 µg/l for dibutyltin. Triphenyltin, used as a fungicide in the potato production, and tetrabutyltin were not found in any of the samples.

Analyses of the water samples for 4 hormones, ethinyl oestradiol, oestradiol, oestrone and progesterone showed that these hormones were not present in any of the samples in concentrations above the detection limit of 0.1 µg/l. Results of a few studies in Europe show that these hormones can be found in surface waters but only infrequently and in concentrations 10-100 times below the detection limit in this study.

In addition blank levels were found in water for butylbenzyl phthalate (0.05 µg/l), di-N-butylphthalate (1.4 µg/l), diisonobylester (2.6 µg/l) and for bisphenol-A (0.01 µg/l). For the phthalates the results are corrected for the blank levels. Blank levels of di-N-butylphthalate (75 pct value) in water were about 1.4 µg/l. Because of this the LOD for DBP was raised to 1 µg/l for water.

4.2.5.2 *Sediment*

In sediments di-isononyl phthalate is found in 15 of the 17 samples in concentrations up to 747 µg/kg dw. The fact that it is found as often and in higher concentrations than di-(2-ethylhexyl) phthalate indicates that these “newer” phthalates are gradually replacing

the older phthalates. Dibutyltin, a degradation product of tributyltin, is found in the majority of samples in concentrations up to 16 µg/kg dw.

Recoveries of internal standards and the recoveries of individual compounds in the spiked QC samples are generally above 70%. Blank levels of di-N-butylphthalate in sediment were about 5 µg/kg dw. Because of this the LOD for DBP was raised to 5 µg/kg dw for sediments

4.2.5.3 *Biota*

The results for the biota samples are given in table 16c. For the phthalates again high blank results were found. As a result the detection limit of di-n-butyl phthalate was raised to 100 µg/kg dw and those of the two other phthalates to 20 µg/kg dw. The highest concentrations were found for di-isononyl phthalate in 12% of the samples, ranging from 11847 up to 34519 µg/kg dw. Butylbenzyl phthalate was found in 24% of the samples, ranging from 292 to 2226 µg/kg dw.

Dibutyltin, a degradation product of tributyltin, is found in the samples of series 1 in concentrations up to 47 µg/kg dw.

Bisphenol-A was found in 18% of the samples, ranging up to 12 µg/kg dw.

Recoveries of internal standards and the recoveries of individual compounds in the spiked QC samples are generally above 77% with the exception of the phthalates for which irregular recoveries were found. This is probably caused by the blank levels for these compounds. Results for the phthalates are corrected for the blank levels.

4.2.6 *Nitrated aromatics and amines*

Nitrogen containing compounds are widespread in our environment in different forms. Many of these compounds and their derivatives are known for their carcinogenic properties. Aromatic amines such as benzidines and toluidines are often formed as side-products in the production of dyes, or are formed as degradation products of dyes used in products. A number of such nitrated aromatics have been determined in this study.

4.2.6.1 *Water*

The results for these compounds are summarized in table 17a. Apart from dichloroanilines and chloronitrotoluenes that are detected in a few samples, nitrated aromatics are not found. Most notably is diethylamine that is found in 10% of the samples in concentrations ranging from 1.1 µg/l to 538 µg/l. While this maximum concentrations exceeds the target EQS for this compound, the 90-pct value of 0.45 µg/l indicates that most are below the target EQS.

The recoveries of the individual compounds in the spiked QC samples indicate good recoveries, generally above 69%. Another point is that while the recoveries for most individual compounds in the spiked QC samples are good, those for the dichloroanilines and monochlorotoluidines (chloronitrotoluenes) showed irregular results in water. Because of this the reported concentrations for the dichloroanilines and monochlorotoluidines should be interpreted as an indication.

4.2.6.2 *Sediment*

The results in table 17b show that of the nitrated aromatics and amines only diethylamine and chloronitrotoluenes were found in the sediment samples. Diethylamine was found in 7 of the 17 samples in a concentration range of 10 to 109 µg/kg dw.

Surprisingly, chloronitrotoluenes were found in as many as 13 of 17 samples in a narrow concentration range of 13 to 23 µg/kg dw. While this suggests the possibility of an interference, the identification criteria were met and so there is no reason to exclude these results. Another point is that while the recoveries for most individual compounds in the spiked QC samples are good, those for the dichloroanilines and monochlorotoluidines (chloronitrotoluenes) showed irregular results in sediments. Because of this the reported concentrations for the dichloroanilines and monochlorotoluidines should be interpreted as an indication.

4.2.6.3 *Biota*

The results for the biota are summarized in table 17c. Dimethyl- and diethylamine were not determined in biota. Only nitrobenzene was found in concentrations up to 14 µg/kg dw.

No blank levels were observed in the method blank sample. The recoveries of the individual compounds in the spiked QC samples indicate good recoveries, mostly above 63%, with exception of 2-chloroaniline (37%), benzidine (39%) and 3,3'-dichlorobenzidine (11%).

4.2.7 *Polychlorinated dibenzodioxins and dibenzofurans*

Polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) belong to the dioxin group and occur as undesired by-products in the manufacture of chlorophenols, chlorinated biphenyls and naphthalenes, chlorobenzenes and certain biocides. They also occur in paper pulp and sludge and are found in emissions of incinerators and car exhausts. Of particular interest are the 2,3,7,8-substituted dioxins, especially 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) which is an extremely toxic compound. Due to its environmental stability, good solubility in fats and slow metabolism, dioxins can be observed in biological samples including human fats and milk.

4.2.7.1 *Water*

The results for dioxins in water are summarized in table 18a. **Please notice that these results are expressed in pg/l and not in µg/l.** Dioxins were found only in a limited number of samples. As usual, if dioxins are found in non-suspected environmental samples, these are most often the higher substituted hepta- and octa-CDD. Two samples also contained concentrations of 2378-T4CDF as well as 12378-P5CDF although only slightly above the LOD value. The sum of dioxins and furans originates mainly from the contributions of the octa-CDD and octa-CDF values. There is not much information about the levels of dioxins in water. The data that can be found present concentrations in the range of 9 to 175 pg/l, mainly OCDD found in groundwater. For legislation purposes dioxin results are normally expressed in Toxic Equivalence, TEQ. The maximum value for the sum of PCDD/F expressed in pg TEQ/l in these 156 samples was 2.2 pg TEQ/l. In the Netherlands an indicative limit value of 100 pg TEQ/l was proposed.

The recoveries of the added internal standards are around 100% in water. Note that the results are corrected for the recovery of these compound specific internal standards. Blank values were not found in any of the method blanks.

Based on the results in Phase 1 it was decided not to analyse dioxins during Phase 3 in the water samples.

4.2.7.2 *Sediment*

The results for dioxins in sediment are summarized in table 18b. **Please notice that these results are expressed in ng/kg dw and not in µg/kg dw.** Comparable with the situation in water it are mainly the higher substituted hepta- and octa-CDD that are found in the sediments. From the lower substituted congeners 12378-P5CDD, 2378-T4CDF and 12378-P5CDF are the most important. Almost all maximum measured dioxin concentrations originate from one sample, sample 0597-5-1869, in which almost all dioxin congeners were detected. Expressed in toxic equivalence this sampled contained 8.3 ng TEQ/kg dw. This is still far below the Dutch limit value for dioxins in sediments, 1000 ng TEQ/kg dw.

The recoveries of the added internal standards are around 80% in sediments. Note that the results are corrected for the recovery of these compound specific internal standards. Blank values were not found in any of the method blanks.

4.2.7.3 *Biota*

The results for dioxins and furanes in biota are summarized in table 18c. Please notice that these results are expressed in ng/kg dw and not in µg/kg dw.

Some of the 2,3,7,8-Substituted dioxins and furans are found in most samples. As usual in samples from non-contaminated sites the highest concentrations are found for the octa-CDD congener, in this case 41 ng/kg dw. Another congener often found in mussels is the tetra-CDF which was found in concentrations ranging from 0.20 to 6.1 ng/kg dw. In addition, both penta-CDF and hexa-CDF congeners were found in measurable quantities. More remarkable is the finding of a relatively high level of 2,3,7,8-TCDD in one of the samples (4.8 ng/kg dw). When expressed in toxic equivalence the dioxin and furan concentration in the samples ranges from 2.1 to 12 ng TEQ/kg dw (when a detection limit of 2 ng TEQ/kg is considered), which is in the range of 0 to 10 ng TEQ/kg dw for non-contaminated sites.

The recoveries of the added internal standards in the biota samples were ranging from 70% to 100% for the individual congeners. Note that the results are corrected for the recovery of these internal standards. Blank values were not found in any of the method blank.

4.2.8 *Anions and phenols*

Finally, a number of anions and total phenols are part of the Relevant Pollutants group.

4.2.8.1 *Water*

The results for these parameters are summarized in table 19a. **Please notice that the results are expressed in mg/l and not in µg/l.** As expected chloride is found in every sample and in more than 25% of the samples the target EQS is exceeded. This is no surprise since seawater and/or brackish water samples were involved. Fluoride is also found often, in 67% of the samples, and because the target EQS is very low all samples exceed this EQS value. Cyanide and phenols were found in only a few samples, however, all these exceed the target EQS value.

The QC samples for cyanide, fluoride and chloride in water show recoveries above 92%.

4.2.8.2 *Sediment*

The results of anions and phenols in sediment are listed in table 19b. As in water, chloride and fluoride have been found in most samples in concentrations from up to 12600 mg/kg for chloride and 2.9 mg/l for fluoride. Cyanides were found in about 24% of the sediment samples while phenols were not found at all. The recoveries of these compounds from sediments were not determined.

4.2.8.3 *Biota*

Anions and phenols were not analysed in the biota samples.

Table 12a Relevant Pollutants: Polychloro-biphenyls, -phenols and -benzenes in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured min	max	25-pct	50-pct	75-pct	90 pct
PCB 28	R017	0.50	0.002	µg/l	153	0.0020	0.064	<	0.0023	0.0051	0.0082
PCB 52	R018	0.50	0.002	µg/l	103	0.0015	0.033	<	<	0.0025	0.0042
PCB 101	R019	0.50	0.002	µg/l	30	0.0021	0.025	<	<	<	0.0021
PCB 118	R020	0.50	0.002	µg/l	5	0.0022	0.059	<	<	<	<
PCB 153	R021	0.50	0.002	µg/l	2	0.0034	0.013	<	<	<	<
PCB 138	R022	0.50	0.002	µg/l	7	0.0023	0.013	<	<	<	<
PCB 180	R023	0.50	0.002	µg/l	0	<	<	<	<	<	<
sum PCB	R060	0.50	0.50	µg/l	132	0.0020	0.10	<	<	0.0053	0.012
sum PCT	R919	0.50	0.10	µg/l	2	0.13	0.21	<	<	<	<
sum polychloronaphthalenes	R918	0.77	0.10	µg/l	6	0.11	4.9	<	<	<	<
2,4/2,5-dichlorophenol	R028	10	0.010	µg/l	21	0.0014	0.12	<	<	<	<
mono-chlorophenol	R042	10	0.050	µg/l	18	0.052	2.4	<	<	<	<
trichlorophenols	R043	1.0	0.010	µg/l	48	0.010	0.35	<	<	<	0.050
4-chloor-3-methylfenol	R950	10	0.010	µg/l	12	0.010	0.64	<	<	<	<
mono-chlorobenzene	R044	1.0	0.10	µg/l	11	0.13	11	<	<	<	<
1,2,4,5-tetrachlorobenzene	R051	n/a	0.10	µg/l	2	0.10	0.16	<	<	<	<
dichlorobenzenes	R055	10	0.10	µg/l	35	0.10	2.1	<	<	<	0.12

Table 12b Relevant Pollutants: Polychloro-biphenyls, -phenols and -benzenes in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
PCB 28	R017	n/a	0.40	µg/kg dw	15	0.50	35	0.59	5.1	18	21
PCB 52	R018	n/a	0.40	µg/kg dw	9	0.41	13	<	0.41	0.75	1.4
PCB 101	R019	n/a	0.40	µg/kg dw	6	0.42	21	<	<	0.54	2.0
PCB 118	R020	n/a	0.40	µg/kg dw	7	0.45	23	<	<	0.82	2.5
PCB 153	R021	n/a	0.40	µg/kg dw	6	0.42	22	<	<	0.67	1.2
PCB 138	R022	n/a	0.40	µg/kg dw	6	0.80	29	<	<	1.1	1.7
PCB 180	R023	n/a	0.40	µg/kg dw	3	0.44	10	<	<	<	0.45
sum PCB	R060	n/a	0.002	µg/kg dw	15	0.50	138	0.59	7.2	21	35
sum PCT	R919	n/a	0.40	µg/kg dw	0	<	<	<	<	<	<
sum polychloronaphthalenes	R918	n/a	20	µg/kg dw	0	<	<	<	<	<	<
2,4/2,5-dichlorophenol	R028	n/a	1.0	µg/kg dw	1	1.4	1.4	<	<	<	<
mono-chlorophenol	R042	n/a	10	µg/kg dw	0	<	<	<	<	<	<
trichlorophenols	R043	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
4-chloor-3-methylfenol	R950	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
mono-chlorobenzene	R044	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,2,4,5-tetrachlorobenzene	R051	n/a	20	µg/kg dw	0	<	<	<	<	<	<
dichlorobenzenes	R055	n/a	20	µg/kg dw	2	30	62	<	<	<	12

Table 12c Relevant Pollutants: Polychloro-biphenyls, -phenols and -benzenes in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured min	max	25-pct	50-pct	75-pct	90 pct
PCB 28	R017	n/a	0.40	µg/kg dw	17	1.7	9.2	2.9	3.5	4.2	6.0
PCB 52	R018	n/a	0.40	µg/kg dw	17	1.2	8.6	2.2	2.6	3.8	4.5
PCB 101	R019	n/a	0.40	µg/kg dw	17	0.98	13	1.5	2.1	3.8	6.6
PCB 118	R020	n/a	0.40	µg/kg dw	17	0.80	12	1.7	3.2	6.0	7.5
PCB 153	R021	n/a	0.40	µg/kg dw	17	2.0	42	3.6	6.1	9.0	14
PCB 138	R022	n/a	0.40	µg/kg dw	17	1.7	36	4.5	6.7	9.6	15
PCB 180	R023	n/a	0.40	µg/kg dw	14	0.61	26	0.89	1.2	2.8	7.5
sum PCB	R060	n/a	2.0	µg/kg dw	17	9.6	126	17	27	43	63
sum PCT	R919	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
sum polychloronaphthalenes	R918	n/a	20	µg/kg dw	8	2.7	47	6.7	9.3	14	29
2,4/2,5-dichlorophenol	R028	n/a	2.0	µg/kg dw	1	2.1	2.1	<	<	<	<
mono-chlorophenol	R042	n/a	10	µg/kg dw	8	4.5	14	6.1	8.7	11	12
trichlorophenols	R043	n/a	2.0	µg/kg dw	1	5.3	5.3	<	<	<	1.1
4-chloor-3-methylfenol	R950	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
mono-chlorobenzene	R044	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,2,4,5-tetrachlorobenzene	R051	n/a	20	µg/kg dw	0	<	<	<	<	<	<
dichlorobenzenes	R055	n/a	20	µg/kg dw	5	8.2	23	<	<	20	22

Table 13a Relevant Pollutants : Pesticides in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured min	max	25-pct	50-pct	75-pct	90 pct
cyanuric chloride	R200	0.10	0.050	µg/l	0	<	<	<	<	<	<
oxydemeton-methyl	R201	0.50	0.10	µg/l	1	45	45	<	<	<	<
dichlobenil	R203	n/a	0.010	µg/l	41	0.010	0.50	<	<	<	0.026
tribenuron-methyl	R204	0.10	0.020	µg/l	17	0.022	0.16	<	<	<	<
biphenyl	R205	1.0	0.010	µg/l	12	0.010	0.30	<	<	<	<
mecoprop	R206	0.020	0.020	µg/l	48	0.013	31	<	<	<	0.040
MCPA	R207	0.10	0.010	µg/l	23	0.010	0.12	<	<	<	<
propachlor	R208	1.3	0.010	µg/l	7	0.023	0.40	<	<	<	<
dichlorprop	R209	0.40	0.020	µg/l	9	0.022	1.0	<	<	<	<
bromoxynil	R210	100	0.020	µg/l	4	0.027	3.3	<	<	<	<
2,4-D	R211	0.10	0.020	µg/l	2	0.033	0.22	<	<	<	<
ethoprophos	R212	0.010	0.010	µg/l	1	0.087	0.087	<	<	<	<
chlorpropham	R213	10	0.020	µg/l	5	0.020	0.17	<	<	<	<
dimethoate	R215	0.10	0.020	µg/l	3	0.091	0.29	<	<	<	<
carbofuran	R216	0.10	0.010	µg/l	9	0.013	1.3	<	<	<	<
triclopyr	-	-	-	-	-	-	-	-	-	-	-
propyzamide	R220	100	0.020	µg/l	1	0.50	0.50	<	<	<	<
triallate	R221	0.019	0.005	µg/l	0	<	<	<	<	<	<
pirimicarb	R222	0.090	0.020	µg/l	2	0.087	0.24	<	<	<	<
bentazon	R223	0.10	0.020	µg/l	5	0.023	0.31	<	<	<	<
tolclofos-methyl	R224	0.80	0.020	µg/l	0	<	<	<	<	<	<
ioxynil	R226	10	0.050	µg/l	0	<	<	<	<	<	<
diazinon	-	-	-	-	-	-	-	-	-	-	-
pirimiphos-methyl	R227	0.050	0.010	µg/l	5	0.016	0.045	<	<	<	<
ethofumesate	R228	0.10	0.020	µg/l	6	0.021	1.3	<	<	<	<
fenitrothion	R229	0.010	0.010	µg/l	2	0.016	0.06	<	<	<	<
malathion	R231	0.010	0.010	µg/l	5	0.010	0.068	<	<	<	<

Table 13a (continued). Relevant Pollutants : Pesticides in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
fenpropimorf	R234	0.10	0.020	µg/l	0	<	<	<	<	<	<
pendimethalin	R239	1.5	0.010	µg/l	1	0.38	0.38	<	<	<	<
metazachlor	R240	0.34	0.020	µg/l	3	0.024	0.41	<	<	<	<
captan	R242	0.10	0.10	µg/l	4	0.11	1.8	<	<	<	<
kresoxim-methyl	R245	0.10	0.010	µg/l	4	0.011	0.085	<	<	<	<
permethrin	R252	0.010	0.020	µg/l	1	0.050	0.050	<	<	<	<
prochloraz	R255	4.0	0.020	µg/l	3	0.12	0.24	<	<	<	<
cyfluthrin	R256	0.020	0.020	µg/l	0	<	<	<	<	<	<
cypermethrin	R257	0.10	0.020	µg/l	1	0.032	0.032	<	<	<	<
deltamethrin	R258	0.020	0.020	µg/l	0	<	<	<	<	<	<
oxamyl	R300	1.8	0.050	µg/l	13	0.051	0.28	<	<	<	<
trichlorofon	R301	0.020	0.020	µg/l	0	<	<	<	<	<	<
metamitron	R302	0.10	0.010	µg/l	5	0.017	0.038	<	<	<	<
carbendazim	R303	0.11	0.010	µg/l	17	0.011	0.066	<	<	<	<
chloridazon	R304	0.10	0.020	µg/l	4	0.022	0.24	<	<	<	<
thiabendazole	R305	5.0	0.050	µg/l	3	0.063	0.14	<	<	<	<
chlorotoluron	R307	0.40	0.020	µg/l	2	0.041	0.18	<	<	<	<
monolinuron	R310	0.10	0.010	µg/l	13	0.010	0.24	<	<	<	<
methiocarb	R311	0.010	0.010	µg/l	1	0.011	0.011	<	<	<	<
linuron	R312	0.10	0.010	µg/l	0	<	<	<	<	<	<
epoxiconazole	R313	0.10	0.010	µg/l	52	0.010	0.22	<	<	<	0.024
diflubenzuron	R314	0.015	0.010	µg/l	2	0.037	0.077	<	<	<	<
glyphosate	R350	0.10	0.10	µg/l	40	0.10	4.0	<	<	<	0.12
amitraz	-	-	-	-	-	-	-	-	-	-	-
chlormequat	R358	n/a	0.10	µg/l	0	<	<	<	<	<	<
paraquat	R359	0.10	0.50	µg/l	0	<	<	<	<	<	<
maneb/zineb/thiram/mancozeb	R940	0.10	0.10	µg/l	24	0.11	35	<	<	<	<

Table 13b Relevant Pollutants : Pesticides in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
cyanuric chloride	R200	n/a	10	µg/kg dw	0	<	<	<	<	<	<
oxydemeton-methyl	R201	0.0003	20	µg/kg dw	0	<	<	<	<	<	<
dichlobenil	R203	n/a	4.0	µg/kg dw	3	5.8	12	<	<	<	5.9
tribenuron-methyl	R204	n/a	10	µg/kg dw	0	<	<	<	<	<	<
biphenyl	R205	n/a	2.0	µg/kg dw	4	5.6	32	<	<	<	12
mecoprop	R206	0.02	2.0	µg/kg dw	1	3.6	3.6	<	<	<	<
MCPA	R207	0.05	2.0	µg/kg dw	0	<	<	<	<	<	<
propachlor	R208	0.06	4.0	µg/kg dw	0	<	<	<	<	<	<
dichlorprop	R209	32	4.0	µg/kg dw	0	<	<	<	<	<	<
bromoxynil	R210	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
2,4-D	R211	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
ethoprophos	R212	0.003	2.0	µg/kg dw	0	<	<	<	<	<	<
chlorpropham	R213	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
dimethoate	R215	0.8	4.0	µg/kg dw	6	4.5	18	<	<	5.0	7.6
carbofuran	R216	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
propyzamide	R220	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
triallate	R221	0.2	1.0	µg/kg dw	3	1.1	3.2	<	<	<	1.1
pirimicarb	R222	0.02	4.0	µg/kg dw	0	<	<	<	<	<	<
bentazon	R223	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
tolclofos-methyl	R224	1	4.0	µg/kg dw	0	<	<	<	<	<	<
ioxynil	R226	n/a	10	µg/kg dw	0	<	<	<	<	<	<
pirimiphos-methyl	R227	n/a	2.0	µg/kg dw	3	2.3	4.3	<	<	<	2.5
ethofumesate	R228	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
fenitrothion	R229	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
malathion	R231	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<

Table 13b (continued). Relevant Pollutants : Pesticides in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
fenpropimorf	R234	n/a	4.0	µg/kg dw	1	4.5	4.5	<	<	<	<
pendimethalin	R239	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
metazachlor	R240	3.0	4.0	µg/kg dw	0	<	<	<	<	<	<
captan	R242	n/a	20	µg/kg dw	2	71	139	<	<	<	28
kresoxim-methyl	R245	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
permethrin	R252	0.009	4.0	µg/kg dw	0	<	<	<	<	<	<
prochloraz	R255	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
cyfluthrin	R256	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
cypermethrin	R257	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
deltamethrin	R258	0.010	4.0	µg/kg dw	0	<	<	<	<	<	<
oxamyl	R300	0.010	10	µg/kg dw	0	<	<	<	<	<	<
trichlorofon	R301	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
metamitron	R302	1.0	2.0	µg/kg dw	0	<	<	<	<	<	<
carbendazim	R303	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
chloridazon	R304	3.0	4.0	µg/kg dw	0	<	<	<	<	<	<
thiabendazole	R305	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
chlorotoluron	R307	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
monolinuron	R310	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
methiocarb	R311	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
linuron	R312	0.90	2.0	µg/kg dw	0	<	<	<	<	<	<
epoxiconazole	R313	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
diflubenzuron	R314	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
maneb/zineb/thiram/mancozeb	R940	n/a	4.0	µg/kg dw	1	14	14	<	<	<	<

Table 13c Relevant Pollutants : Pesticides in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
cyanuric chloride	R200	n/a	10	µg/kg dw	0	<	<	<	<	<	<
oxydemeton-methyl	R201	n/a	20	µg/kg dw	0	<	<	<	<	<	<
dichlobenil	R203	n/a	4.0	µg/kg dw	5	4.7	24	<	<	5.2	17
tribenuron-methyl	R204	n/a	10	µg/kg dw	0	<	<	<	<	<	<
biphenyl	R205	n/a	2.0	µg/kg dw	4	2.4	6.3	<	<	2.5	3.4
mecoprop	R206	n/a	2.0	µg/kg dw	4	3.1	22	<	1.6	5.3	14
MCPA	R207	n/a	2.0	µg/kg dw	1	11	11	<	<	<	<
propachlor	R208	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
dichlorprop	R209	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
bromoxynil	R210	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
2,4-D	R211	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
ethoprophos	R212	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
chlorpropham	R213	n/a	4.0	µg/kg dw	1	8.2	8.2	<	<	<	<
dimethoate	R215	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
carbofuran	R216	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
propyzamide	R220	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
triallate	R221	n/a	1.0	µg/kg dw	1	2.08	2.08	<	<	<	<
pirimicarb	R222	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
bentazon	R223	n/a	4.0	µg/kg dw	1	<	<	<	<	<	<
tolclofos-methyl	R224	n/a	4.0	µg/kg dw	2	14	19	<	<	3.4	15
ioxynil	R226	n/a	10	µg/kg dw	0	<	<	<	<	<	<
pirimiphos-methyl	R227	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
ethofumesate	R228	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
fenitrothion	R229	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
malathion	R231	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<

Table 13c (continued). Relevant Pollutants : Pesticides in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
fenpropimorf	R234	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
pendimethalin	R239	n/a	5.0	µg/kg dw	1	82	82	<	<	<	16
metazachlor	R240	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
captan	R242	n/a	20	µg/kg dw	0	<	<	<	<	<	<
kresoxim-methyl	R245	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
permethrin	R252	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
prochloraz	R255	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
cyfluthrin	R256	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
cypermethrin	R257	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
deltamethrin	R258	n/a	4.0	µg/kg dw	1	59	59	<	<	<	18
oxamyl	R300	n/a	10	µg/kg dw	0	<	<	<	<	<	<
trichlorofon	R301	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
metamitron	R302	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
carbendazim	R303	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
chloridazon	R304	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
thiabendazole	R305	n/a	10	µg/kg dw	0	<	<	<	<	<	<
chlorotoluron	R307	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
monolinuron	R310	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
methiocarb	R311	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
linuron	R312	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
epoxiconazole	R313	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
diflubenzuron	R314	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<

Table 14a Relevant Pollutants : Volatiles in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
vinylchloride	R100	0.50	0.10	µg/l	2	0.83	1.4	<	<	<	<
bromomethane	R101	0.10	0.50	µg/l	1	4.4	4.4	<	<	<	<
1,1-dichloroethene	R102	10	0.10	µg/l	8	0.108	2.2	<	<	<	<
carbon disulphide	R104	n/a	0.10	µg/l	0	<	<	<	<	<	<
MTBE	R105	n/a	0.10	µg/l	30	0.102	9.8	<	<	<	0.115
1,2-dichloroethene	R106	10	0.10	µg/l	25	0.106	0.8	<	<	<	<
1,1-dichloroethane	R107	10	0.10	µg/l	11	0.130	0.6	<	<	<	<
1,1,1-trichloroethane	R110	10	0.10	µg/l	11	0.169	0.2	<	<	<	<
1,2-dichloropropane	R115	0.10	0.10	µg/l	0	<	<	<	<	<	<
1,3-dichloropropene	R116	0.10	0.10	µg/l	1	0.98	0.98	<	<	<	<
toluene	R117	10	0.10	µg/l	64	0.10	60	<	<	<	0.19
1,1,2-trichloroethane	R119	10	0.10	µg/l	4	0.44	1.4	<	<	<	<
1,2-dibromoethane	R121	2.0	0.10	µg/l	0	<	<	<	<	<	<
ethylbenzene	R122	10	0.10	µg/l	16	0.11	21	<	<	<	<
p,m-xylene	R123	10	0.10	µg/l	28	0.10	36	<	<	<	<
o-xylene	R124	10	0.10	µg/l	36	0.10	12	<	<	<	0.11
styrene	R125	50	0.10	µg/l	34	0.10	0.84	<	<	<	0.12
iso-propylbenzene	R126	4.2	0.10	µg/l	13	0.11	6.6	<	<	<	<
1,1,2,2-tetrachloroethane	R127	10	0.10	µg/l	14	0.11	1.1	<	<	<	<
2-chlorotoluene	R128	1.0	0.10	µg/l	0	<	<	<	<	<	<
3-chlorotoluene	R129	1.0	0.10	µg/l	0	<	<	<	<	<	<
4-chlorotoluene	R130	1.0	0.10	µg/l	0	<	<	<	<	<	<
chloroprene	R134	10	0.10	µg/l	0	<	<	<	<	<	<
3-chloropropene	R135	10	0.10	µg/l	5	0.11	1.3	<	<	<	<
dichloro-di-isopropylether	R136	10	0.10	µg/l	1	0.17	0.17	<	<	<	<
2,3-dichloropropene	R137	10	0.10	µg/l	0	<	<	<	<	<	<
epichlorohydrin	R138	0.10	0.10	µg/l	4	0.45	3.2	<	<	<	<
hexachloroethane	R139	10	0.10	µg/l	0	<	<	<	<	<	<
1,1,2-trichloro-1,2,2-trifluoroethane	R140	3.7	0.10	µg/l	0	<	<	<	<	<	<

Table 14b Relevant Pollutants : Volatiles in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
vinylchloride	R100	n/a	20	µg/kg dw	0	<	<	<	<	<	<
bromomethane	R101	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,1-dichloroethene	R102	n/a	20	µg/kg dw	0	<	<	<	<	<	<
carbon disulphide	R104	n/a	20	µg/kg dw	0	<	<	<	<	<	<
MTBE	R105	n/a	20	µg/kg dw	10	22	170	<	23	34	65
1,2-dichloroethene	R106	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,1-dichloroethane	R107	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,1,1-trichloroethane	R110	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,2-dichloropropane	R115	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,3-dichloropropene	R116	n/a	20	µg/kg dw	0	<	<	<	<	<	<
toluene	R117	n/a	20	µg/kg dw	3	34	164	<	<	<	60
1,1,2-trichloroethane	R119	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,2-dibromoethane	R121	n/a	20	µg/kg dw	0	<	<	<	<	<	<
ethylbenzene	R122	n/a	20	µg/kg dw	0	<	<	<	<	<	<
p,m-xylene	R123	n/a	20	µg/kg dw	0	<	<	<	<	<	<
o-xylene	R124	n/a	20	µg/kg dw	0	<	<	<	<	<	<
styrene	R125	n/a	20	µg/kg dw	0	<	<	<	<	<	<
iso-propylbenzene	R126	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,1,2,2-tetrachloroethane	R127	n/a	20	µg/kg dw	0	<	<	<	<	<	<
2-chlorotoluene	R128	n/a	20	µg/kg dw	0	<	<	<	<	<	<
3-chlorotoluene	R129	n/a	20	µg/kg dw	0	<	<	<	<	<	<
4-chlorotoluene	R130	n/a	20	µg/kg dw	0	<	<	<	<	<	<
chloroprene	R134	n/a	20	µg/kg dw	0	<	<	<	<	<	<
3-chloropropene	R135	n/a	20	µg/kg dw	0	<	<	<	<	<	<
dichloro-di-isopropylether	R136	n/a	20	µg/kg dw	0	<	<	<	<	<	<
2,3-dichloropropene	R137	n/a	20	µg/kg dw	0	<	<	<	<	<	<
epichlorohydrin	R138	n/a	20	µg/kg dw	0	<	<	<	<	<	<
hexachloroethane	R139	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1,1,2-trichloro-1,2,2-trifluoroethan	R140	n/a	20	µg/kg dw	0	<	<	<	<	<	<

Table 14c Relevant Pollutants : Volatiles in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
vinylchloride	R100	n/a	10	µg/kg dw	0	<	<	<	<	<	<
bromomethane	R101	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,1-dichloroethene	R102	n/a	10	µg/kg dw	0	<	<	<	<	<	<
carbon disulphide	R104	n/a	10	µg/kg dw	0	<	<	<	<	<	<
MTBE	R105	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,2-dichloroethene	R106	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,1-dichloroethane	R107	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,1,1-trichloroethane	R110	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,2-dichloropropane	R115	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,3-dichloropropene	R116	n/a	10	µg/kg dw	0	<	<	<	<	<	<
toluene	R117	n/a	10	µg/kg dw	1	12	12	<	<	<	<
1,1,2-trichloroethane	R119	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,2-dibromoethane	R121	n/a	10	µg/kg dw	0	<	<	<	<	<	<
ethylbenzene	R122	n/a	10	µg/kg dw	0	<	<	<	<	<	<
p,m-xylene	R123	n/a	10	µg/kg dw	0	<	<	<	<	<	<
o-xylene	R124	n/a	10	µg/kg dw	0	<	<	<	<	<	<
styrene	R125	n/a	10	µg/kg dw	0	<	<	<	<	<	<
iso-propylbenzene	R126	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,1,2,2-tetrachloroethane	R127	n/a	10	µg/kg dw	0	<	<	<	<	<	<
2-chlorotoluene	R128	n/a	10	µg/kg dw	0	<	<	<	<	<	<
3-chlorotoluene	R129	n/a	10	µg/kg dw	0	<	<	<	<	<	<
4-chlorotoluene	R130	n/a	10	µg/kg dw	0	<	<	<	<	<	<
chloroprene	R134	n/a	10	µg/kg dw	0	<	<	<	<	<	<
3-chloropropene	R135	n/a	10	µg/kg dw	0	<	<	<	<	<	<
dichloro-di-isopropylether	R136	n/a	10	µg/kg dw	0	<	<	<	<	<	<
2,3-dichloropropene	R137	n/a	10	µg/kg dw	0	<	<	<	<	<	<
epichlorohydrin	R138	n/a	10	µg/kg dw	0	<	<	<	<	<	<
hexachloroethane	R139	n/a	10	µg/kg dw	0	<	<	<	<	<	<
1,1,2-trichloro-1,2,2-trifluoroeth	R140	n/a	10	µg/kg dw	0	<	<	<	<	<	<

Table 15a Relevant Pollutants: Metals in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured min	max	25-pct	50-pct	75-pct	90 pct
arsenic	R504	1.0	0.10	µg/l	102	0.14	58	<	<	0.78	1.1
zinc	R505	2.3	0.10	µg/l	220	0.98	547	3.1	7.6	20	48
copper	R506	0.50	0.10	µg/l	103	0.19	43	<	<	1.5	2.7
chromium	R507	0.30	0.10	µg/l	46	0.34	77	<	<	0.35	1.7
selenium	R508	5.3	0.10	µg/l	107	0.14	47	<	<	0.57	0.84
antimony	R509	0.40	0.10	µg/l	113	0.10	16	<	<	0.15	0.84
molybdenum	R510	4.3	0.10	µg/l	253	0.054	73	0.26	0.61	3.3	9.2
titanium	R511	20	0.10	µg/l	33	0.38	50	<	<	<	0.67
tin	R512	0.20	0.10	µg/l	24	0.11	5.8	<	<	<	<
barium	R513	75	0.10	µg/l	287	1.8	542	14	24	49	92
beryllium	R514	0.20	0.10	µg/l	2	0.10	0.10	<	<	<	<
boron	R515	6.5	0.10	µg/l	286	5.9	4301	14	25	1325	3102
uranium	R516	1.0	0.10	µg/l	214	0.10	9.5	0.025	0.87	2.1	2.6
vanadium	R517	0.90	0.10	µg/l	207	0.10	50	0.13	0.22	0.36	1.6
cobalt	R518	0.20	0.10	µg/l	148	0.10	33	<	0.12	0.18	0.35
thallium	R519	1.6	0.10	µg/l	8	0.10	0.19	<	<	<	<
tellurium	R520	100	0.10	µg/l	22	0.14	2.5	<	<	<	<
silver	R521	1.2	0.10	µg/l	2	0.13	0.15	<	<	<	<

Table 15b Relevant Pollutants: Metals in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
arsenic	R504	29	0.010	mg/kg dw	17	2.1	15	3.4	4.0	8.3	12
zinc	R505	140	0.010	mg/kg dw	17	20	237	46	65	83	181
copper	R506	36	0.010	mg/kg dw	17	4.5	49	9.0	11	16	30
chromium	R507	100	0.010	mg/kg dw	17	7.8	80	17	31	45	66
selenium	R508	0.7	0.14	mg/kg dw	1	0.19	0.19	<	<	<	<
antimony	R509	3	0.010	mg/kg dw	17	0.18	2.9	0.60	0.90	1.4	1.9
molybdenum	R510	3	0.010	mg/kg dw	17	0.30	3.1	0.37	0.48	0.60	2.6
titanium	R511	n/a	0.010	mg/kg dw	17	262	2971	621	1325	2110	2710
tin	R512	n/a	0.010	mg/kg dw	17	0.28	7.6	1.7	2.0	3.2	7.1
barium	R513	160	0.010	mg/kg dw	17	44	321	100	183	224	279
beryllium	R514	1.1	0.010	mg/kg dw	17	0.16	3.6	0.59	0.82	1.6	1.9
boron	R515	n/a	1.3	mg/kg dw	0	<	<	<	<	<	<
uranium	R516	n/a	0.010	mg/kg dw	17	0.60	2.4	0.97	1.1	1.6	2.0
vanadium	R517	42	0.010	mg/kg dw	17	11	87	16	28	43	65
cobalt	R518	9	0.010	mg/kg dw	17	4.5	281	7.5	11	92	173
thallium	R519	1	0.010	mg/kg dw	17	0.029	0.84	0.15	0.25	0.35	0.69
tellurium	R520	n/a	0.010	mg/kg dw	9	0.067	0.14	<	0.067	0.078	0.12
silver	R521	5.5	0.010	mg/kg dw	17	0.095	1.2	0.13	0.15	0.21	0.85
aluminium	R980	n/a	0.010	mg/kg dw	17	3651	48422	13309	27306	34487	42607

Table 15c Relevant Pollutants: Metals in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
arsenic	R504	n/a	0.010	mg/kg dw	17	0.36	13	0.53	1.2	11	12
zinc	R505	n/a	0.010	mg/kg dw	17	51	137	69	74	87	106
copper	R506	n/a	0.010	mg/kg dw	17	1.6	8.6	3.0	5.6	6.3	7.4
chromium	R507	n/a	0.010	mg/kg dw	17	0.75	17	2.8	3.7	6.4	11.7
selenium	R508	n/a	0.010	mg/kg dw	17	0.34	2.5	0.54	0.69	0.8	1.1
antimony	R509	n/a	0.010	mg/kg dw	8	0.035	0.07	0.041	0.064	0.069	0.072
molybdenum	R510	n/a	0.010	mg/kg dw	17	0.043	2.7	0.137	0.33	0.61	1.3
titanium	R511	n/a	0.010	mg/kg dw	17	3.2	95	5.7	15	42	64
tin	R512	n/a	0.010	mg/kg dw	13	0.082	0.46	0.11	0.17	0.24	0.32
barium	R513	n/a	0.010	mg/kg dw	17	0.48	9	1.0	2.1	3.6	7.0
beryllium	R514	n/a	0.010	mg/kg dw	8	0.014	0.054	0.019	0.024	0.034	0.053
boron	R515	n/a	0.010	mg/kg dw	9	8.2	54	9.7	11	13	21
uranium	R516	n/a	0.010	mg/kg dw	8	0.10	0.26	0.13	0.16	0.20	0.25
vanadium	R517	n/a	0.010	mg/kg dw	14	0.13	6.2	0.45	2.0	2.5	3.8
cobalt	R518	n/a	0.010	mg/kg dw	17	0.036	0.93	0.11	0.26	0.47	0.60
thallium	R519	n/a	0.010	mg/kg dw	1	0.016	0.016	<	<	<	<
tellurium	R520	n/a	0.010	mg/kg dw	4	0.040	0.24	<	<	0.055	0.11
silver	R521	n/a	0.010	mg/kg dw	14	0.11	1.1	0.16	0.25	0.59	0.81

Table 16a Relevant Pollutants: Hormone-disrupting compounds in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured min max	25-pct	50-pct	75-pct	90 pct
di-n-butylphthalate	R230	0.10	1.0	µg/l	69	0.012 8.9	<	<	<	2.0
butylbenzylphthalate	R249	n/a	0.010	µg/l	78	0.010 2.6	<	<	0.015	0.10
diisononylester DINP	R254	n/a	0.010	µg/l	32	0.045 15.4	<	<	<	0.13
nonylphenol ethoxylates	R355	0.10	0.050	µg/l	40	0.050 2.0	<	<	<	0.074
bisphenol-A	R356	n/a	0.010	µg/l	42	0.010 0.38	<	<	<	0.015
di-2-ethylhexyl adipate (DEHA)	R423	n/a	0.050	µg/l	0	< <	<	<	<	<
HBCD	R915	n/a	0.020	µg/l	4	0.021 0.17	<	<	<	<
tetrabromobisphenol-A	R951	n/a	0.001	µg/l	12	0.0013 0.068	<	<	<	<
dibutyltin	R931	0.010	0.005	µg/l	15	0.0056 0.049	<	<	<	<
tetrabutyltin	R932	0.016	0.005	µg/l	0	< <	<	<	<	<
triphenyltin	R933	0.005	0.005	µg/l	0	< <	<	<	<	<
tri-n-propyltin	R934	n/a	0.005	µg/l	6	0.0050 0.043	<	<	<	<

Parameter	No.	target EQS	LOD	Unit	frequency (N=156)	measured min max	25-pct	50-pct	75-pct	90 pct
ethinyl oestradiol	R960	n/a	0.10	µg/l	0	< <	<	<	<	<
oestradiol	R961	n/a	0.10	µg/l	0	< <	<	<	<	<
oestrone	R962	n/a	0.10	µg/l	0	< <	<	<	<	<
progesterone	R963	n/a	0.10	µg/l	0	< <	<	<	<	<

Table 16b Relevant Pollutants: Hormone-disrupting compounds in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
di-n-butylphthalate	R230	n/a	5.0	µg/kg dw	11	5.6	300	<	33	69	143
butylbenzylphthalate	R249	n/a	2.0	µg/kg dw	1	6.5	6.5	<	<	<	<
diisononylester DINP	R254	n/a	2.0	µg/kg dw	15	47	747	51	99	191	440
nonylphenol ethoxylates	R355	n/a	5.0	µg/kg dw	1	51	51	<	<	<	<
bisphenol-A	R356	n/a	1.0	µg/kg dw	2	2.7	5.5	<	<	<	1.1
di-2-ethylhexyl adipate (DEHA)	R423	n/a	2.0	µg/kg dw	0	<	<	<	<	<	<
HBCD	R915	n/a	4.0	µg/kg dw	1	4.4	4.4	<	<	<	<
tetrabromobisphenol-A	R951	n/a	0.20	µg/kg dw	5	0.23	0.51	<	<	0.23	0.30
dibutyltin	R931	n/a	0.500	µg/kg dw	10	0.18	16	<	0.22	0.76	2.7
tetrabutyltin	R932	0.80	0.500	µg/kg dw	1	0.23	0.23	<	<	<	<
triphenyltin	R933	n/a	0.500	µg/kg dw	0	<	<	<	<	<	<
tri-n-propyltin	R934	n/a	0.500	µg/kg dw	1	1.687	1.687	<	<	<	<

Table 16c Relevant Pollutants: Hormone-disrupting compounds in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
di-n-butylphthalate	R230	n/a	100	µg/kg dw	2	113	173	<	<	57	137
butylbenzylphthalate	R249	n/a	20	µg/kg dw	4	292	2226	<	<	531	789
diisononylester DINP	R254	n/a	20	µg/kg dw	2	11847	34519	<	<	<	14114
nonylphenol ethoxylates	R355	n/a	10	µg/kg dw	1	12.5	12.5	<	<	<	2
bisphenol-A	R356	n/a	2.0	µg/kg dw	3	4.2	12	<	<	2.1	11
HBCD	R915	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
tetrabromobisphenol-A	R951	n/a	0.20	µg/kg dw	0	<	<	<	<	<	<
dibutyltin	R931	n/a	1.0	µg/kg dw	8	2.7	47	6.7	9.3	14	29
tetrabutyltin	R932	n/a	1.0	µg/kg dw	1	2.8	2.8	<	<	<	<
triphenyltin	R933	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
tri-n-propyltin	R934	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<

Table 17a Relevant Pollutants: Nitrated aromatics and amines in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured min max	25-pct	50-pct	75-pct	90 pct
dimethylamine	R352	7.5	1.0	µg/l	11	1.1 18	<	<	<	<
diethylamine	R353	10	1.0	µg/l	29	1.1 538	<	<	<	0.45

Parameter	No.	target EQS	LOD	Unit	frequency (N=156)	measured min max	25-pct	50-pct	75-pct	90 pct
benzylchloride	R400	10	0.010	µg/l	0	< <	<	<	<	<
nitrobenzene	R401	0.10	0.050	µg/l	0	< <	<	<	<	<
2-chloroaniline	R402	3.0	0.010	µg/l	0	< <	<	<	<	<
benzylidenechloride	R403	10	0.010	µg/l	0	< <	<	<	<	<
4-nitrotoluene	R407	1.0	0.010	µg/l	0	< <	<	<	<	<
1-chloronaphthalene	R427	0.77	0.005	µg/l	0	< <	<	<	<	<
1-chloro-2,4-dinitrobenzene	R433	5.0	0.010	µg/l	0	< <	<	<	<	<
4-chloro-2-nitroaniline	R434	3.0	0.10	µg/l	0	< <	<	<	<	<
benzidine	R435	0.10	0.020	µg/l	0	< <	<	<	<	<
3,3'-dichlorobenzidine	R436	10	0.020	µg/l	0	< <	<	<	<	<
monochlorotoluidines:	R480	10	0.10	µg/l	0	< <	<	<	<	<
chloronitrotoluenes	R481	1.0	0.10	µg/l	3	0.12 0.68	<	<	<	<
dichloroanilines	R482	0.50	0.050	µg/l	5	0.055 0.37	<	<	<	<
chloronitrobenzenes	R483	1.0	0.050	µg/l	0	< <	<	<	<	<
dichloronitrobenzenes:	R484	1.4	0.020	µg/l	0	< <	<	<	<	<

Table 17b Relevant Pollutants: Nitrated aromatics and amines in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
dimethylamine	R352	n/a	10	µg/kg dw	0	<	<	<	<	<	<
diethylamine	R353	n/a	10	µg/kg dw	7	10	109	<	<	47	68
benzylchloride	R400	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
nitrobenzene	R401	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
2-chloroaniline	R402	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
benzylidenechloride	R403	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
4-nitrotoluene	R407	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1-chloronaphthalene	R427	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
1-chloro-2,4-dinitrobenzene	R433	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
4-chloro-2-nitroaniline	R434	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
benzidine	R435	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
3,3'-dichlorobenzidine	R436	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
monochlorotoluidines:	R480	n/a	20	µg/kg dw	0	<	<	<	<	<	<
chloronitrotoluenes	R481	n/a	10	µg/kg dw	13	13	23	13	14	16	18
dichloroanilines	R482	n/a	10	µg/kg dw	0	<	<	<	<	<	<
chloronitrobenzenes	R483	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
dichloronitrobenzenes:	R484	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<

Table 17c Relevant Pollutants: Nitrated aromatics and amines in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured min	max	25-pct	50-pct	75-pct	90 pct
benzylchloride	R400	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
nitrobenzene	R401	n/a	10	µg/kg dw	2	10	14	<	<	<	11
2-chloroaniline	R402	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
benzylidenchloride	R403	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
4-nitrotoluene	R407	n/a	20	µg/kg dw	0	<	<	<	<	<	<
1-chloronaphthalene	R427	n/a	1.0	µg/kg dw	0	<	<	<	<	<	<
1-chloro-2,4-dinitrobenzene	R433	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
4-chloro-2-nitroaniline	R434	n/a	20	µg/kg dw	0	<	<	<	<	<	<
benzidine	R435	n/a	5.0	µg/kg dw	0	<	<	<	<	<	<
3,3'-dichlorobenzidine	R436	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<
monochlorotoluidines	R480	n/a	20	µg/kg dw	0	<	<	<	<	<	<
chloronitrotoluenes	R481	n/a	20	µg/kg dw	0	<	<	<	<	<	<
dichloroanilines	R482	n/a	10	µg/kg dw	0	<	<	<	<	<	<
chloronitrobenzenes	R483	n/a	10	µg/kg dw	0	<	<	<	<	<	<
dichloronitrobenzenes	R484	n/a	4.0	µg/kg dw	0	<	<	<	<	<	<

Table 18a Relevant Pollutants: Polychlorinated dibenzodioxins and dibenzofuranes in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=156)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
2378 T4CDD	R600	n/a	1.0	pg/l	0	<	<	<	<	<	<
12378 P5CDD	R601	n/a	1.0	pg/l	0	<	<	<	<	<	<
123478 H6CDD	R602	n/a	5.0	pg/l	0	<	<	<	<	<	<
123678 H6CDD	R603	n/a	5.0	pg/l	0	<	<	<	<	<	<
123789 H6CDD	R604	n/a	5.0	pg/l	0	<	<	<	<	<	<
1234678 H7CDD	R605	n/a	5.0	pg/l	7	7.2	49	<	<	<	<
12346789 O8CDD	R606	n/a	10	pg/l	14	11	615	<	<	<	<
2378 T4CDF	R607	n/a	1.0	pg/l	3	1.0	2.7	<	<	<	<
12378 P5CDF	R608	n/a	1.0	pg/l	3	1.4	5.0	<	<	<	<
23478 P5CDF	R609	n/a	1.0	pg/l	2	1.9	3.1	<	<	<	<
123478 H6CDF	R610	n/a	5.0	pg/l	2	5.7	10	<	<	<	<
123678 H6CDF	R611	n/a	5.0	pg/l	1	6.3	6.3	<	<	<	<
123789 H6CDF	R612	n/a	5.0	pg/l	0	<	<	<	<	<	<
234678 H6CDF	R613	n/a	5.0	pg/l	0	<	<	<	<	<	<
1234678 H7CDF	R614	n/a	5.0	pg/l	5	5.7	24	<	<	<	<
1234789 H7CDF	R615	n/a	5.0	pg/l	0	<	<	<	<	<	<
12346789 O8CDF	R616	n/a	10	pg/l	3	18	33	<	<	<	<
sum PCDDF TEQ	R620	n/a	10	pg TEQ/l	9	0.0011	2.2	<	<	<	<
sum dioxins	R621	n/a	50	pg/l	14	11	665	<	<	<	<
sum furans	R622	n/a	50	pg/l	5	1.0	99	<	<	<	<

Table 18b Relevant Pollutants: Polychlorinated dibenzodioxins and dibenzofuranes in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured min max	25-pct	50-pct	75-pct	90 pct
2378 T4CDD	R600	n/a	0.200	ng/kg dw	1	0.4 0.4	<	<	<	<
12378 P5CDD	R601	n/a	0.200	ng/kg dw	4	0.3 1.5	<	<	<	0.5
123478 H6CDD	R602	n/a	1.000	ng/kg dw	1	1.4 1.4	<	<	<	<
123678 H6CDD	R603	n/a	1.000	ng/kg dw	1	4.8 4.8	<	<	<	<
123789 H6CDD	R604	n/a	1.000	ng/kg dw	1	3.7 3.7	<	<	<	<
1234678 H7CDD	R605	n/a	1.000	ng/kg dw	13	0.5 72	0.5	3.0	5.3	11
12346789 O8CDD	R606	n/a	10.000	ng/kg dw	11	12 391	<	24	39	80
2378 T4CDF	R607	n/a	0.200	ng/kg dw	5	0.4 4.7	<	<	0.4	0.4
12378 P5CDF	R608	n/a	0.200	ng/kg dw	3	0.2 3.3	<	<	<	0.2
23478 P5CDF	R609	n/a	0.200	ng/kg dw	3	0.3 4.2	<	<	<	0.4
123478 H6CDF	R610	n/a	1.000	ng/kg dw	1	7.2 7.2	<	<	<	<
123678 H6CDF	R611	n/a	1.000	ng/kg dw	1	3.3 3.3	<	<	<	<
123789 H6CDF	R612	n/a	1.000	ng/kg dw	0	< <	<	<	<	<
234678 H6CDF	R613	n/a	1.000	ng/kg dw	1	2.8 2.8	<	<	<	<
1234678 H7CDF	R614	n/a	1.000	ng/kg dw	11	0.6 48	<	1.0	2.3	3.3
1234789 H7CDF	R615	n/a	1.000	ng/kg dw	1	1.9 1.9	<	<	<	<
12346789 O8CDF	R616	n/a	10.000	ng/kg dw	1	60 60	<	<	<	<
sum PCDDF TEQ	R620	n/a	2.000	ng/kg dw	1	8.3 8.3	<	<	<	<
sum dioxins	R621	n/a	10.000	ng/kg dw	11	13 474	<	26	45	92
sum furans	R622	n/a	10.000	ng/kg dw	1	135 135	<	<	<	<

Table 18c Relevant Pollutants: Polychlorinated dibenzodioxins and dibenzofuranes in biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
2378 T4CDD	R600	n/a	0.20	ng/kg dw	4	0.19	4.8	<	0.094	0.37	1.8
12378 P5CDD	R601	n/a	0.20	ng/kg dw	8	0.26	1.9	0.13	0.36	0.53	0.66
123478 H6CDD	R602	n/a	1.0	ng/kg dw	0	<	<	<	<	<	<
123678 H6CDD	R603	n/a	1.0	ng/kg dw	2	1.1	1.2	<	<	<	1.1
123789 H6CDD	R604	n/a	1.0	ng/kg dw	0	<	<	<	<	<	<
1234678 H7CDD	R605	n/a	1.0	ng/kg dw	9	1.2	7.2	1.6	3.5	4.5	6.3
12346789 O8CDD	R606	n/a	10	ng/kg dw	6	12	41	9.2	18	24	33
2378 T4CDF	R607	n/a	0.20	ng/kg dw	13	0.20	6.1	0.35	0.90	2.6	4.0
12378 P5CDF	R608	n/a	0.20	ng/kg dw	11	0.22	0.61	0.26	0.30	0.40	0.53
23478 P5CDF	R609	n/a	0.20	ng/kg dw	17	0.29	19	1.1	2.3	4.3	6.7
123478 H6CDF	R610	n/a	1.0	ng/kg dw	2	1.5	12	<	<	<	2.6
123678 H6CDF	R611	n/a	1.0	ng/kg dw	0	<	<	<	<	<	<
123789 H6CDF	R612	n/a	1.0	ng/kg dw	3	1.1	4.0	<	<	0.53	1.4
234678 H6CDF	R613	n/a	1.0	ng/kg dw	0	<	<	<	<	<	<
1234678 H7CDF	R614	n/a	1.0	ng/kg dw	3	1.0	1.3	<	<	1.1	1.2
1234789 H7CDF	R615	n/a	1.0	ng/kg dw	0	<	<	<	<	<	<
12346789 O8CDF	R616	n/a	10	ng/kg dw	1	1.6	1.6	<	<	<	<
sum PCDDF TEQ	R620	n/a	2.0	ng/kg dw	10	2.1	12	0.51	2.2	3.4	6.9
sum dioxins	R621	n/a	10	ng/kg dw	6	15	56	11	23	29	42
sum furans	R622	n/a	10	ng/kg dw	2	10	38	<	<	<	13

Table 19a Relevant Pollutants: Anions and sum-parameters in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
cyanide	R522	0.001	0.002	mg/l	15	0.0020	0.043	<	<	<	<
fluoride	R523	0.001	0.10	mg/l	193	0.030	1.2	<	0.12	0.48	0.90
chloride	R524	250	1.0	mg/l	287	13	20100	19	27	5950	17180
phenols	R974	0.030	0.030	mg/l	3	0.090	0.35	<	<	<	<

Table 19b Relevant Pollutants: Anions and sum-parameters in sediment.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured		25-pct	50-pct	75-pct	90 pct
						min	max				
cyanide	R522	n/a	0.50	mg/kg dw	4	0.50	1.4	<	<	<	1.0
fluoride	R523	500	0.20	mg/kg dw	12	0.30	2.9	<	0.50	1.3	1.9
chloride	R524	n/a	0.40	mg/kg dw	17	4.4	12600	11	108	8000	10200
phenols	R974	n/a	0.02	mg/kg dw	0	<	<	<	<	<	<

4.3 General Components

As mentioned before most parameters in the group of General Components are determined by the SERBD laboratory in Kilkenny. For the water samples 4 parameters were determined by TNO. The results of these parameters are summarized in table 20a, 20b and 20c. The results for the QA/QC can be found in table 21. Please note that for sediment the results of QA/QC-samples for particle size and aluminium are expressed as the repeatability of these parameters.

4.3.1 *Nitrate and sum-parameters in water*

Nitrate should have been determined in saline water samples only, but was determined in all aqueous samples. Nitrate is found in most of the samples in concentrations ranging from 0.09 to 49 mg/l with a median concentration of 2.2 mg/l. The sum-parameters, total nitrogen, total organic carbon and total phosphorus are found in 37% to 59% of the samples up to concentrations of 820 mg/l for total nitrogen. The concentrations of total phosphorus range from 0.05 to 200 mg/l with a 90-pct value of 0.47 mg/l. The maximum concentration of 200 mg/l for total phosphorus in the first series was an exception. In Dutch surface waters total phosphorus is generally found in concentrations between 0.05 and 0.3 mg/l.

QC samples showed recoveries of 81% for total phosphorus and 102% for nitrate in water.

4.3.2 *TOC, particle size, aluminium and moisture content for sediment*

Aluminium is a common component in sediments and is found in all samples in concentrations up to 48 g/kg dw. This parameter, together with the particle size distribution and moisture content of the sediments is summarized in table 20b. Recoveries from sediment were not determined. The repeatability of the particle size distribution is better than 3%. For Aluminium the repeatability is 5.9%.

4.3.3 *Lipid and moisture content in biota*

Lipid and moisture content in biota were determined and the results are summarized in table 19c. The lipid content of the flesh of eel (serie 2) ranged from 6.0% to 28% which is around the average value of 16% that is normally found for eel tissue. The moisture content ranged from 56% to 80%, also a normal value.

The lipid content of the flesh of the mussels (serie 1) ranged from 0.6% to 1.3% which is around the average value of 1% that is normally found for mussel tissue. The moisture content ranged from 79% to 86%, also a normal value.

For the parameters lipid and moisture no QC-results are available.

Table 20a General Components : Nitrate and sum-parameters in water.

Parameter	No.	target EQS	LOD	Unit	frequency (N=287)	measured min max	25-pct	50-pct	75-pct	90 pct
nitrate	R972	n/a	0.050	mg/l	255	0.090 49	1.3	5.9	13	24
total nitrogen	R971	n/a	0.50	mg/l	119	0.50 820	<	<	0.73	2.3
total organic carbon	R973	n/a	5.0	mg/l	170	0.30 470	<	4.7	7.8	13
total phosphorus	R970	n/a	0.050	mg/l	105	0.050 200	<	<	0.080	0.47

Table 20b General Components : Particle size distribution, Aluminium, moisture content and total organic carbon.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured min max	25-pct	50-pct	75-pct	90 pct
total organic carbon	R973	n/a	1.0	%	17	0.20 8.5	0.72	1.3	2.6	4.2
Particle Size % >2 µm	R975	n/a	1.0	%	17	78 100	89	97	99	100
Particle Size % <2 µm	R976	n/a	1.0	%	15	0.27 22	1.1	2.9	11	14
Particle Size % > 63 µm	R977	n/a	1.0	%	16	5.3 100	19	42	88	95
Particle Size % <63 µm	R978	n/a	1.0	%	16	3.1 100	12	58	81	90
aluminium	R980	n/a	0.010	mg/kg dw	17	3651 48422	13309	27306	34487	42607
moisture content	R979	n/a	1.0	%	17	14 72	19	26	41	55

Table 20c General Components : Total lipid and moisture content of biota.

Parameter	No.	target EQS	LOD	Unit	frequency (N=17)	measured min max	25-pct	50-pct	75-pct	90 pct
total lipid content		n/a	0.10	%	17	0.60 28	0.9	6.0	17	22
moisture content		n/a	1.0	%	17	56 86	68	80	84	85

4.4 Results of QA/QC measures and samples

4.4.1 *Sample integrity*

Upon receipt of the samples the integrity and the temperature of the samples was checked. All samples were received in good order and were in agreement with the sample registration form. For the water samples the temperature of the 13 shipments ranged from 6.8 °C to 10.1 °C. Considering that the samples were shipped with a temperature of around 4 °C, this means that the average temperature during the transportation period of maximum 3 days was around 7 °C. For the sediment samples it was visually determined that these were still frozen. Therefore the condition of the samples is considered to be sufficient to have maintained their original composition.

4.4.2 *Recovery of internal standards*

In most of the determinations an internal standard is added to the sample before analysis. Two kinds of internal standards are used, isotopically labelled internal standards and surrogate internal standards. Isotopically labelled internal standards are ²D- or ¹³C-labelled compounds identical to the actual compounds that will be determined in the analysis. These were used for instance for the dioxins, PAH, PCB and a few others. The labelled internal standards were used to determine the performance of the method and to quantify the analytes, e.g. the results were corrected for the recovery of the labelled internal standard. Surrogate standards are not compound specific and are used for example in the determination of the pesticides. If surrogate standards are applied the recovery is used to evaluate the performance of the method, but not to correct the quantification because the surrogate standards are not compound specific. An exception is the recovery of the surrogate standard for the organotin compounds that is used to correct the results for the other organotin compounds.

In general the performance of a method was accepted if the recoveries of the internal standards (label or surrogate) were in the range of 60% to 140%. Exceptions are the recovery of the surrogate standard for organotins which normally is found around 50% and the recovery of labelled internal standards with a high volatility such as the label of naphthalene and monochlorophenol. The recoveries of the internal standards are listed in table 21. The recoveries of internal standards used to correct the results of analytes are printed bold. In general the recoveries are in the range of 60% to 140%.

4.4.3 *Results of spiked samples and duplicates*

With each series of samples a spiked sample was generated by the addition of a mixture containing most of the compounds of interest to a mixed sample. This was done for most of the organic analytes, volatiles as well as semi-volatiles. These spiked samples were stored for 24 hours at 4 °C and were analysed together with the actual samples. The concentration spiked to the samples was about 5 to 20 times the expected limit of detection. For dioxins these QC samples were omitted because of the relative high price of these analyses, the amount of sample required and the fact that a labelled internal standard is applied that already contains all 17 dioxins. Other analytes that were not added are chloroprene, the dimethyl- and diethylamine and chlormequat.

The recoveries of the analytes in the spiked samples are given in table 21. In general the results show good recoveries in the range of 60% to 130%. Exceptions are cyanuric chloride for which very irregular results were found, and the chlorotoluidines and dichloroanilines for which the recovery strongly depends on the quality of the analytical column and the composition of the sample extract. In addition strange results were found for the recovery of butylbenzylphthalate, di-butyl- and di-(2-ethylhexyl) phthalate. While the blank values of these compounds in samples were acceptable, irregular recoveries ranging from 100% up to 1000% were found in the spiked samples. On the other hand the recoveries for butylbenzyl phthalate and di-isononyl phthalate were good. Moreover, the concentrations for dibutyl- and di-(2-ethylhexyl) phthalate found in actual samples are in the range of what may be expected.

For the metal determinations samples were analysed in duplicate. As a quality control the differences in the results relative to the average result were evaluated. The results are given in table 21 and are printed in italics to distinguish them from the recoveries of the other compounds. In general these differences are smaller than 10%.

For anions and total phosphate QC samples were prepared in milli-Q water and analysed with the samples. The results indicate good recoveries. Because of the relative low total phosphate concentrations found in the samples, a few QC samples were stored for one week at 4 °C before analysis. The recoveries found in these samples were somewhat lower but within the standard deviation of the other recoveries.

4.4.4 *Results of method blanks*

With each series a method blank was analysed. This blank is a complete method blank including all steps and reagents but without an actual sample. In the case of the metals and anions a sample of milli-Q water was used. The results are given in table 21 showing that for most analytes no blank values were observed. Notable exceptions are dibutyl- and di-(2-ethylhexyl) phthalate for which blank values were found in the method blanks. For both analytes blank values in the order of 2 to 10 times the LOD value were found. The results of actual samples are corrected for these blank values. Other compounds for which blank values were found are naphthalene, anthracene, PCB 28 and 52, dichlobenil, dichlorobenzenes, DINP, trichlorofon and bisphenol-A. Since these blank values were found in a limited number of method blank samples and were in the order of the LOD value, no correction of results for these blank values was applied.

Table 21 Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data water sample analyses					LOD	Unit	QC data sediment sample analyses				
				internal standard		QC samples		method blank			internal standard		QC samples		method blank
				recovery %	variance %	recovery %	variance %				recovery %	variance %	recovery %	variance %	
naphthalene	P001	0.010	µg/l	66	10	103	20	0.07	1.0	µg/kg dw	50	13	68	-	<
anthracene	P006	0.002	µg/l	78	11	86	13	<	0.50	µg/kg dw	94	10	119	-	<
fluoranthene	P007	0.005	µg/l	93	10	91	22	0.005	0.50	µg/kg dw	102	12	104	-	<
benzo[b]fluoranthene	P011	0.005	µg/l	106	16	93	23	<	0.50	µg/kg dw	120	9	98	-	<
benzo[k]fluoranthene	P012	0.005	µg/l	98	15	94	16	<	0.50	µg/kg dw	104	11	126	-	<
benzo[a]pyrene	P013	0.005	µg/l	88	13	82	19	<	0.50	µg/kg dw	104	8	129	-	<
indeno[1,2,3-cd]pyrene	P014	0.005	µg/l	97	15	93	17	<	0.50	µg/kg dw	114	12	120	-	<
benzo[g,h,i]perylene	P016	0.005	µg/l	98	16	93	18	<	0.50	µg/kg dw	95	11	85	-	<
pentachlorophenol	P041	0.010	µg/l	81	13	91	27	<	1.0	µg/kg dw	96	10	76	1	<
1,3,5-trichlorobenzene	P048	0.010	µg/l			88	14	<	1.0	µg/kg dw			76	9	<
1,2,4-trichlorobenzene	P049	0.010	µg/l	88	14	102	28	<	1.0	µg/kg dw	73	14	75	13	<
1,2,3-trichlorobenzene	P050	0.010	µg/l			84	15	<	1.0	µg/kg dw			72	6	<
pentachlorobenzene	P053	0.002	µg/l	88	12	91	13	<	0.20	µg/kg dw	96	10	89	5	<
hexachlorobenzene	P054	0.002	µg/l	99	12	89	11	<	0.20	µg/kg dw	115	10	71	8	<
dichloromethane	P103	0.10	µg/l			106	25	<	1.0	µg/kg dw			97	17	<
trichloromethane	P109	0.10	µg/l			104	14	<	1.0	µg/kg dw			95	17	<
tetrachloromethane	P111	0.10	µg/l			115	20	<	1.0	µg/kg dw			100	28	<
1,2-dichloroethane	P112	0.10	µg/l	112	20	99	16	<	1.0	µg/kg dw	84	18	85	6	<
benzene	P113	0.10	µg/l			95	10	<	1.0	µg/kg dw			90	9	<
trichloroethene	P114	0.10	µg/l			94	10	<	1.0	µg/kg dw			89	11	<
tetrachloroethene	P120	0.10	µg/l			95	12	<	1.0	µg/kg dw			84	10	<
hexachlorobutadiene	P202	0.002	µg/l			84	20	<	0.20	µg/kg dw			93	5	<
trifluralin	P214	0.005	µg/l			76	10	<	0.50	µg/kg dw			78	9	<
atrazine	P218	0.010	µg/l			92	12	<	1.0	µg/kg dw			60	8	<
lindane	P219	0.005	µg/l			82	8	<	0.50	µg/kg dw			71	4	<
alachlor	P225	0.010	µg/l			86	12	<	1.0	µg/kg dw			87	11	<
aldrin	P232	0.005	µg/l			84	12	<	0.50	µg/kg dw			77	8	<
chlorpyrifos(-ethyl)	P233	0.010	µg/l	90	16	87	8	<	1.0	µg/kg dw	116	9	111	12	<
isodrin	P238	0.005	µg/l			78	9	<	0.50	µg/kg dw			108	17	<
chlorfenvinphos	P241	0.010	µg/l			90	9	<	1.0	µg/kg dw			71	1	<
endosulfan-alpha	P243	0.010	µg/l			85	15	<	1.0	µg/kg dw			109	12	<
dieldrin	P244	0.005	µg/l			80	9	<	0.50	µg/kg dw			82	3	<
endrin	P246	0.005	µg/l			88	11	<	0.50	µg/kg dw			66	2	<
endosulfan-beta	P247	0.010	µg/l			98	12	<	1.0	µg/kg dw			72	2	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data biota sample analyses				method blank 75-pct
				internal standard		QC samples		
				recovery %	variance %	recovery %	variance %	
naphthalene	P001	1.0	µg/kg dw	76	13	94	6	10
anthracene	P006	0.50	µg/kg dw	85	14	98	8	<
fluoranthene	P007	0.50	µg/kg dw	113	22	115	14	2.0
benzo[b]fluoranthene	P011	0.50	µg/kg dw	104	10	90	10	<
benzo[k]fluoranthene	P012	0.50	µg/kg dw	106	8	130	30	<
benzo[a]pyrene	P013	0.50	µg/kg dw	94	15	97	9	<
indeno[1,2,3-cd]pyrene	P014	0.50	µg/kg dw	87	5	113	14	<
benzo[g,h,i]perylene	P016	0.50	µg/kg dw	82	5	105	12	<
pentachlorophenol	P041	1.0	µg/kg dw	76	15	96	17	<
1,3,5-trichlorobenzene	P048	1.0	µg/kg dw			114	9	<
1,2,4-trichlorobenzene	P049	1.0	µg/kg dw	82	14	153	43	4.0
1,2,3-trichlorobenzene	P050	1.0	µg/kg dw			135	49	1.8
pentachlorobenzene	P053	0.20	µg/kg dw	108	13	103	1	<
hexachlorobenzene	P054	0.20	µg/kg dw	111	14	108	9	<
dichloromethane	P103	10	µg/kg dw			91	10	<
trichloromethane	P109	10	µg/kg dw			84	23	<
tetrachloromethane	P111	10	µg/kg dw			93	11	<
1,2-dichloroethane	P112	10	µg/kg dw	65	18	92	16	<
benzene	P113	10	µg/kg dw			87	20	<
trichloroethene	P114	10	µg/kg dw			97	14	<
tetrachloroethene	P120	10	µg/kg dw			89	11	<
hexachlorobutadiene	P202	0.20	µg/kg dw			52	7	<
trifluralin	P214	0.50	µg/kg dw			27	14	<
atrazine	P218	1.0	µg/kg dw			77	9	<
lindane	P219	0.50	µg/kg dw			96	11	<
alachlor	P225	1.0	µg/kg dw			94	3	<
aldrin	P232	0.50	µg/kg dw			105	9	<
chlorpyrifos(-ethyl)	P233	1.0	µg/kg dw	90	7	93	9	<
isodrin	P238	0.50	µg/kg dw			88	8	<
chlorfenvinphos	P241	1.0	µg/kg dw			108	10	<
endosulfan-alpha	P243	1.0	µg/kg dw			93	5	<
dieldrin	P244	0.50	µg/kg dw			89	1	<
endrin	P246	0.50	µg/kg dw			93	5	<
endosulfan-beta	P247	1.0	µg/kg dw			102	4	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	QC data water sample analyses						QC data sediment sample analyses							
		LOD	Unit	internal standard		QC samples		method blank	LOD	Unit	internal standard		QC samples		method blank
				recovery %	variance %	recovery %	variance %				recovery %	variance %			
2,4'-DDT	P248	0.002	µg/l			85	14	<	0.20	µg/kg dw			87	-	<
4,4'-DDT	P250	0.002	µg/l			111	19	<	0.20	µg/kg dw			106	-	<
di-(2-ethylhexyl)-phthalate (DEH)	P251	2	µg/l	90	16	irregular	-	1.6	50	µg/kg dw	116	9	137	63	25
simazine	P306	0.010	µg/l			89	14	<	1.0	µg/kg dw			76	3	<
isoproturon	P308	0.010	µg/l			85	10	<	1.0	µg/kg dw			74	8	<
diuron	P309	0.010	µg/l			85	13	<	1.0	µg/kg dw			60	5	<
4-tert-octylphenol	P357	0.010	µg/l	-	-	86	27	<	1.0	µg/kg dw	-	-	69	8	<
nonylphenols	P358	0.010	µg/l	-	-	72	25	0.01	1.0	µg/kg dw	-	-	73	14	<
cadmium	P500	0.10	µg/l			2.6	0.6	<	0.10	mg/kg dw			2.3	-	<
lead	P501	1.0	µg/l	96	6	5.5	1.0	<	0.10	mg/kg dw	92	8	4.8	-	<
mercury	P502	0.10	µg/l			4.1	1.7	<	0.10	mg/kg dw			5.4	-	<
nickel	P503	1.0	µg/l			3.2	2.0	<	0.10	mg/kg dw			2.4	-	<
BDE-209	P914	0.020	µg/l			60	19	<	2.0	µg/kg dw			82	-	<
C10-C13 (PCA)	P917	0.10	µg/l	108	12	87	14	<	10	µg/kg dw	98	14	95	-	<
sum diphenyl ether, pentabromo	P920	0.001	µg/l			81	11	<	0.10	µg/kg dw			87	-	<
sum diphenyl ether, octabromo	P921	0.002	µg/l			83	13	0.001	0.20	µg/kg dw			83	-	<
tributyltin	P930	0.005	µg/l	76	10	96	16	<	0.500	µg/kg dw	47	9	112	12	<
PCB 28	R017	0.002	µg/l	93	11	94	12	0.006	0.40	µg/kg dw	89	7	92	3	0.5
PCB 52	R018	0.002	µg/l	93	13	99	12	0.003	0.40	µg/kg dw	90	4	87	5	<
PCB 101	R019	0.002	µg/l	93	13	103	14	<	0.40	µg/kg dw	102	7	107	13	<
PCB 118	R020	0.002	µg/l			111	17	<	0.40	µg/kg dw			102	12	<
PCB 153	R021	0.002	µg/l			103	11	<	0.40	µg/kg dw			100	14	<
PCB 138	R022	0.002	µg/l	108	14	88	23	<	0.40	µg/kg dw	117	8	93	9	<
PCB 180	R023	0.002	µg/l	99	13	100	12	<	0.40	µg/kg dw	100	7	91	15	<
2,4/2,5-dichlorophenol	R028	0.010	µg/l	86	18	99	15	<	1.0	µg/kg dw	95	10	97	12	<
mono-chlorophenol	R042	0.050	µg/l	60	23	82	18	<	10	µg/kg dw	90	13	79	5	<
trichlorophenols	R043	0.010	µg/l	95	15	108	20	<	2.0	µg/kg dw	98	8	87	11	<
mono-chlorobenzene	R044	0.10	µg/l	106	23	93	18	<	20	µg/kg dw	82	30	87	11	<
1,2,4,5-tetrachlorobenzene	R051	0.10	µg/l	86	16	94	20	<	20	µg/kg dw	86	8	100	12	<
dichlorobenzenes	R055	0.10	µg/l	90	20	106	17	<	20	µg/kg dw	55	27	91	5	<
sum PCB	R060	0.50	µg/l	-	-	-	-	-	0.002	µg/kg dw	-	-	-	-	-
vinylchloride	R100	0.10	µg/l			108	20	<	20	µg/kg dw			75	17	<
bromomethane	R101	0.50	µg/l			115	21	<	20	µg/kg dw			79	18	<
1,1-dichloroethene	R102	0.10	µg/l	106	23	106	14	<	20	µg/kg dw	84	18	93	10	<
carbon disulphide	R104	0.10	µg/l			90	9	<	20	µg/kg dw			97	9	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data biota sample analyses				method blank 75-pct	
				internal standard		QC samples			
				recovery %	variance %	recovery %	variance %		
2,4'-DDT	P248	0.20	µg/kg dw			89	6	<	
4,4'-DDT	P250	0.20	µg/kg dw			104	10	<	
di-(2-ethylhexyl)-phthalate (DEH)	P251	500	µg/kg dw	90	7	irregular	-	<	
simazine	P306	1.0	µg/kg dw				83	30	<
isoproturon	P308	1.0	µg/kg dw				46	19	<
diuron	P309	1.0	µg/kg dw				85	1	<
4-tert-octylphenol	P357	1.0	µg/kg dw	-	-	-	-	<	
nonylphenols	P358	1.0	µg/kg dw	-	-	-	-	<	
cadmium	P500	0.010	mg/kg dw			1.3	1.3	<	
lead	P501	0.010	mg/kg dw	95	4	2.6	2.0	<	
mercury	P502	0.010	mg/kg dw			-	-	<	
nickel	P503	0.010	mg/kg dw			4.3	5.7	<	
BDE-209	P914	2.0	µg/kg dw			96	3.2	<	
C10-C13 (PCA)	P917	10	µg/kg dw	102	12	89	8.5	<	
sum diphenyl ether, pentabromo	P920	0.10	µg/kg dw			91	8.7	<	
sum diphenyl ether, octabromo	P921	0.20	µg/kg dw			82	9.5	<	
tributyltin	P930	0.50	µg/kg dw	85	11	90	1.3	<	
PCB 28	R017	0.40	µg/kg dw	116	8	118	23	1.6	
PCB 52	R018	0.40	µg/kg dw	117	10	96	15	1.1	
PCB 101	R019	0.40	µg/kg dw	125	17	88	13	<	
PCB 118	R020	0.40	µg/kg dw			101	7	<	
PCB 153	R021	0.40	µg/kg dw	124	14	109	23	<	
PCB 138	R022	0.40	µg/kg dw			96	26	<	
PCB 180	R023	0.40	µg/kg dw	119	22	105	11	<	
2,4/2,5-dichlorophenol	R028	2.0	µg/kg dw	97	15	104	2	<	
mono-chlorophenol	R042	10	µg/kg dw	85	11	102	6	<	
trichlorophenols	R043	2.0	µg/kg dw	106	16	103	6	<	
mono-chlorobenzene	R044	20	µg/kg dw	8	5	98	18	<	
1,2,4,5-tetrachlorobenzene	R051	20	µg/kg dw	95	13	129	8	<	
dichlorobenzenes	R055	20	µg/kg dw	58	10	134	21	27	
sum PCB	R060	2.0	µg/kg dw	-	-	-	-	-	
vinylchloride	R100	10	µg/kg dw			69	16	<	
bromomethane	R101	10	µg/kg dw	65	18	72	14	<	
1,1-dichloroethene	R102	10	µg/kg dw			93	20	<	
carbon disulphide	R104	10	µg/kg dw			90	16	<	

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data water sample analyses					LOD	Unit	QC data sediment sample analyses				
				internal standard		QC samples		method blank			internal standard		QC samples		method blank
				recovery %	variance %	recovery %	variance %				recovery %	variance %			
MTBE	R105	0.10	µg/l			127	76	<	20	µg/kg dw			107	13	<
1,2-dichloroethene	R106	0.10	µg/l			91	22	<	20	µg/kg dw			98	9	<
1,1-dichloroethane	R107	0.10	µg/l			103	13	<	20	µg/kg dw			90	17	<
1,1,1-trichloroethane	R110	0.10	µg/l			115	20	<	20	µg/kg dw			92	15	<
1,2-dichloropropane	R115	0.10	µg/l			106	18	<	20	µg/kg dw			92	11	<
1,3-dichloropropene	R116	0.10	µg/l			104	17	<	20	µg/kg dw	84	18	89	5	<
toluene	R117	0.10	µg/l			96	10	<	20	µg/kg dw			87	9	<
1,1,2-trichloroethane	R119	0.10	µg/l			107	25	<	20	µg/kg dw			94	18	<
1,2-dibromoethane	R121	0.10	µg/l			100	18	<	20	µg/kg dw			84	10	<
ethylbenzene	R122	0.10	µg/l			88	10	<	20	µg/kg dw			91	13	<
p,m-xylene	R123	0.10	µg/l			87	10	<	20	µg/kg dw			88	11	<
o-xylene	R124	0.10	µg/l			89	10	<	20	µg/kg dw			81	13	<
styrene	R125	0.10	µg/l	106	23	84	7	<	20	µg/kg dw			89	7	<
iso-propylbenzene	R126	0.10	µg/l			89	23	<	20	µg/kg dw			80	12	<
1,1,2,2-tetrachloroethane	R127	0.10	µg/l			107	16	<	20	µg/kg dw			92	16	<
2-chlorotoluene	R128	0.10	µg/l			88	11	<	20	µg/kg dw			82	3	<
3-chlorotoluene	R129	0.10	µg/l			104	10	<	20	µg/kg dw			94	8	<
4-chlorotoluene	R130	0.10	µg/l			93	6	<	20	µg/kg dw			81	6	<
chloroprene	R134	0.10	µg/l			86	13	<	20	µg/kg dw	84	18	not deter.	-	<
3-chloropropene	R135	0.10	µg/l			84	14	<	20	µg/kg dw			71	9	<
dichloro-di-isopropylether	R136	0.10	µg/l			89	15	<	20	µg/kg dw			75	15	<
2,3-dichloropropene	R137	0.10	µg/l			87	15	<	20	µg/kg dw			80	14	<
epichlorohydrin	R138	0.10	µg/l			73	16	<	20	µg/kg dw			55	7	<
hexachloroethane	R139	0.10	µg/l			90	17	<	20	µg/kg dw			89	13	<
1,1,2-trichloro-1,2,2-trifluoroethane	R140	0.10	µg/l			88	15	<	20	µg/kg dw			69	6	<
cyanuric chloride	R200	0.050	µg/l			82	10	<	10	µg/kg dw			61	6	<
oxydemeton-methyl	R201	0.10	µg/l			84	29	<	20	µg/kg dw			83	13	<
dichlobenil	R203	0.010	µg/l			70	7	0.01	4.0	µg/kg dw			90	16	<
tribenuron-methyl	R204	0.020	µg/l			77	18	<	10	µg/kg dw			84	20	<
biphenyl	R205	0.010	µg/l	87	10	68	7	<	2.0	µg/kg dw	116	9	86	15	<
mecoprop	R206	0.020	µg/l			101	26	<	2.0	µg/kg dw			75	20	<
MCPA	R207	0.010	µg/l			76	16	<	2.0	µg/kg dw			53	10	<
propachlor	R208	0.010	µg/l			83	10	<	4.0	µg/kg dw			72	6	<
dichlorprop	R209	0.020	µg/l			81	20	<	4.0	µg/kg dw			39	17	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data biota sample analyses				method blank 75-pct
				internal standard recovery %	variance %	QC samples recovery %	variance %	
MTBE	R105	10	µg/kg dw			122	10	<
1,2-dichloroethene	R106	10	µg/kg dw			83	27	<
1,1-dichloroethane	R107	10	µg/kg dw			86	21	<
1,1,1-trichloroethane	R110	10	µg/kg dw			102	1	<
1,2-dichloropropane	R115	10	µg/kg dw			79	30	<
1,3-dichloropropene	R116	10	µg/kg dw	65	18	80	36	<
toluene	R117	10	µg/kg dw			77	21	<
1,1,2-trichloroethane	R119	10	µg/kg dw			79	34	<
1,2-dibromoethane	R121	10	µg/kg dw			82	35	<
ethylbenzene	R122	10	µg/kg dw			88	12	<
p,m-xylene	R123	10	µg/kg dw			96	2	<
o-xylene	R124	10	µg/kg dw			97	0	<
styrene	R125	10	µg/kg dw			93	10	<
iso-propylbenzene	R126	10	µg/kg dw			85	11	<
1,1,2,2-tetrachloroethane	R127	10	µg/kg dw			104	3	<
2-chlorotoluene	R128	10	µg/kg dw			89	4	<
3-chlorotoluene	R129	10	µg/kg dw			91	15	<
4-chlorotoluene	R130	10	µg/kg dw			88	11	<
chloroprene	R134	10	µg/kg dw	65	18	87	18	<
3-chloropropene	R135	10	µg/kg dw			85	18	<
dichloro-di-isopropylether	R136	10	µg/kg dw			not det.	-	<
2,3-dichloropropene	R137	10	µg/kg dw			71	17	<
epichlorohydrin	R138	10	µg/kg dw			not det.	-	<
hexachloroethane	R139	10	µg/kg dw			46	1	<
1,1,2-trichloro-1,2,2-trifluoroethane	R140	10	µg/kg dw			32	1	<
cyanuric chloride	R200	10	µg/kg dw			89	14	<
oxydemeton-methyl	R201	20	µg/kg dw			92	12	<
dichlobenil	R203	4.0	µg/kg dw			75	14	<
tribenuron-methyl	R204	10	µg/kg dw			47	32	<
biphenyl	R205	2.0	µg/kg dw	110	8	62	5	<
mecoprop	R206	2.0	µg/kg dw			111	4	<
MCPA	R207	2.0	µg/kg dw			94	13	<
propachlor	R208	4.0	µg/kg dw			78	2	<
dichlorprop	R209	4.0	µg/kg dw			112	4	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data water sample analyses					LOD	Unit	QC data sediment sample analyses				
				internal standard		QC samples		method blank			internal standard		QC samples		method blank
				recovery %	variance %	recovery %	variance %				recovery %	variance %	recovery %	variance %	
bromoxynil	R210	0.020	µg/l			65	22	<	4.0	µg/kg dw			96	8	<
2,4-D	R211	0.020	µg/l			57	21	<	4.0	µg/kg dw			69	11	<
ethoprophos	R212	0.010	µg/l			85	9	<	2.0	µg/kg dw			85	9	<
chlorpropham	R213	0.020	µg/l			87	14	<	4.0	µg/kg dw			87	10	<
dimethoate	R215	0.020	µg/l			74	25	<	4.0	µg/kg dw			91	9	<
carbofuran	R216	0.010	µg/l			81	27	<	2.0	µg/kg dw			67	4	<
triclopyr		0.020	µg/l			79	28	<							
propyzamide	R220	0.020	µg/l			87	19	<	2.0	µg/kg dw			82	25	<
triallate	R221	0.005	µg/l			82	7	<	1.0	µg/kg dw			67	1	<
pirimicarb	R222	0.020	µg/l			87	9	<	4.0	µg/kg dw			68	2	<
bentazon	R223	0.020	µg/l			70	18	<	4.0	µg/kg dw			98	22	<
tolclofos-methyl	R224	0.020	µg/l			83	8	<	4.0	µg/kg dw			70	4	<
ioxynil	R226	0.050	µg/l			88	12	<	10	µg/kg dw			75	6	<
diazinon		0.020	µg/l			65	19	<							
pirimiphos-methyl	R227	0.010	µg/l			80	10	<	2.0	µg/kg dw			73	4	<
ethofumesate	R228	0.020	µg/l			86	11	<	4.0	µg/kg dw			63	2	<
fenitrothion	R229	0.010	µg/l			102	20	<	2.0	µg/kg dw			86	5	<
di-n-butylphthalate	R230	0.010	µg/l	87	10	700	801	1.4	1.0	µg/kg dw	116	9	161	20	5.0
malathion	R231	0.010	µg/l			90	14	<	2.0	µg/kg dw			85	4	<
fenpropimorf	R234	0.020	µg/l			107	27	<	4.0	µg/kg dw			89	3	<
pendimethalin	R239	0.010	µg/l			85	15	<	5.0	µg/kg dw			100	10	<
metazachlor	R240	0.020	µg/l			92	15	<	4.0	µg/kg dw			84	5	<
captan	R242	0.10	µg/l			90	20	<	20	µg/kg dw			106	21	<
kresoxim-methyl	R245	0.010	µg/l			79	12	<	2.0	µg/kg dw			73	4	<
butylbenzylphthalate	R249	0.010	µg/l			109	33	0.05	2.0	µg/kg dw			112	28	<
permethrin	R252	0.020	µg/l			90	16	<	4.0	µg/kg dw			95	4	<
diisononyl ester DINP	R254	0.010	µg/l			104	36	2.6	2.0	µg/kg dw			not deter.	-	<
prochloraz	R255	0.020	µg/l			89	17	<	2.0	µg/kg dw			86	15	<
cyfluthrin	R256	0.020	µg/l			92	12	<	4.0	µg/kg dw			111	5	<
cypermethrin	R257	0.020	µg/l			97	15	<	4.0	µg/kg dw			100	16	<
deltamethrin	R258	0.020	µg/l			90	17	<	4.0	µg/kg dw			94	9	<
oxamyl	R300	0.050	µg/l			90	32	<	10	µg/kg dw			77	9	<
trichlorofon	R301	0.020	µg/l			78	20	<	4.0	µg/kg dw			37	9	<
metamitron	R302	0.010	µg/l			86	22	<	2.0	µg/kg dw			90	13	<
carbendazim	R303	0.010	µg/l			89	20	<	2.0	µg/kg dw			64	3	<
chloridazon	R304	0.020	µg/l			93	13	<	4.0	µg/kg dw			101	13	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data biota sample analyses				method blank 75-pct
				internal standard		QC samples		
				recovery %	variance %	recovery %	variance %	
bromoxynil	R210	4.0	µg/kg dw			98	14	<
2,4-D	R211	4.0	µg/kg dw			89	17	<
ethoprophos	R212	2.0	µg/kg dw			90	10	<
chlorpropham	R213	4.0	µg/kg dw			87	15	<
dimethoate	R215	4.0	µg/kg dw			97	11	<
carbofuran	R216	2.0	µg/kg dw			101	12	<
triclopyr								
propyzamide	R220	2.0	µg/kg dw			96	12	<
triallate	R221	1.0	µg/kg dw			83	4	<
pirimicarb	R222	4.0	µg/kg dw			77	2	<
bentazon	R223	4.0	µg/kg dw			60	5	<
tolclofos-methyl	R224	4.0	µg/kg dw			93	5	<
ioxynil	R226	10	µg/kg dw			88	8	<
diazinon								
pirimiphos-methyl	R227	2.0	µg/kg dw			82	3	<
ethofumesate	R228	4.0	µg/kg dw			106	15	<
fenitrothion	R229	2.0	µg/kg dw			114	12	<
di-n-butylphthalate	R230	100	µg/kg dw	110	8	irregular	-	<
malathion	R231	2.0	µg/kg dw			103	10	<
fenpropimorf	R234	4.0	µg/kg dw			31	20	<
pendimethalin	R239	5.0	µg/kg dw			95	16	<
metazachlor	R240	4.0	µg/kg dw			89	1	<
captan	R242	20	µg/kg dw			95	24	<
kresoxim-methyl	R245	2.0	µg/kg dw			92	5	<
butylbenzylphthalate	R249	20	µg/kg dw			irregular	-	<
permethrin	R252	4.0	µg/kg dw			104	7	<
diisononylester DINP	R254	20	µg/kg dw			irregular	-	<
prochloraz	R255	2.0	µg/kg dw			83	18	<
cyfluthrin	R256	4.0	µg/kg dw			91	2	<
cypermethrin	R257	4.0	µg/kg dw			104	7	<
deltamethrin	R258	4.0	µg/kg dw			102	12	<
oxamyl	R300	10	µg/kg dw			64	3	<
trichlorofon	R301	4.0	µg/kg dw			104	8	<
metamitron	R302	2.0	µg/kg dw			74	49	<
carbendazim	R303	2.0	µg/kg dw			42	13	<
chlorigazon	R304	4.0	µg/kg dw			53	38	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data water sample analyses					LOD	Unit	QC data sediment sample analyses				
				internal standard		QC samples		method blank			internal standard		QC samples		method blank
				recovery	variance	recovery	variance				recovery	variance	recovery	variance	
				%	%	%	%	75-pct			%	%	%	%	
thiabendazole	R305	0.050	µg/l			68	27	<	2.0	µg/kg dw			52	4	<
chlorotoluron	R307	0.020	µg/l			83	10	<	4.0	µg/kg dw			71	8	<
monolinuron	R310	0.010	µg/l	87	10	75	16	<	2.0	µg/kg dw			83	11	<
methiocarb	R311	0.010	µg/l			91	30	<	2.0	µg/kg dw	116	9	74	7	<
linuron	R312	0.010	µg/l			80	17	<	2.0	µg/kg dw			71	8	<
epoxiconazole	R313	0.010	µg/l			88	13	<	2.0	µg/kg dw			70	6	<
diflubenzuron	R314	0.010	µg/l			95	16	<	2.0	µg/kg dw			43	6	<
glyphosate	R350	0.10	µg/l	-	-	75	12	<							<
amitraz		0.02	µg/l	-	-	-	-	-							<
dimethylamine	R352	1.0	µg/l	91	9	not deter.	-	<	10	µg/kg dw	93	36	not deter.	-	<
diethylamine	R353	1.0	µg/l			not deter.	-	<	10	µg/kg dw			not deter.	-	<
nonylphenol ethoxylates	R355	0.050	µg/l	-	-	70	18	<	5.0	µg/kg dw	-	-	53	9	<
bisphenol-A	R356	0.010	µg/l	77	20	80	17	0.01	1.0	µg/kg dw	67	5	72	10	<
chlormequat	R358	0.10	µg/l	108	14	80	25	<							<
paraquat	R359	0.50	µg/l	-	-	68	17	<							<
benzylchloride	R400	0.010	µg/l			83	8	<	5.0	µg/kg dw			64	3	<
nitrobenzene	R401	0.050	µg/l			102	9	<	1.0	µg/kg dw			69	13	<
2-chloroaniline	R402	0.010	µg/l			80	33	<	5.0	µg/kg dw			50	13	<
benzylidenechloride	R403	0.010	µg/l			77	15	<	5.0	µg/kg dw			73	9	<
4-nitrotoluene	R407	0.010	µg/l			71	18	<	20	µg/kg dw			63	14	<
di-2-ethylhexyl adipate (DEHA)	R423	0.050	µg/l			not deter.	-	<	2.0	µg/kg dw			not deter.	-	<
1-chloronaphthalene	R427	0.005	µg/l			80	12	<	1.0	µg/kg dw			102	8	<
1-chloro-2,4-dinitrobenzene	R433	0.010	µg/l	94	14	77	16	<	5.0	µg/kg dw	108	9	95	1	<
4-chloro-2-nitroaniline	R434	0.10	µg/l			77	17	<	1.0	µg/kg dw			72	15	<
benzidine	R435	0.020	µg/l			69	13	<	5.0	µg/kg dw			106	5	<
3,3'-dichlorobenzidine	R436	0.020	µg/l			99	24	<	4.0	µg/kg dw			99	17	<
monochlorotoluidines:	R480	0.10	µg/l			irregular	-	<	20	µg/kg dw			irregular	-	<
chloronitrotoluenes	R481	0.10	µg/l			79	15	<	10	µg/kg dw			85	12	<
dichloroanilines	R482	0.050	µg/l			irregular	-	<	10	µg/kg dw			irregular	-	<
chloronitrobenzenes	R483	0.050	µg/l			80	8	<	4.0	µg/kg dw			80	15	<
dichloronitrobenzenes:	R484	0.020	µg/l			73	13	<	4.0	µg/kg dw			76	15	<
arsenic	R504	0.10	µg/l			5.6	2.6	<	0.010	mg/kg dw			4.5	-	<
zinc	R505	0.10	µg/l	96	6	11.6	2.9	<	0.010	mg/kg dw			13	-	<
copper	R506	0.10	µg/l			5.6	1.4	<	0.010	mg/kg dw	92	8	4.2	-	<
chromium	R507	0.10	µg/l			5.2	3.0	<	0.010	mg/kg dw			3.1	-	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data biota sample analyses				method blank 75-pct
				internal standard		QC samples		
				recovery %	variance %	recovery %	variance %	
thiabendazole	R305	10	µg/kg dw			80	8	<
chlorotoluron	R307	4.0	µg/kg dw			66	36	<
monolinuron	R310	2.0	µg/kg dw			58	28	<
methiocarb	R311	2.0	µg/kg dw	110	8	90	25	<
linuron	R312	2.0	µg/kg dw			75	14	<
epoxiconazole	R313	2.0	µg/kg dw			88	21	<
diflubenzuron	R314	2.0	µg/kg dw			83	11	<
glyphosate	R350							
amitraz								
dimethylamine	R352							
diethylamine	R353							
nonylphenol ethoxylates	R355	10	µg/kg dw	-	-	-	-	<
bisphenol-A	R356	2	µg/kg dw	77	7	-	-	<
chlormequat	R358							
paraquat	R359							
benzylchloride	R400	5.0	µg/kg dw			87	17	<
nitrobenzene	R401	10	µg/kg dw			97	12	<
2-chloroaniline	R402	5.0	µg/kg dw			37	11	<
benzylidenechloride	R403	5.0	µg/kg dw			87	17	<
4-nitrotoluene	R407	20	µg/kg dw			86	15	<
1-chloronaphthalene	R427	1.0	µg/kg dw			90	6	<
1-chloro-2,4-dinitrobenzene	R433	5.0	µg/kg dw			66	16	<
4-chloro-2-nitroaniline	R434	20	µg/kg dw			88	6	<
benzidine	R435	5.0	µg/kg dw			39	9	<
3,3'-dichlorobenzidine	R436	4.0	µg/kg dw			11	13	<
monochlorotoluidines:	R480	20	µg/kg dw			63	21	<
chloronitrotoluenes	R481	20	µg/kg dw			94	4	<
dichloroanilines	R482	10	µg/kg dw			64	23	<
chloronitrobenzenes	R483	10	µg/kg dw			85	4	<
dichloronitrobenzenes:	R484	4.0	µg/kg dw			95	5	<
arsenic	R504	0.010	mg/kg dw			1.5	0.65	<
zinc	R505	0.010	mg/kg dw			1.2	0.40	<
copper	R506	0.010	mg/kg dw	95	4	2.2	0.42	<
chromium	R507	0.010	mg/kg dw			4.3	2.6	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data water sample analyses					LOD	Unit	QC data sediment sample analyses				
				internal standard		QC samples		method blank			internal standard		QC samples		method blank
				recovery %	variance %	recovery %	variance %				recovery %	variance %			
selenium	R508	0.10	µg/l			2.6	0.7	<	0.070	mg/kg dw			3.5	-	<
antimony	R509	0.10	µg/l			2.9	1.4	<	0.010	mg/kg dw			8.2	-	<
molybdenum	R510	0.10	µg/l			2.8	2.0	<	0.010	mg/kg dw			6.1	-	<
titanium	R511	0.10	µg/l			4.1	1.3	<	0.010	mg/kg dw			2.7	-	<
tin	R512	0.10	µg/l			7.8	4.5	<	0.010	mg/kg dw			8.5	-	<
barium	R513	0.10	µg/l			5.8	3.4	<	0.010	mg/kg dw			3.2	-	<
beryllium	R514	0.10	µg/l	96	6	not obs.	not obs.	<	0.010	mg/kg dw	92	8	3.4	-	<
boron	R515	0.10	µg/l			6.5	2.3	<	1.3	mg/kg dw			not deter.	-	<
uranium	R516	0.10	µg/l			4.6	1.4	<	0.010	mg/kg dw			4.7	-	<
vanadium	R517	0.10	µg/l			4.9	2.3	<	0.010	mg/kg dw			2.8	-	<
cobalt	R518	0.10	µg/l			3.2	1.7	<	0.010	mg/kg dw			3.1	-	<
thallium	R519	0.10	µg/l			3.6	3.1	<	0.010	mg/kg dw			5.2	-	<
tellurium	R520	0.10	µg/l			5.6	1.1	<	0.010	mg/kg dw			not obs.	-	<
silver	R521	0.10	µg/l			not obs.	not obs.	<	0.010	mg/kg dw			4.9	-	<
cyanide	R522	0.002	mg/l	-	-	92	6	<	0.50	mg/kg dw	-	-	not deter.	-	<
fluoride	R523	0.10	mg/l	-	-	92	5	<	0.20	mg/kg dw	-	-	not deter.	-	<
chloride	R524	1.0	mg/l	-	-	101	5	<	0.40	mg/kg dw	-	-	not deter.	-	<
2378 T4CDD	R600	1.0	pg/l	88	5	-	-	<	0.002	µg/kg dw	80	6	-	-	<
12378 P5CDD	R601	1.0	pg/l	100	7	-	-	<	0.002	µg/kg dw	86	9	-	-	<
123478 H6CDD	R602	5.0	pg/l	99	5	-	-	<	0.010	µg/kg dw	82	8	-	-	<
123678 H6CDD	R603	5.0	pg/l	100	4	-	-	<	0.010	µg/kg dw	82	8	-	-	<
123789 H6CDD	R604	5.0	pg/l	99	6	-	-	<	0.010	µg/kg dw	82	10	-	-	<
1234678 H7CDD	R605	5.0	pg/l	101	5	-	-	<	0.010	µg/kg dw	82	17	-	-	<
12346789 O8CDD	R606	10	pg/l	93	24	-	-	<	0.020	µg/kg dw	84	14	-	-	<
2378 T4CDF	R607	1.0	pg/l	98	6	-	-	<	0.002	µg/kg dw	80	8	-	-	<
12378 P5CDF	R608	1.0	pg/l	101	5	-	-	<	0.002	µg/kg dw	78	10	-	-	<
23478 P5CDF	R609	1.0	pg/l	98	4	-	-	<	0.002	µg/kg dw	83	7	-	-	<
123478 H6CDF	R610	5.0	pg/l	99	6	-	-	<	0.010	µg/kg dw	81	9	-	-	<
123678 H6CDF	R611	5.0	pg/l	100	5	-	-	<	0.010	µg/kg dw	81	9	-	-	<
123789 H6CDF	R612	5.0	pg/l	96	6	-	-	<	0.010	µg/kg dw	82	9	-	-	<
234678 H6CDF	R613	5.0	pg/l	98	6	-	-	<	0.010	µg/kg dw	80	8	-	-	<
1234678 H7CDF	R614	5.0	pg/l	102	5	-	-	<	0.010	µg/kg dw	85	10	-	-	<
1234789 H7CDF	R615	5.0	pg/l	100	7	-	-	<	0.010	µg/kg dw	88	10	-	-	<
12346789 O8CDF	R616	10	pg/l	98	9	-	-	<	0.020	µg/kg dw	78	17	-	-	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data biota sample analyses				method blank 75-pct
				internal standard recovery %	variance %	QC samples recovery %	variance %	
selenium	R508	0.010	mg/kg dw			2.4	2.1	<
antimony	R509	0.010	mg/kg dw			3.4	3.8	<
molybdenum	R510	0.010	mg/kg dw			12	17	<
titanium	R511	0.010	mg/kg dw			0.68	1.0	<
tin	R512	0.010	mg/kg dw			5.4	4.8	<
barium	R513	0.010	mg/kg dw			3.4	1.4	<
beryllium	R514	0.010	mg/kg dw	95	4	22	15	<
boron	R515							
uranium	R516	0.010	mg/kg dw			4.1	2.3	<
vanadium	R517	0.010	mg/kg dw			11	3	<
cobalt	R518	0.010	mg/kg dw			1.6	1.4	<
thallium	R519	0.010	mg/kg dw			2.2	0.82	<
tellurium	R520	0.010	mg/kg dw			-	-	<
silver	R521	0.010	mg/kg dw			5.5	3.7	<
cyanide	R522							
fluoride	R523							
chloride	R524							
2378 T4CDD	R600	0.20	ng/kg dw	67	7	-	-	<
12378 P5CDD	R601	0.20	ng/kg dw	78	9	-	-	<
123478 H6CDD	R602	1.0	ng/kg dw	99	6	-	-	<
123678 H6CDD	R603	1.0	ng/kg dw	92	6	-	-	<
123789 H6CDD	R604	1.0	ng/kg dw	86	8	-	-	<
1234678 H7CDD	R605	1.0	ng/kg dw	98	7	-	-	<
12346789 O8CDD	R606	10	ng/kg dw	97	8	-	-	<
2378 T4CDF	R607	0.20	ng/kg dw	81	7	-	-	<
12378 P5CDF	R608	0.20	ng/kg dw	96	4	-	-	<
23478 P5CDF	R609	0.20	ng/kg dw	96	3	-	-	<
123478 H6CDF	R610	1.0	ng/kg dw	101	3	-	-	<
123678 H6CDF	R611	1.0	ng/kg dw	102	4	-	-	<
123789 H6CDF	R612	1.0	ng/kg dw	90	4	-	-	<
234678 H6CDF	R613	1.0	ng/kg dw	99	4	-	-	<
1234678 H7CDF	R614	1.0	ng/kg dw	104	5	-	-	<
1234789 H7CDF	R615	1.0	ng/kg dw	87	9	-	-	<
12346789 O8CDF	R616	10	ng/kg dw	88	7	-	-	<

Parameter	No.	LOD	Unit	QC data water sample analyses					LOD	Unit	QC data sediment sample analyses				
				internal standard		QC samples		method blank			internal standard		QC samples		method blank
				recovery	variance	recovery	variance				recovery	variance			
				%	%	%	%	75-pct			%	%	%	%	
sum PCDDF TEQ	R620	10	pg/l	-	-	-	-	-	0.020	µg/kg dw	-	-	-	-	
sum dioxins	R621	50	pg/l	-	-	-	-	-	0.10	µg/kg dw	-	-	-	-	
sum furans	R622	50	pg/l	-	-	-	-	-	0.10	µg/kg dw	-	-	-	-	
HBCD	R915	0.020	µg/l	112	9	91	22	<	4.0	µg/kg dw	98	14	83	-	<
polychloronaphthalenes	R918	0.10	µg/l	-	-	91	24	<	20	µg/kg dw	-	-	106	-	<
PCT	R919	0.10	µg/l	-	-	90	18	<	0.40	µg/kg dw	-	-	92	-	<
dibutyltin	R931	0.005	µg/l			89	15	<	0.500	µg/kg dw			108	14	<
tetrabutyltin	R932	0.005	µg/l	103	11	100	16	<	0.500	µg/kg dw	47	9	114	12	<
triphenyltin	R933	0.005	µg/l			90	24	<	0.500	µg/kg dw			86	12	<
tri-n-propyltin	R934	0.005	µg/l			85	15	<	0.500	µg/kg dw			106	11	<
maneb/zineb/thiram/mancozeb	R940	0.10	µg/l	88	12	87	16	<	4.0	µg/kg dw	67	47	62	26	<
4-chloor-3-methylfenol	R950	0.010	µg/l	-	-	99	18	<	5.0	µg/kg dw	-	-	69	12	<
tetrabromobisphenol-A	R951	0.001	µg/l	112	9	90	28	<	0.20	µg/kg dw	98	14	79	-	<
ethinyl oestradiol	R960	0.10	µg/l	-	-	110	24	<							
oestradiol	R961	0.10	µg/l	-	-	112	24	<							
oestrone	R962	0.10	µg/l	-	-	114	26	<							
progesterone	R963	0.10	µg/l	-	-	108	38	<							
total phosphorus	R970	0.050	mg/l	-	-	81	9	<							
total nitrogen	R971	0.50	mg/l	-	-	-	-	<							
nitrate	R972	0.050	mg/l	-	-	102	16	<							
total organic carbon	R973	5.0	mg/l	-	-	-	-	<	1.0	%	-	-	not deter.	-	<
phenols	R974	0.030	mg/l	-	-	-	-	<	0.020	mg/kg dw	-	-	not deter.	-	<
Particle Size % >2 µm	R975								1.0	%	-	-	-	3	-
Particle Size % <2 µm	R976								1.0	%	-	-	-	3	-
Particle Size % > 63 µm	R977								1.0	%	-	-	-	3	-
Particle Size % <63 µm	R978								1.0	%	-	-	-	3	-
Moisture content	R979								1.0	%	-	-	-	0.5	-
Aluminum	R980								0.10	mg/kg dw	-	-	5.9	-	<

Table 21 (continued). Recoveries of internal standards and results of QC samples.

Parameter	No.	LOD	Unit	QC data biota sample analyses				method blank 75-pct
				internal standard		QC samples		
				recovery %	variance %	recovery %	variance %	
sum PCDDF TEQ	R620	2.0	ng/kg dw	-	-	-	-	
sum dioxins	R621	10	ng/kg dw	-	-	-	-	
sum furans	R622	10	ng/kg dw	-	-	-	-	
HBCD	R915	4.0	µg/kg dw	101	12	94	11	<
polychloronaphthalenes	R918	20	µg/kg dw	-	-	-	-	<
PCT	R919	2.0	µg/kg dw	-	-	-	-	<
dibutyltin	R931	1.0	µg/kg dw			89	3	<
tetrabutyltin	R932	1.0	µg/kg dw	85	11	81	7	<
triphenyltin	R933	1.0	µg/kg dw			95	8	<
tri-n-propyltin	R934	1.0	µg/kg dw			79	14	<
maneb/zineb/thiram/mancozeb	R940							
4-chloor-3-methylfenol	R950	5.0	µg/kg dw	-	-	107	2	<
tetrabromobisphenol-A	R951	0.20	µg/kg dw	101	12	99	24	<
total phosphorus	R970							
total nitrogen	R971							
nitrate	R972							
total organic carbon	R973							
phenols	R974							
total lipid		0.20	%					
moisture content		1.0	%					

5 Conclusions

In this study the concentrations of a large number of chemical parameters in Irish surface waters and sediments were determined. The compound groups of interest were the Priority Action Substances, a large number of additional substances that were considered Relevant Pollutants, and a limited number of General Components. The results show that:

Priority Action Substances

- Of the 51 Priority Action Substances in water, 4 compounds are not found at all while only 3 compounds are found in more than 50% of the 287 samples that were analysed. For about 18 compounds a 90-pct value is calculated indicating that the majority of compounds is found in no more than 10% of the aqueous samples. Overall, the highest concentrations were found for metals followed by the polycyclic aromatic hydrocarbons, than volatiles and pesticides.
- Priority Action Substances found in more than 50% of the aqueous samples include naphthalene, fluoranthene and nickel. The median concentrations of these compounds range from 0.0090 µg/l for fluoranthene to 0.044 µg/l for naphthalene and 1.4 µg/l for nickel. If high concentrations were found these were generally present in just one or a limited number of samples.
- In the 17 sediment samples that were analysed 21 of the Priority Action Substances are not found at all while only 12 of the 51 compounds are found in more than 50% of the samples. The latter parameters mainly include polycyclic aromatic hydrocarbons and metals with the highest concentrations found for the polycyclic aromatic hydrocarbons.
- In the 21 biota samples that were analysed 20 of the Priority Action Substances are not found at all, while 18 of the 51 compounds are found in more than 50% of the samples. The latter parameters mainly include polycyclic aromatic hydrocarbons, pesticides and metals with the highest concentrations found for the pesticides. Most metals were found in every biota sample.
- The concentrations of the Priority Action Substances found in water, sediment and biota are in general not different from concentrations that may be found in other non-suspect locations or countries. Exceptions are the pesticides. The number of pesticides that is found, but also the concentrations appear to be lower than in countries with more agriculture such as The Netherlands.

Relevant Pollutants

- Of the 156 Relevant Pollutants 50 were not found in any of the aqueous samples. For only 10 parameters a 50-pct value is calculated while for 34 parameters a 90-pct value was calculated indicating that 34 parameters are found in at least 10% of the samples while only 10 parameters are found in at least 50% of the samples. Overall, the highest concentrations were found for metals followed by the hormone disturbing compounds, volatiles and anions, than polycyclic aromatic hydrocarbons and pesticides.

- The 10 Relevant Pollutants found in 50% of the samples are PCB's (only background concentrations) but mostly metals and the anions fluoride and chloride. Well known toxic compounds as the dioxins are found only in a very limited number of samples and in low concentrations. Estrogens were not found in any of the samples.
- In sediment 92 of the Relevant Pollutants are not found in any of the samples. 29 parameters are found in more than 50% of the samples. As in the water samples, these 29 parameters are mainly PCB's and metals. Typical exceptions are MTBE, a number of phthalates, including the "newer" di-isononyl phthalate, dibutyltin and, strangely, chloronitrotoluenes. All metals were found in all sediment samples. Mostly low concentrations were found in the sediment samples.
- In the 21 biota samples, that were analysed, 92 of the Relevant Pollutants are not found in all samples, while 37 of the 156 compounds are found in more than 50% of the samples. The latter parameters mainly include PCB's, metals, polychlorinated dibenzodioxins and dibenzofuranes with the highest concentrations found for the metals.
- In general, no extraordinary concentrations are found for the Relevant Pollutants in water, sediment or biota. As before most of these concentrations can be found at other non-suspect locations.

6 QA/QC Statement

The determinations of organic parameters in this study are performed in compliance with NEN-EN-ISO/IEC 17025 and RvA accreditation no. 1, “The determination of polychlorodibenzo-p-dioxins and-dibenzofurans”; 2 “The determination of polychlorobiphenyls”; 8 “The determination of polycyclic aromatic hydrocarbons” and 19, “The development and application of methods for the determination of organic contaminants in environmental matrices, wastes and materials”. TNO Environment and Geosciences is listed in the RvA register under no. L 026.

RvA is the Dutch Council for Accreditation and is a member of the European co-operation for Accreditation (EA) and the International Laboratory Accreditation Co-operation (ILAC). In addition TNO Environment and Geosciences operates in compliance with the Quality System standard ISO 9001 (certificate no. 07246-2003-AQ-ROT-RvA).

The determinations of metals are performed by TNO Environment and Geosciences in compliance with the Quality System Standard ISO 9001 (certificate no. 07246-2003-AQ-ROT-RvA).

The determination of sum parameters and anions are performed by AL-West C.V. in compliance with NEN-EN-ISO/IEC 17025 and RvA accreditations no, 27, 35, 41, 42, 48, 49 and 51. A.L. West C.V. is listed in the RvA register under no. L005.

7 Signature

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Names and functions of the cooperators

Dr. R.J.B. Peters	Coordinator
Ing. M.M.G. Houtzager	Project Leader
Ing. R. Geenen	Project Leader
Ing. H. Beeltje	Technician
Drs. R.J. van Delft	Technician
Ing. A. van Renesse	Technician
Ing. H. de Weerd	Technician
Ing. S. Walraven	Technician
Dr. B.J.H. van Os	Technician
P.G. Boshuis	Technician

Names and establishments to which part of the research was put out to contract

TNO-KvL: - Analyses of estrogens in water samples
- HRMS analyses of dioxins in sample extracts of water and sediment samples

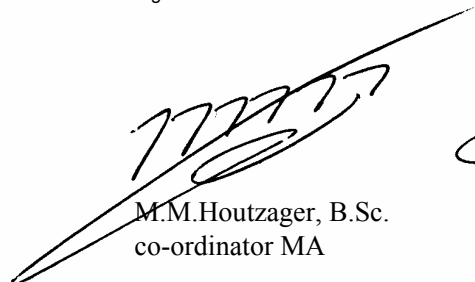
TNO-NITG: - Analyses of metals in water and sediment samples
- Determination of particle size distribution in sediments

AL-West C.V.: - Analysis sum-parameters and anions in water samples

Date upon which, or period in which the research took place

May 2005 – December 2006

Signature:



M.M.Houtzager, B.Sc.
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Dr L.A. van de Kuil
team manager