Environmental Monitoring Report

on

Persistent Organic Pollutants (POPs)

in Japan

2002-2004

Environmental Health and Safety Division

Environmental Health Department

Ministry of the Environment of JAPAN (MOE)

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Contents

List of Acronyms

Substances

HCB	Hexachlorobenzene
DDT	Dichlorodiphenyltrichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDD	Dichlorodiphenyldichloroethane
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzo-*p*-dioxins
PCDFs	Polychlorinated dibenzofurans
HCH	Hexachloro cyclohexane (Benzenehexachloride)
PFOS	Perfluorooctane sulfonic acid

Others

FY	Fiscal Year (from April to March)
GC/MS	Gas Chromatography/Mass Spectrometry
LC/MS	Liquid Chromatography/Mass Spectrometry
MOE	Ministry of the Environment of Japan
MQL	Method Quantification Limit
MDL	Method Detection Limit

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Foreward

Persistent organic pollutants (POPs) such as PCBs and DDTs are toxic, persistent and bioaccumlative and are transferred through the air, water and migratory species across international boundaries and deposited far from their location of emission and accumulate in terrestrial and aquatic ecosystems. It came to be internationally recognised that there are concerns about health impacts, *inter alia*, upon women and future generations due to exposure to POPs especially in developing countries.

It had been increasingly stressed that actions by only a limited number of countries were insufficient for the worldwide elimination and reduction of POPs, thus the Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention) was adopted at the Conference of Plenipotentiaries held in Stockholm in May 2001. The Stockholm Convention entered into force on 17 May 2004. The Governemnt of Japan had positively contributed to the work to establish the internationally-binding document, and acceded to the Stockholm Convention on 30 August 2002.

According to Article 16 of the Strockholm Convention, its effectiveness shall be evaluated starting four years after the date of entry into force of the Stockholm Convention, i.e. before 17 May 2008. Comparable monitoring data on 12 POPs under the Stockholm Convention from national, regional and global monitoring programmes are needed for a scientifically sound and meaningful evaluation.

In Japan, triggered by the environmental problems due to PCBs in the 1970s, the Ministry of the Environment of Japan (MOE) has systematically conducted the “Environmental Survey and Monitoring of Chemicals” Programme and identified actual existence/non-existence and/or temporal and spatial trends of 837 chemicals (as of the end of FY2004) including POPs in the environment over a 30-year period.

Since FY2002, MOE has continued to refine the methodologies for sampling and analysing for 10 substance groups among 12 POPs listed in the Annexes to the Stockholm Convention – Aldrin, Dieldrin, Endrin, Heptachlors, Chlordanes, HCB, Mirex, Toxaphenes, PCBs and DDTs, following the renovations of sampling/analysis procedures for PCDDs/PCDFs in the 1990s, with reference to the outcome of the “Workshop to Develop a POPs Global Monitoring Programme (GMP) to support the Effectiveness Evaluation of the Stockholm Convention on POPs” held in Geneva in 2003. Thus, MOE has conducted the refined environmental monitoring of “12 POPs”since FY2002 as a part of the “Environmental Survey and Monitoring of Chemicals” Programme. MOE is convinced that the data on “12 POPs” obtained in the Programme will contribute to the effective evaluations of the Stockholm Convention.

This report comprises two chapters. Chapter 1 shows monitoring data on the substances relevant to “12 POPs” listed in the Annexes to the Stockholm Convention, and Chapter 2 summerises the data on 5 substances that were proposed for listing in Annex A of the Stockholm Convention and considered at the firest meeting of the Persistent Organic Pollutants Review Committee (POPRC) held in November 2005 – Pentabromodiphenyl ether, Chlordecone, Hexabromobiphenyl, HCHs (although the proposal was for Lindane, this report includes data on alpha, beta, gamma and delta isomers of HCH.) and Perfluorooctane sulfonate (PFOS).

CHAPTER 1

ENVIRONMENTAL MONITORING OF "12 PERSISTENT ORGANIC POLLUTANTS (POPs)" IN JAPAN

1. Purpose of the Monitoring

In 1974, Ministry of the Environment of Japan (MOE) commenced the "Environmental Survey and Monitoring of Chemicals" Programme. Under this Programme, environmental survey and monitoring of chemicals including persistent organic pollutants (POPs) have been carried out in a systematic and uniform manner.

The Programme consists of 2 parts: (1) environmental survey of various chemicals to elucidate the presence (i.e., existence/not existence in the environment); and (2) environmental monitoring of specific persistent and bioaccumulative substances to identify temporal and spatial trends in the environment. The data obtained and evaluations thereto in the Programme have been compiled and published as an annual report – "*Kagaku-busshitsu To Kankyo*" (chemicals in the environment).

This Chapter extracts and summerises the emvironmental monitoring data on the substances relevant to the 12 POPs listed in Annexes A, B and/or C of the Stockholm Convention on the Persistent Organic Pollutants (hereinafter referred to as "Stockholm Convention") which were obtained under the Programme supplemented with additional data of other surveys conducted by MOE for FY2002-2004.

2. Target substances and sites

The FY2002-2004 environmental monitoring under the "Environmental Survey and Monitoring of Chemicals" Programme targeted the total 25 substance groups (see Table 1-2-1) relevant to the 12 POPs listed in the Stockholm Convention. The focussed 25 substances were selected with reference to the "essential analytes" for the determination of POPs by the Workshop to Develop a POPs Global Monitoring Programme (GMP) to Support the Effectiveness Evaluation of the Stockholm Convention on POPs, held in Geneva from 24 to 27 March 2003. Within the scheme of the Programme, the Expert Group on POPs Monitoring reviewed the obtained data and its subgroup verified each of the actual sampling and analytical procedures. The data on PCDDs/PCDFs were also appraised by other expert groups.

The monitoring sites are shown in Figures 1-2-1 to 1-2-4. The number of the sites for "12 POPs" environmental monitoring in FY2002-2004 were: 34 to 37 for atmospheric air and precipitation (Figure 1-2-1.); 21 to 23 for wildlife (bivalves, fish and birds) (Figure 1-2-2.); 38 to 40 for surface water (Figure 1-2-3); and 62 to 63 for bottom sediment (Figure 1-2-4.).

Table 1-2-1 Target Substances/Media for 12 POPs Monitoring in FY2002-2004

No.	Target Substances	Media			
		Atmospheric Air & Precipitation	Wildlife	Surface Water	Bottom Sediment
1	Aldrin	X	X	X	X
2	Dieldrin	X	X	X	X
3	Endrin	X	X	X	X
4	Heptachlors Heptachlor *cis*-Heptachlor epoxide *trans*-Heptachlor epoxide	X	X	X	X
5	Chlordanes *cis*-Chlordane *trans*-Chlordane Oxychlordane *cis*-Nonachlor *trans*-Nonachlor	X	X	X	X
6	HCB	X	X	X	X
7	Mirex	X	X	X	X
8	Toxaphenes Parlar-26 Parlar-50 Parlar-62	X	X	X	X
9	PCBs (total)	X	X	X	X
10	DDTs *p,p'*-DDT *o,p'*-DDT *p,p'*-DDE *o,p'*-DDE *p,p'*-DDD *o,p'*-DDD	X	X	X	X
11	PCDDs	X		X	X
12	PCDFs	X		X	X

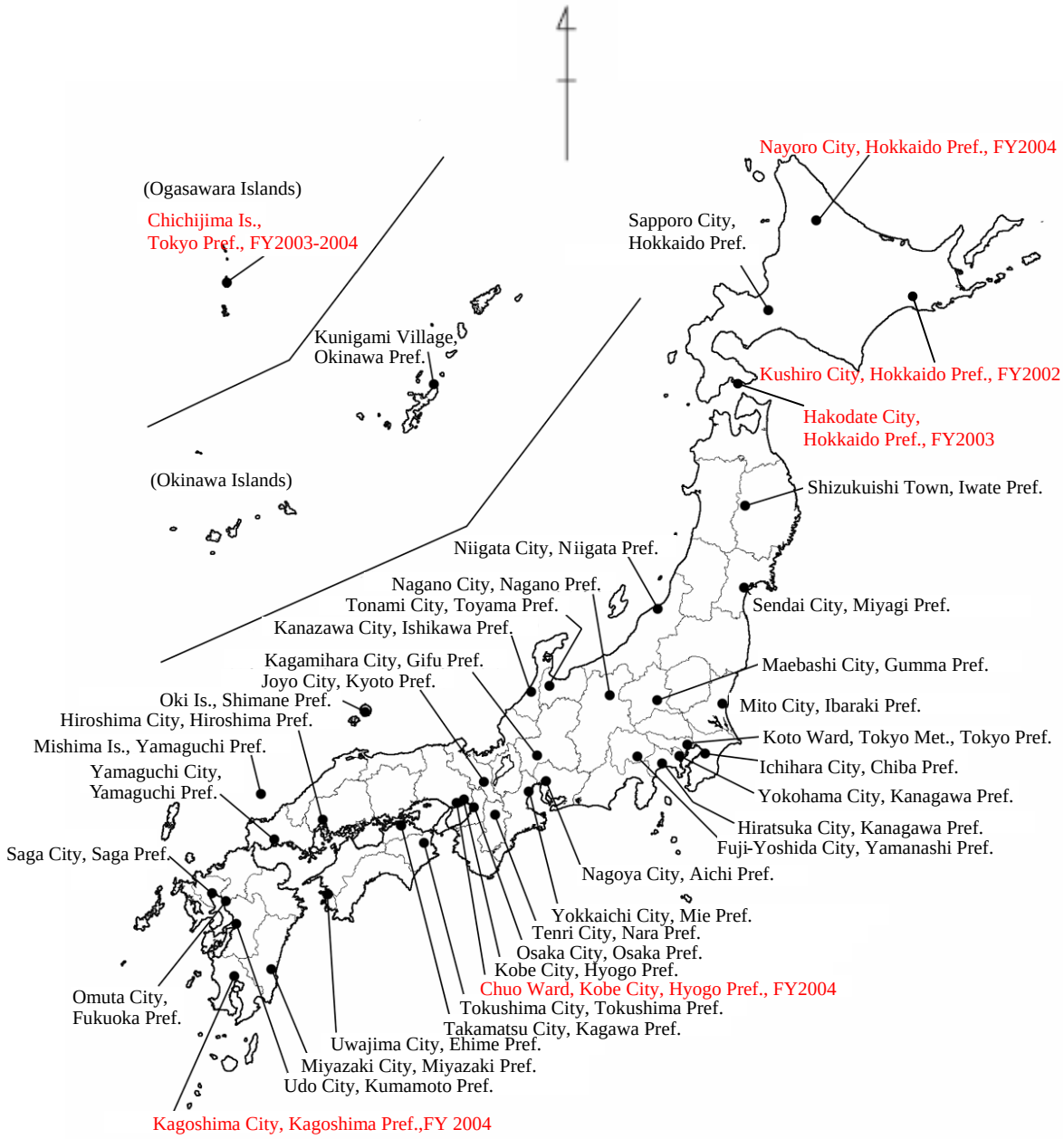


Figure 1-2-1 Sites for 12 POPs Monitoring for Atmospheric Air and Precipitation (FY2002-2004)

Legend to this Figure: The red-coloured sites mean the sites where the monitoring was conducted only in the indicated fiscal year(s) during FY2002-2004.

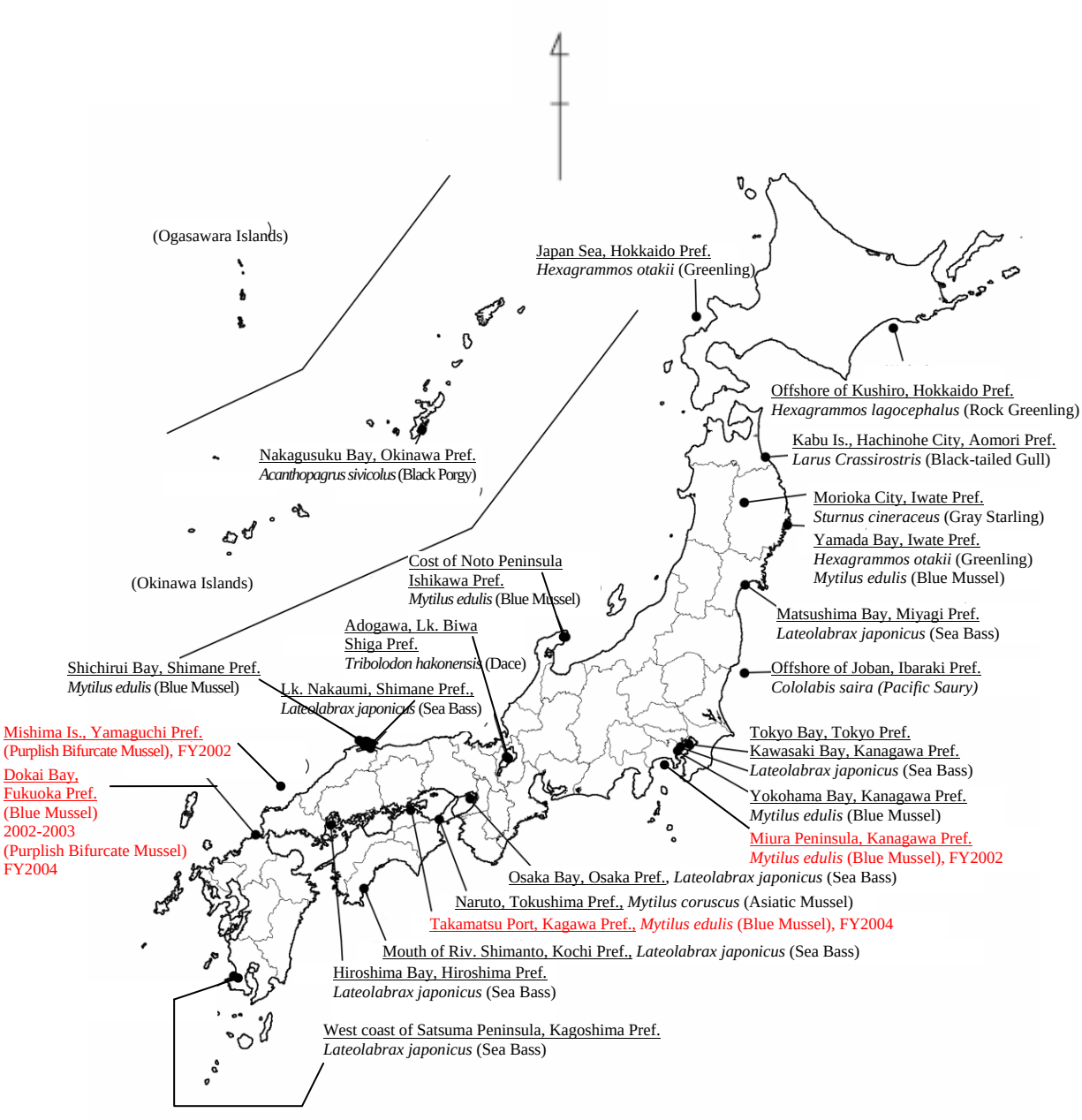


Figure 1-2-2 Sites for 12 POPs Monitoring for Wildlife (FY2002-2004)

Legend to this Figure: The red-coloured sites mean the sites where the monitoring was conducted only in the indicated fiscal year(s) during FY2002-2004.

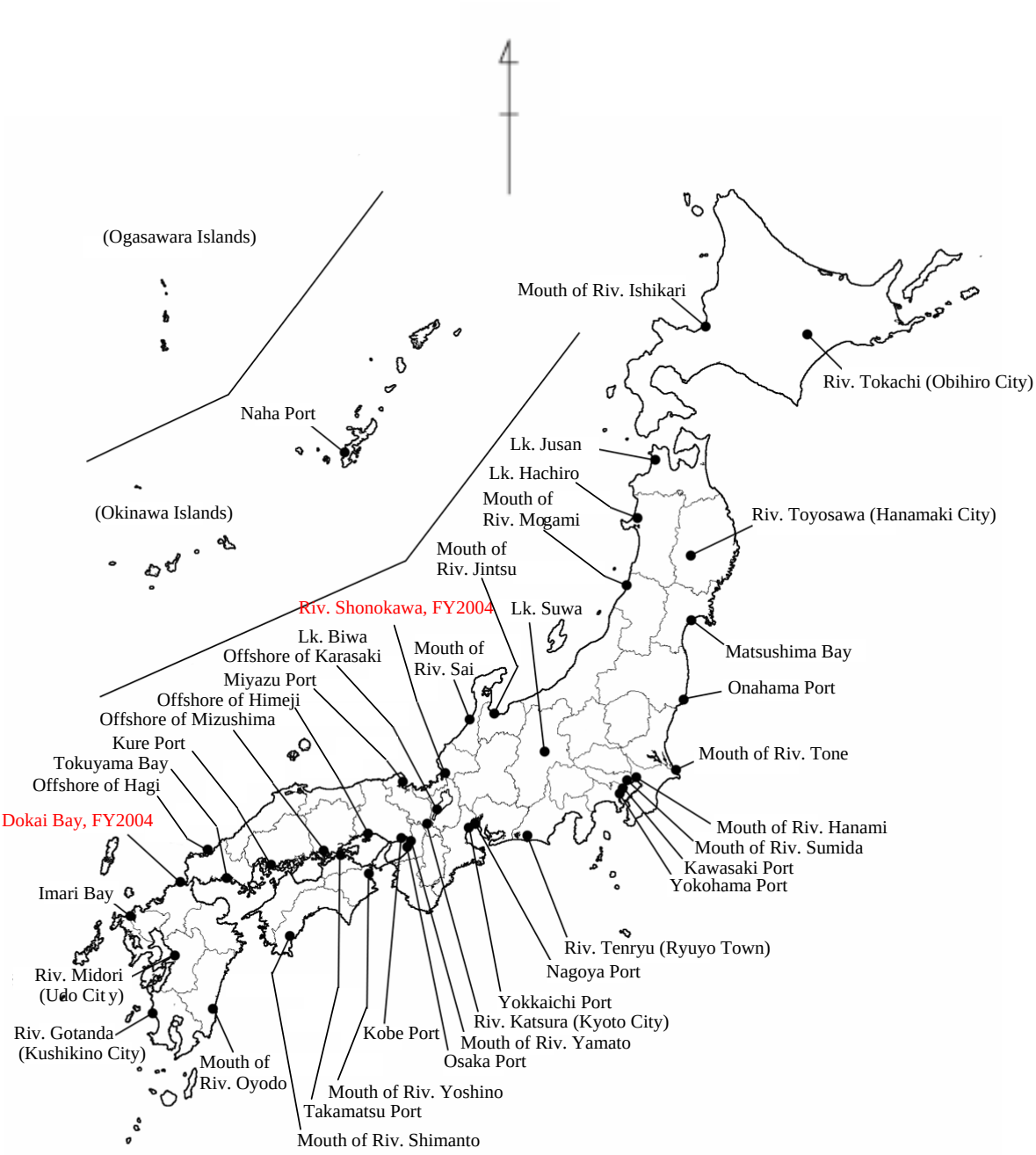


Figure 1-2-3 Sites for 12 POPs Monitoring for Surface Water (FY2002-2004)

Legend to this Figure: The red-coloured sites mean the sites where the monitoring was conducted only in the indicated fiscal year(s) during FY2002-2004.

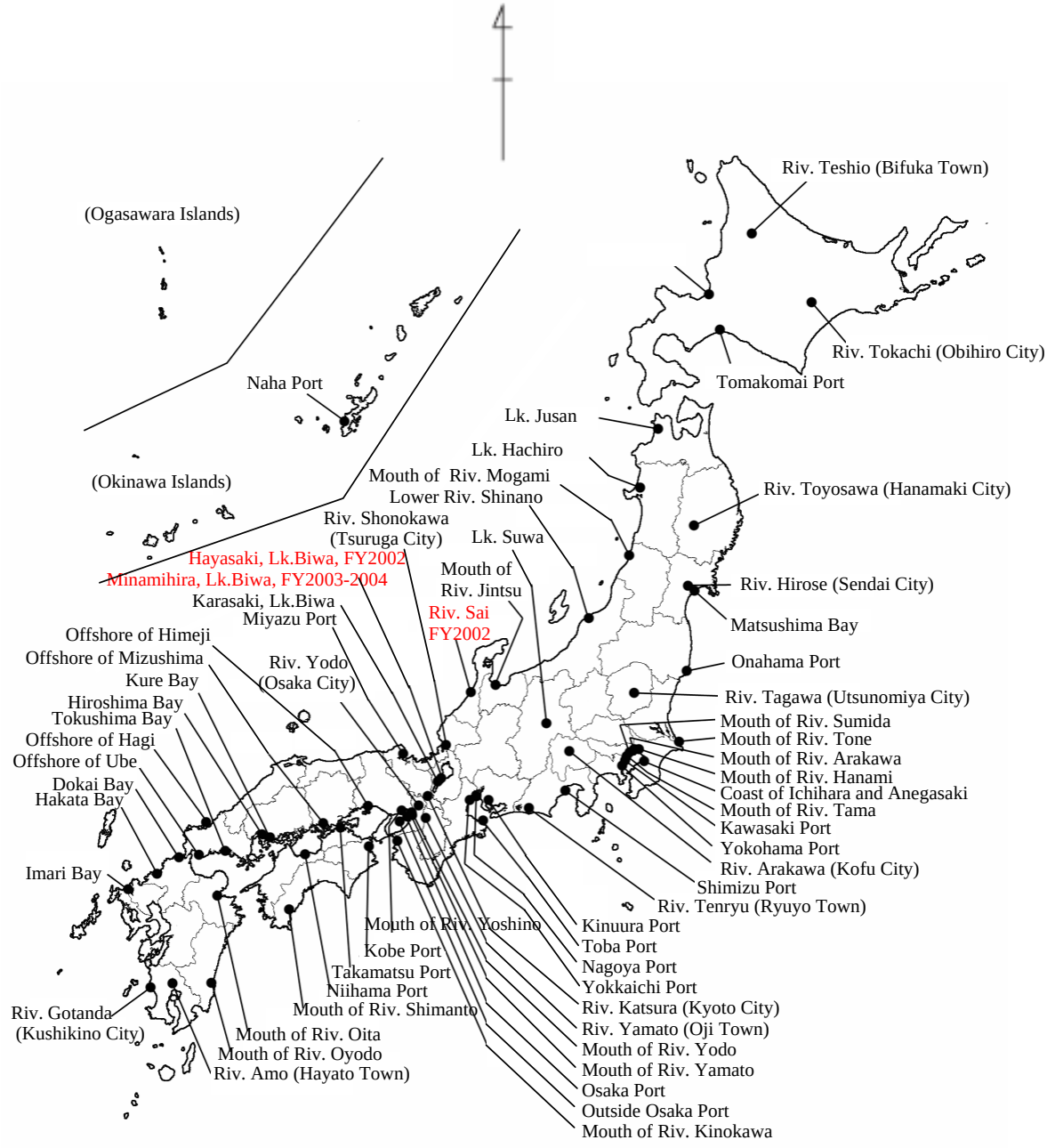


Figure 1-2-4 Sites for 12 POPs Monitoring for Bottom Sediment (FY2002-2004)

Legend to this Figure: The red-coloured sites mean the sites where the monitoring was conducted only in the indicated fiscal year(s) during FY2002-2004.

3. Methods of sampling/analysis

(1) Selection of the monitoring sites

The points where chemical substances were being released (i.e., near the outlet for waste water of a factory, etc. where the substances were being manufactured or used, or near points through which transportation facilities passed, etc.) and points directly affected by pollution were excluded from sampling sites.

(2) Sampling methods

The methodologies for sampling 12-POPs-relevant substances other than PCDDs/PCDFs in each of the targeted matrices were shown below. Collected samples were placed in bags or containers so that the samples would not elute or adsorb, and were analysed as soon as possible. For preservation, samples were kept in refrigerators or freezers, etc. in a manner according to the documented protocol.

A. Air and precipitation

Sampling should take place, in principle, between September and November when the weather is stable. Samples should be collected by adsorption to resin, glass fiber filters, etc. or sucked by canister. The sites for air sampling should be on the location where information on status of air is available. The sites significantly affected by a particular source of chemicals, by transportation facilities, etc. should be avoided.

Information collected at sampling sites:
Information on weather, temperature, humidity, wind direction, wind velocity, surrounding geography and traffic conditions at neighbouring roads during the sampling time should be recorded.

B. Wildlife

In sea areas, a sea bass or young sea bass should be the first choice and, if not available, a goby, striped mullet or flatfish could be accepted. At lakes, marshes and rivers, a dace should be used and, if not available, a carp or crucian carp could be accepted as a standard sample. Although It is preferable to use a single body of the sample, pool of several bodies could be also allowed. In such a case, a small-bodied sample couls be used after sufficient cleansing. For fish, a collection of 3 samples from the site should be considered sufficient.

Preparation of fish for analysis:
Edible parts (muscles) should be used. Any part of the fish could be used, but more than approximately 100g should be ensured for analytical samples. In cases where the body weight of the fish is under 100g, the edible parts of several fish should be carved and homogenised.

Preparation of bivalves for analysis:
Edible parts of the required quantity should be collected and homogenised for use as samples. Sludge should be removed to the most extent as possible.

For wildlife samples, lipid weight (%) is measured by the following method:
Five grams of the sample is placed in a homogeniser cup, after which 20 mL of chloroform and 40 mL of methanol are added, and then homogenised for 2 minutes. An additional 20 mL of chloroform is added, followed by 2-minutes homogenising. The sample is then filtered with a Buchner funnel and homogenised with 80 mL of chloroform and methanol mixture (1:1). 60 mL

of distilled water is added to the entire chloroform-methanol fraction placed in the separation funnel, and should be then shaken gently. The lower chloroform fraction is collected and dryed with anhydrous sodium sulfate, and the solvent should be evaporated using a rotary evaporator. The residue is dried using phosphorus pentoxide, and the weight is measured.

Information collected at sampling sites: Standard Japanese vernacular name should be confirmed, and body length (excluding tail), body weight and lipid weight should be recorded.

C. Surface water

Water sampling is conducted at a time when the days preceding the day of sampling has been relatively sunny and the water quality is stable. In monitoring, three samples should be collected at spots within a unit range of 500 square meters, so that they are collected in as widespread spots as possible. The depth for sampling point should be, in principle, 0–50 cm beneath the surface vertically under the spot selected within the unit range. However, water in 0–2 cm depth should be avoided for sampling so that floating garbage and oils should not be contained in the samples.

Preparation for analysis:
No filtration or centrifugal separation, etc. should be conducted.

Information collected at sampling sites:
Temperature, colour by visual (eye) observation, transparency and turbidity should be recorded.

D. Bottom sediment

In monitoring, three samples should be collected within a unit range of 500 square meters so that they are collected in as widespread points as possible. In this case, the sample for bottom sediment is a mixture of samples from 3 spots in equal quantities.

The bottom sediment collected using an Ekman-Birge bottom sampler or other proportionate bottom samplers is placed on a clean tray. The sampled sediment, after being removed from extraneous substances such as pebbles, shells and bits of animals and plants, should be sieved with a 16-mesh sieve (hole diameter: 1 mm) and provided for analysis. The sludge content (weight of sample through the sieve/weight of original sample) (%) is measured. Dry weight (105–110°C for about 2 hours) and ignition loss (600 ± 25°C for about 2 hours) should be measured for part of the samples.

Samples for analysis should be, in principle, not air- or heat-dried, and the measured value per dry weight should be calculated.

Information collected at sampling sites: Appearance, odour, foreign substance, depth of water at sampling point, water content, ignition loss and sludge content should be recorded.

(3) Analytical methods
The analytical methods utilised for the “12 POPs” monitoring in FY2002-2004 for each of the monitored matrices are shown in the Appendix.

4. Monitoring results

Summaries of the detection results of the FY2002-2004 monitorings are shown in Table 1-4-1 to 1-4-4.

Table 1-4-1 Results of 12 POPs Monitoring (Air and Precipitation) in FY2002-2004

Air & Precipitation		FY2002			FY2003				FY2004		
Substance	Min	Max	Mean		Min	Max	Mean		Min	Max	Mean
Aldrin	<0 .020	3.2	0 .030(tr)	w	<0 .0077	28	1 .5	w	<0 .05	14	0 12(tr)
	-	-	-	c	0 .030	6 .9	0 .55	c	<0 .05	13	0 .08(tr)
Dieldrin	0 .73	110	5 .6	w	2 .1	260	19	w	1 .1	280	17
	-	-	-	c	0 82(tr)	110	5 .7	c	0 .81	76	5 .5
Endrin	<0 .030	2 .5	0 22	w	0 .081	6 .2	0 .74	w	0 .054(tr)	6 .5	0 .64
	-	-	-	c	0 .042	2 .1	0 .23	c	<0 .048	1 .9	0 .23
Heptachlors											
Heptachlor	0 .20	220	11	w	1 .1	240	27	w	0 46	200	23
	-	-	-	c	0 .39	65	10	c	0 .53	100	11
cis-Heptachlor	-	-	-	w	0 .45	28	3 .5	w	0 .65	9 .7	2 .8
epoxide	-	-	-	c	0 .49	6 .6	1 .3	c	0 .44	7 .0	1 .1
trans-Heptachlor	-	-	-	w	<0 .033	0 .30	0 .036(tr)	w	<0 .2	0 .38(tr)	<0 .2
epoxide	-	-	-	c	<0 .033	0 .094(tr)	<0 .033	c	<0 .2	<0 .2	<0 .2
Chlordanes											
cis-Chlordane	0 .86	670	31	w	6 .4	1,600	110	w	2 .3	1,000	92
	-	-	-	c	2 .5	220	30	c	1 .2	290	29
trans-Chlordane	0 .62	820	36	w	6 .5	2,000	130	w	2 .2	1,300	110
	-	-	-	c	2 .5	290	37	c	1 .5	360	35
Oxychlordane	<0 .008	8 .3	0 .96	w	0 .41	12	2 .5	w	0 .41	7 .8	1 .9
	-	-	-	c	0 .41	3 .2	0 .87	c	0 .27	3 .9	0 .80
cis-Nonachlor	0 .071	62	3 .1	w	0 .81	220	12	w	0 .36	130	10
	-	-	-	c	0 .18	23	2 .7	c	0 .087	28	2 .7
trans-Nonachlor	0 .64	550	24	w	5 .1	1,200	87	w	1 .9	870	72
	-	-	-	c	2 .1	180	24	c	0 .95	240	23
HCB	57	3,000	99	w	81	430	150	w	47	430	130
	-	-	-	c	64	320	94	c	51	390	98
Mirex	-	-	-	w	0 .047	0 .19	0 .11	w	0 .042(tr)	0 .16	0 .099
	-	-	-	c	0 .091(tr)	0 .099	0 .044	c	0 .019(tr)	0 .23	0 .046(tr)
Toxaphenes											
Parlar-26	-	-	-	w	0 .17(tr)	0 .77	0 .31	w	0 .17(tr)	0 .46	0 .27
	-	-	-	c	0 .091(tr)	0 .27	0 .17(tr)	c	0 .094(tr)	0 .50	0 .15(tr)
Parlar-50	-	-	-	w	<0 .27	0 .37(tr)	<0 .27	w	<0 .4	<0 .4	<0 .4
	-	-	-	c	<0 .27	<0 .27	<0 .27	c	<0 .4	<0 .4	<0 .4
Parlar-62	-	-	-	w	<0 .52	<0 .52	<0 .52	w	<0 .81	<0 .81	<0 .81
	-	-	-	c	<0 .52	<0 .52	<0 .52	c	<0 .81	<0 .81	<0 .81
PCBs (total)	16	880	100	w	36	2,600	260	w	25	3,300	240
				c	17	630	110	c	20	1,500	130
DDTs											
p,p'-DDT	0 .25	22	1 .9	w	0 .75	24	5 .8	w	0 .41	37	4 .7
	-	-	-	c	0 .31	11	1 .7	c	0 .29	13	1 .8
o,p'-DDT	0 .41	40	2 .2	w	0 .61	38	6 .9	w	0 .54	22	5 .1
	-	-	-	c	0 .43	6 .4	1 .6	c	0 .35	9 .4	1 .5
p,p'-DDE	0 .56	28	2 .8	w	1 .2	51	7 .2	w	0 .62	95	6 .1
	-	-	-	c	1 .1	22	2 .8	c	0 .85	43	2 .9
o,p'-DDE	0 .11	8 .5	0 .60	w	0 .17	7 .5	1 .4	w	0 .14	8 .9	1 .1
	-	-	-	c	0 .18	1 .7	0 .50	c	0 .14	3 .9	0 .53
p,p'-DDD	<0 .006	0 .76	0 .12	w	0 .063	1 .4	0 .30	w	0 .036(tr)	1 .4	0 .24
	-	-	-	c	0 .037(tr)	0 .52	0 .13	c	0 .025(tr)	0 .91	0 .12
o,p'-DDD	<0 .006	0 .85	0 .14	w	0 .059	1 .3	0 .37	w	0 .052(tr)	2 .6	0 .31
	-	-	-	c	0 .062	0 .42	0 .15	c	<0 .048	0 .86	0 .14
PCDDs/PCDFs	0 .021	0 .45	0 .16		0 .017	0 .20	0 .077		0 .021	0 .25	0 .074

Legend and Note to this Table
Unit is pg/m3 whereas pg-TEQ/m3 was used for PCDDs/PCDFs. TEF was calculated according to WHO-TEF(1998).
tr = value less than Method Quantification Limit (MQL) but over than Method Detection Limit (MDL), **w** = warm season (Aug.-Oct.), **c** = cold season (Nov.-Dec.)
mean = geographical mean, whereas arithmetical mean for PCDDs/PCDFs, assuming the data less than MDL as a half of MDL.
Total number of the sites was: 34 in FY2002; 35 (34 in cold season) in FY2003; and 37 in FY2004 for the substances excluding PCDDs/PCDFs whereas 48 sites for PCDDs/PCDFs.

Table 1-4-2 Results of 12 POPs Monitoring (Wildlife) in FY2002-2004

Wildlife / Substance		FY2002 Min	FY2002 Max	FY2002 Mean	FY2003 Min	FY2003 Max	FY2003 Mean	FY2004 Min	FY2004 Max	FY2004 Mean
Aldrin	v	<1 .4	34 (tr)	1 .7(tr)	<0 .84	51	1 .6(tr)	<1 .3	46	1 .7(tr)
	f	<1 .4	2 .0(tr)	<1 .4	<0 .84	1 .9(tr)	<0 .84	<1 .3	2 .4(tr)	<1 .3
	b	<1 .4	<1 .4	<1 .4	<0 .84	<0 .84	<0 .84	<1 .3	<1 .3	<1 .3
Dieldrin	v	7 (tr)	190,000	490	46	78,000	410	42	69,000	510
	f	46	2,400	280	29	1,000	210	23 (tr)	2,800	240
	b	820	1,700	1,200	790	2,200	1,300	370	960	590
Endrin	v	<6	12,000	44	6 .3	5,000	36	5 .7(tr)	4,600	54
	f	<6	180	19	<1 .6	180	14	<4 .2	220	18
	b	<6	99	22	5 .4	96	21	<4 .2	62	11 (tr)
Heptachlors										
Heptachlor	v	<1 .4	15	3 .6	<2 .2	14	2 .8(tr)	<1 .4	16	3 .5(tr)
	f	<1 .4	20	4 .0	<2 .2	11	<2 .2	<1 .4	460	1 .9(tr)
	b	<1 .4	5 .2	2 .1(tr)	<2 .2	<2 .2	<2 .2	<1 .4	1 .5(tr)	<1 .4
cis-Heptachlor epoxide	v	-	-	-	9 .7	880	42	9 .8(tr)	840	57
	f	-	-	-	7 .0	320	42	3 .3(tr)	620	46
	b	-	-	-	370	770	520	190	350	270
trans-Heptachlor epoxide	v	-	-	-	<4 .4	48	<4 .4	<4	55	4 .0(tr)
	f	-	-	-	<4 .4	<4 .4	<4 .4	<4	10 (tr)	<4
	b	-	-	-	<4 .4	<4 .4	<4 .4	<4	<4	<4
Chlordanes										
cis-Chlordane	v	24	26,000	810	110	14,000	1,100	91	14,000	1,200
	f	57	6,900	580	43	4,400	490	68	9,800	580
	b	10	450	67	6 .8	370	47	5 .8(tr)	240	39
trans-Chlordane	v	33	2,300	420	69	2,800	550	53	2,800	510
	f	20	2,700	180	9 .6	1,800	150	17 (tr)	5,200	190
	b	8 .9	26	14	5 .9(tr)	27	11	<16	26 (tr)	14 (tr)
Oxychlordane	v	<1 .2	5,600	76	11	1,900	90	14	1,700	110
	f	16	3,900	160	30	820	140	25	1,500	150
	b	470	890	640	610	1,300	750	320	730	460
cis-Nonachlor	v	8 .6	870	190	48	1,800	290	43	1,800	280
	f	46	5,100	420	19	2,600	350	48	10,000	410
	b	68	450	200	68	660	200	73	240	130
trans-Nonachlor	v	21	1,800	510	140	3,800	780	110	3,400	710
	f	98	8,300	970	85	5,800	880	140	21,000	1,000
	b	350	1,900	880	350	3,700	1,100	390	1,200	680
HCB	v	2 .4	330	23	21 (tr)	660	44	14	80	30
	f	19	910	140	28	1,500	170	26	1,800	220
	b	560	1,600	1,000	790	4,700	1,700	410	2,200	970
Mirex	v	-	-	-	1 .1(tr)	19	4 .8	1 .1(tr)	12	4 .5
	f	-	-	-	1 .7(tr)	25	7 .9	3 .8(tr)	180	11
	b	-	-	-	31	450	110	33	110	61
Toxaphenes										
Parlar-26	v	-	-	-	<15	39 (tr)	<15	<14	32 (tr)	<14
	f	-	-	-	<15	810	29 (tr)	<14	1,000	40 (tr)
	b	-	-	-	<15	2,500	110	<14	810	71
Parlar-50	v	-	-	-	<11	58	13 (tr)	<15	45 (tr)	16 (tr)
	f	-	-	-	<11	1,100	34	<15	1,300	54
	b	-	-	-	<11	3,000	110	<15	1,000	83
Parlar-62	v	-	-	-	<40	<40	<40	<33	<33	<33
	f	-	-	-	<40	580	<40	<33	870	<33
	b	-	-	-	<40	530	96 (tr)	<33	280	64 (tr)
PCBs (total)	v	200	160,000	10,000	1,000	130,000	11,000	1,500	150,000	7,700
	f	1,500	550,000	14,000	870	150,000	11,000	990	540,000	15,000
	b	4,800	22,000	11,000	6,800	42,000	18,000	5,900	13,000	8,900
DDTs										
p,p'-DDT	v	38	1,200	200	49	1,800	290	48	2,600	280
	f	6 .8	24,000	330	3 .7(tr)	1,900	210	5 .5	53,000	310
	b	76	1,300	380	180	1,400	540	160	700	330
o,p'-DDT	v	22	480	100	35	480	130	20	910	130
	f	6 (tr)	2,300	110	2 .9	520	80	3 .7	1,800	130
	b	<4	58	10 (tr)	8 .3	66	18	0 .9(tr)	43	7 .7
p,p'-DDE	v	140	6,000	1,100	190	6,500	1,100	220	8,400	1,000
	f	510	98,000	2,500	180	12,000	2,000	390	52,000	2,500
	b	8,100	170,000	36,000	18,000	240,000	63,000	6,800	200,000	34,000
o,p'-DDE	v	13	1,100	88	17	460	84	19	360	70
	f	3.6	13,000	77	<1 .2	2,500	48	0 .9(tr)	5,800	68
	b	20	49	28	<1 .2	4 .2	2 .0(tr)	<0 .69	3 .7	1 .0(tr)
p,p'-DDD	v	11	3,200	340	7 .5(tr)	2,600	380	7 .8	8,900	300
	f	80	14,000	610	43	3,700	500	56	9,700	640
	b	140	3,900	560	110	3,900	590	52	1,400	310
o,p'-DDD	v	9 (tr)	2,900	130	6 .5	1,900	200	6 .0	2,800	160
	f	<4	1,100	83	<2 .0	920	73	<1 .9	1,700	100
	b	8 (tr)	23	15	5 .0(tr)	36	14	<1 .9	25	5 .6(tr)
PCDDs/PCDFs		No data available								

Legend and Note to this Table
Unit is pg/g-wet.
tr = value less than Method Quantification Limit (MQL) but over than Method Detection Limit (MDL).
v = bivalves (*Mytilus edulis, Septifer virgatus* or *Mytilus coruscus).*
f = fish (*Hexagrammos otakii, H. lagocephalus, Cololabis saira, Lateolabrax japonicus, Acanthopagrus sivicolus* or *Tribolodon hakonensis*).
b = birds (*Strunus cineraceus* or *Larus crassirostris*).
mean = geographical mean, whereas arithmetical mean for PCDDs/PCDFs, assuming the data less than MDL as a half of MDL.
Total numbers of the sites for bivalves, fish and birds were: 8, 14 and 2 in FY2002; 6, 14 and 2 in FY2003; and 7, 14 and 2 in FY2004.

Table 1-4-3 Results of 12 POPs Monitoring (Surface Water) in FY2002-2004

Surface Water	FY2002			FY2003			FY2004		
Substance	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Aldrin	<0 .2	18	0 .69	<0 .2	3 .8	0 .90	<0 .4	13	1 .5(tr)
Dieldrin	3 .3	940	41	9 .7	510	57	9	430	55
Endrin	<2 .0	31	4 .7(tr)	0 .70	78	5 .7	0 .7(tr)	100	7
Heptachlors									
Heptachlor	<0 .5	25	1 .1(tr)	1 .0(tr)	7 .0	1 .8(tr)	<2	29	<2
cis -Heptachlor epoxide	-	-	-	1 .2	170	9 .8	2	77	10
trans -Heptachlor epoxide	-	-	-	<0 .4	2	<0 .4	<0 .3	<0 .3	<0 .3
Chlordanes									
cis -Chlordane	2 .5	880	41	12	920	69	10	1,900	92
trans -Chlordane	3 .1	780	32	6	410	34	5	1,200	32
Oxychlordane	<0 .4	41	2 .4	0 .6(tr)	39	3 .0	0 .7(tr)	47	3 .2
cis -Nonachlor	0 .23	250	7 .6	1 .3	130	8 .0	0 .8	340	7.5
trans -Nonachlor	1 .8	780	29	4 .0	450	26	3 (tr)	1,100	25
HCB	9 .8	1,400	36	11	340	29	11 (tr)	180	30
Mirex	-	-	-	<0 .09	0 .8	0 .13(tr)	<0 .2	1 .1	<0 .2
Toxaphenes									
Parlar-26	-	-	-	<20	<20	<20	<3	<3	<3
Parlar-50	-	-	-	<30	<30	<30	<7	<7	<7
Parlar-62	-	-	-	<90	<90	<90	<30	<30	<30
PCBs (total)	60	11,000	460	230	3,100	530	140	4,400	630
DDTs									
p,p' -DDT	0 .25(tr)	440	12	2 .8(tr)	740	14	<2	310	15
o,p' -DDT	0 .19	77	5 .1	1 .5(tr)	100	6	<2	85	4 .5(tr)
p,p' -DDE	1 .3	760	24	5	380	26	6 (tr)	680	36
o,p' -DDE	<0 .3	680	2 .3	0 .42(tr)	170	2 .2	0 .6(tr)	170	3
p,p' -DDD	0 .57	190	15	4	410	19	2 .4(tr)	740	19
o,p' -DDD	<0 .2	110	5 .5	1 .1	160	7 .1	0 .7(tr)	81	6
PCDDs/PCDFs	0 .018	2 .7	0 .27	0 .020	7 .0	0 .24	0 .011	2 .5	0 .22

Legend and Note to this Table
Unit is pg/L whereas pg-TEQ/L was used for PCDDs/PCDFs. TEF was calculated according to WHO-TEF(1998).
tr = value less than Method Quantification Limit (MQL) but over than Method Detection Limit (MDL).
mean = geographical mean, whereas arithmetical mean for PCDDs/PCDFs, assuming the data less than MDL as a half of MDL.
Total number of the sites was: 38 in FY2002; 36 in FY2003; and 38 in FY2004 for the substances excluding PCDDs/PCDFs whereas 1,340 sites for PCDDs/PCDFs in FY2004.

Table 1-4-4 Results of 12 POPs Monitoring (Bottom Sediment) in FY2002-2004

Bottom Sediment	FY2002			FY2003			FY2004		
Substance	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Aldrin	<2	570	12	<0 .6	1,000	17	<0 .6	390	9
Dieldrin	4 .0	2,300	63	<2	9,100	59	1 .9(tr)	3,700	58
Endrin	<2	19,000	9	<2	29,000	11	<0 .9	6,900	13
Heptachlors									
Heptachlor	<0 .6	120	3 .5	<1	160	2 .4(tr)	<0 .9	170	2 .5(tr)
cis-Heptachlor epoxide	-	-	-	<1	160	4	<2	230	4 .4(tr)
trans-Heptachlor epoxide	-	-	-	<3	<3	<3	<2	2 .5(tr)	<2
Chlordanes									
cis-Chlordane	1 .8	18,000	120	3 .6(tr)	19,000	170	4	36,000	140
trans-Chlordane	2 .1	16,000	130	2 .4(tr)	13,000	120	3	26,000	95
Oxychlordane	<0 .5	120	2 .2	<0 .4	85	2	<0 .8	140	2 .0(tr)
cis-Nonachlor	<0 .7	7,800	66	<0 .9	6,500	59	0 .8(tr)	9,400	46
trans-Nonachlor	3 .1	13,000	120	2 .0	11,000	100	3	23,000	83
HCB	7 .6	19,000	210	5 .0	42,000	140	6 (tr)	25,000	130
Mirex	-	-	-	<0 .4	1,500	1 .8(tr)	<0 .5	220	2 .1
Toxaphenes									
Parlar-26	-	-	-	<30	<30	<30	<20	<20	<20
Parlar-50	-	-	-	<50	<50	<50	<20	<20	<20
Parlar-62	-	-	-	<2,000	<2,000	<2,000	<400	<400	<400
PCBs (total)	39	630,000	9,200	39	5,600,000	8,200	38	1,300,000	7,300
DDTs									
p,p'-DDT	5 (tr)	97,000	270	3 .0	55,000	240	7	98,000	330
o,p'-DDT	<2	27,000	58	<0 .3	3,200	43	1 .1(tr)	17,000	52
p,p'-DDE	8 .4	23,000	660	9 .5	80,000	710	8	39,000	630
o,p'-DDE	<1	16,000	46	0 .5(tr)	24,000	43	<0 .8	28,000	35
p,p'-DDD	2 .2(tr)	51,000	540	3 .7	32,000	590	4	75,000	550
o,p'-DDD	<2	14,000	140	1 .0(tr)	8,800	140	0 .7(tr)	16,000	120
PCDDs/PCDFs									

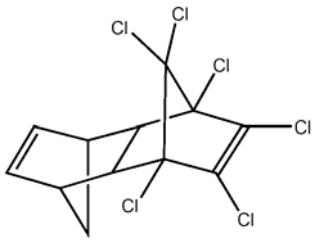
Legend and Note to this Table
Unit is pg/g-dry whereas pg-TEQ/g was used for PCDDs/PCDFs. TEF was calculated according to WHO-TEF(1998).
tr = value less than Method Quantification Limit (MQL) but over than Method Detection Limit (MDL).
mean = geographical mean, whereas arithmetical mean for PCDDs/PCDFs, assuming the data less than MDL as a half of MDL.
Total number of the sites was: 63 in FY2002; 62 in FY2003; and 63 in FY2004 for the substances excluding PCDDs/PCDFs whereas 961 sites for PCDDs/PCDFs in FY2004.

5. Assessment of monitoring results

The target substances analysed in this environment monitoring were Aldrin, Dieldrin, Endrin, three substances relevant to Heptachlors (heptachlor, *cis*-heptachlor epoxide and *trans*-heptachlor epoxide), five substances relevant to Chlordanes (*cis*-chlordane, *trans*-chlordane, oxychlordane, *cis*-nanochlor and *trans*-nanochlor), HCB, Mirex, three substances relevant to Toxaphenes (Parlar-26, Parlar-50 and Parlar-62), total PCBs and six substance relevant to DDTs (*p,p'*-DDT, *o,p'*-DDT, *p,p'*-DDE, *o,p'*-DDE, *p,p'*-DDD and *o,p'*-DDD).

High-sensitivity analyses were carried out in FY2004, in succession from FY2002 and FY2003. The "12 POPs" were detected in all the media except that toxaphenes were not detected in surface water and bottom sediment. Results and assessment of the environment monitoring for each substance (group) are described below.

(1) **Aldrin**



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in FY2004 were comparable to those in FY2002. In FY2003 the values were higher in warm season than in cold season, while the results in FY2004 showed no apparent differences between the warm season and cold season. The substance had been detected at approximately a half of the monitoring sites or more since FY2002, and its persistence in the atmospheric air and precipitation was still recognised in widespread areas.

Wildlife:

Bivalves: The persistent concentrations in FY2004 were comparable to those in FY2002 and FY2003. The substance was detected at about a half of the monitoring sites from FY2002 to FY2004, and its persistence in bivalves in the environment was still recognised in widespread areas.

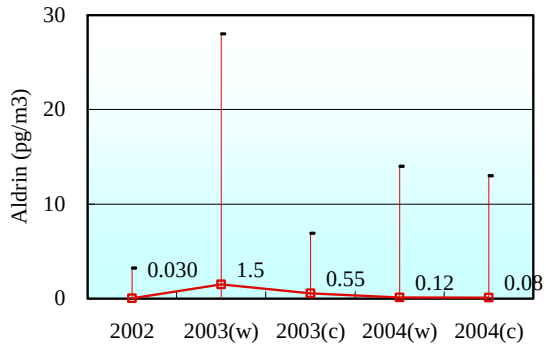
Fish: The substance was detected at two monitoring sites in FY2004, though the values were below the detection limit. The substance had been detected since FY2002: in one of the total 70 samples at one of the 14 sites (FY2002); in sixteen of the total 70 samples at seven of the 14 sites (FY2003); and in five of the total 70 samples at two of the 14 sites (FY2004). Its persistence in fish in the environment was still recognised in widespread areas.

Birds: Although it is difficult to grasp the tendency of its persistence in birds in the environment because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence in birds in the environment was still recognised.

Surface water and bottom sediment: The substance was detected at almost all the monitoring sites from FY2002 to FY2004, and its persistence in surface water as well as bottom sediment was still recognised in widespread areas.

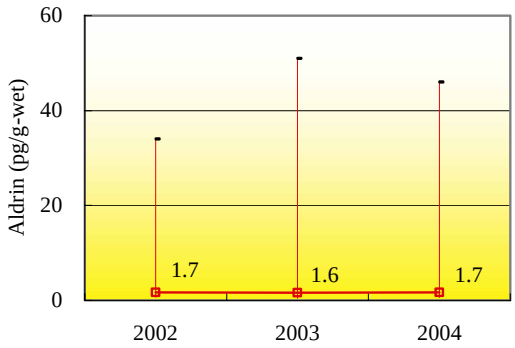
Figure 1-4-1 Detected Frequency and Detection Range of Aldrin

Aldrin (Air and Precipitation)



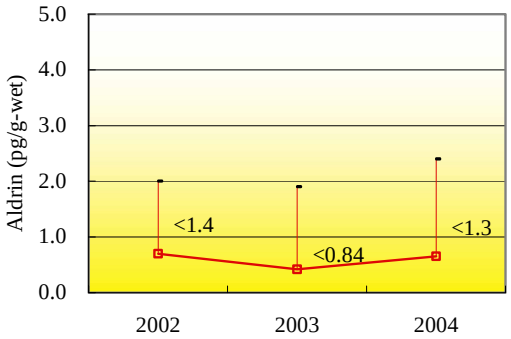
A	41/ 102	34/ 35	34/ 34	15/ 37	14/ 37

Aldrin (Wildlife/Bivalves)



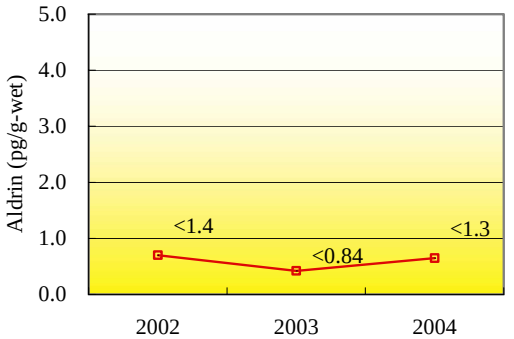
V	12/ 38	15/ 30	16/ 31

Aldrin (Wildlife/Fish)



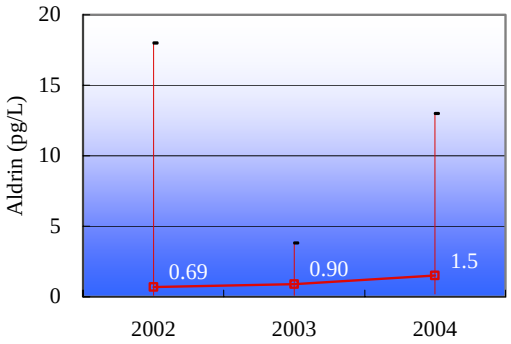
F	1/ 70	16/ 70	5/ 70

Aldrin (Wildlife/Birds)



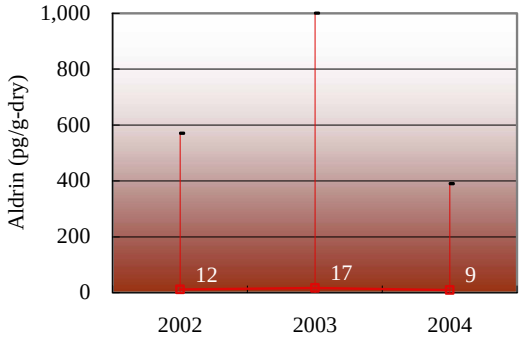
B	0/ 10	0/ 10	0/ 10

Aldrin (Surface Water)



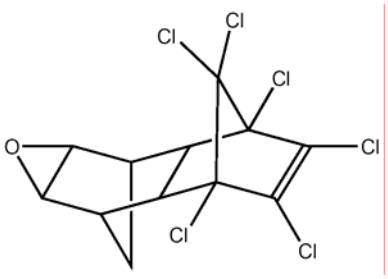
W	93/ 114	34/ 36	33/ 38

Aldrin (Bottom Sediment)



S	149/ 189	178/ 186	170/ 189

(2) **Dieldrin**



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence atmospheric air and precipitation was still recognised in widespread areas.

Wildlife:

Bivalves and fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence in bivalves and fish was still recognised in widespread areas.

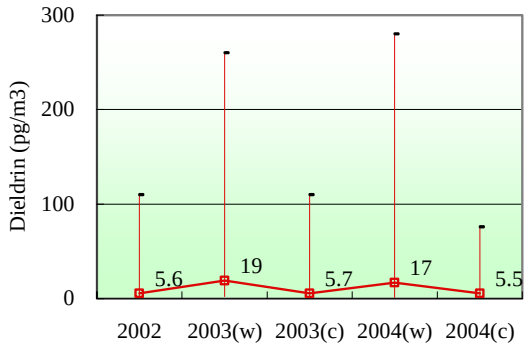
Birds: Although it is difficult to grasp the tendency of its persistence in birds because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance has been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

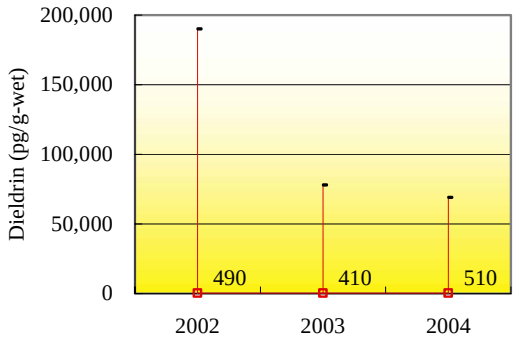
Figure 1-4-2 Detected Frequency and Detection Range of Dieldrin

Dieldrin (Air and Precipitation)



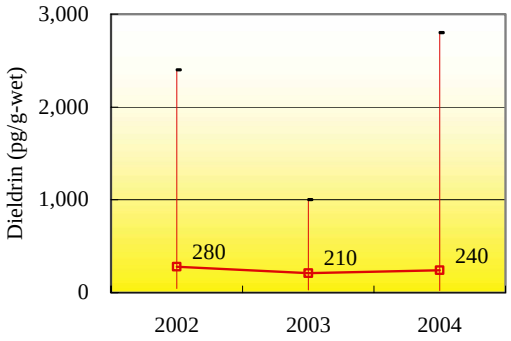
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

Dieldrin (Wildlife/Bivalves)



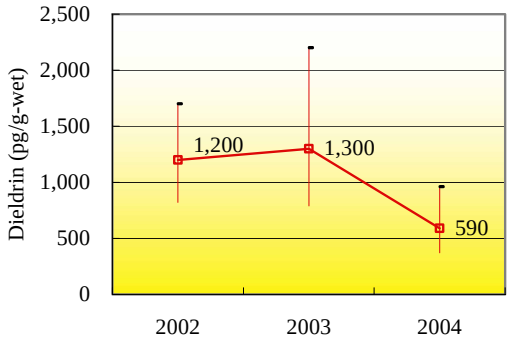
V	38/ 38	30/ 30	31/ 31

Dieldrin (Wildlife/Fish)



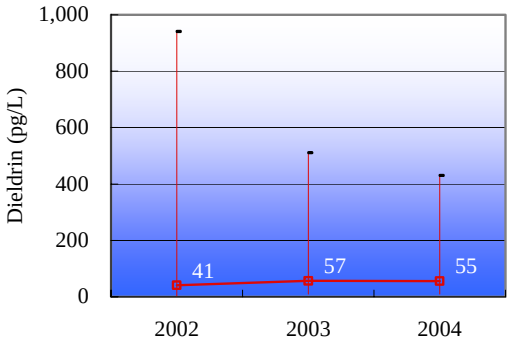
F	70/ 70	70/ 70	70/ 70

Dieldrin (Wildlife/Birds)



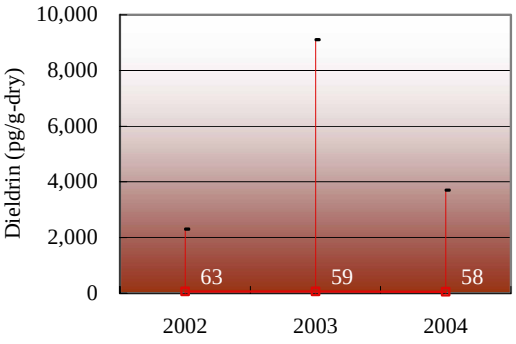
B	10/ 10	10/ 10	10/ 10

Dieldrin (Surface Water)



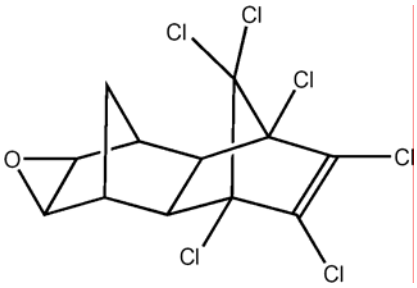
W	114/ 114	36/ 36	38/ 38

Dieldrin (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

(3) Endrin



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in most of the samples from almost all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

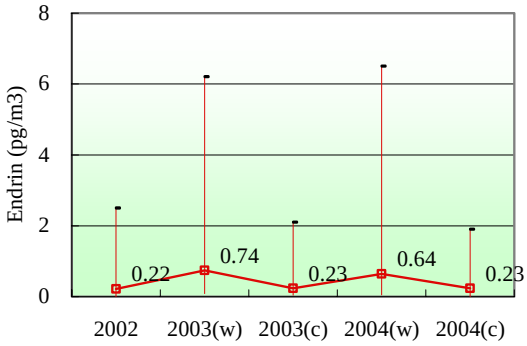
Fish: In FY2004, the substance was detected in 57 of the 70 samples at 13 of the 14 monitoring sites. The substance had been detected in most of the samples from almost all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Birds: Although it is difficult to grasp the tendency of its persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water and bottom sediment: The substance had been detected in most of the samples from almost all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

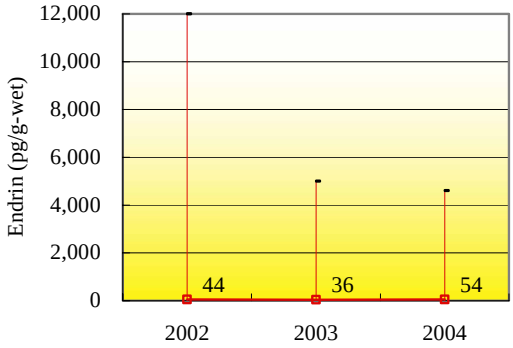
Figure 1-4-3 Detected Frequency and Detection Range of Endrin

Endrin (Air and Precipitation)



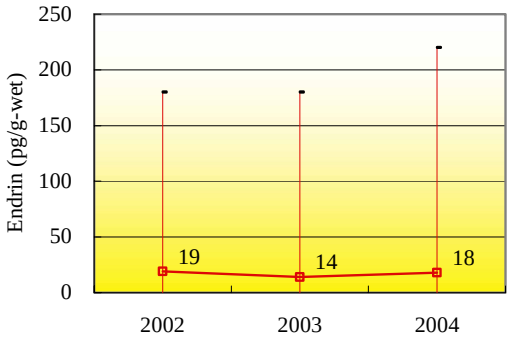
A	90/ 102	35/ 35	34/ 34	37/ 37	36/ 37

Endrin (Wildlife/Bivalves)



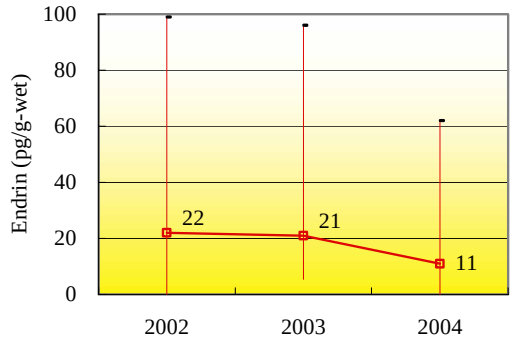
V	35/ 38	30/ 30	31/ 31

Endrin (Wildlife/Fish)



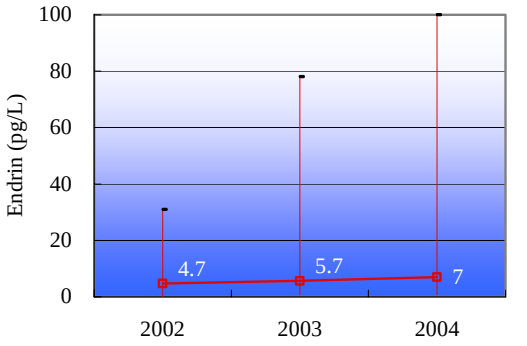
F	54/ 70	67/ 70	57/ 70

Endrin (Wildlife/Birds)



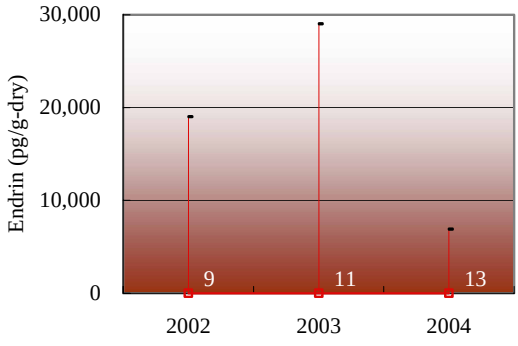
B	7/ 10	10/ 10	5/ 10

Endrin (Surface/Water)



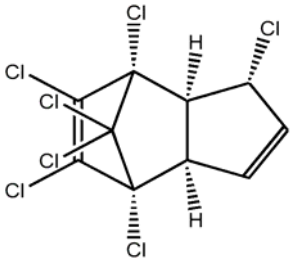
W	101/ 114	36/ 36	38/ 38

Endrin (Bottom/Sediment)

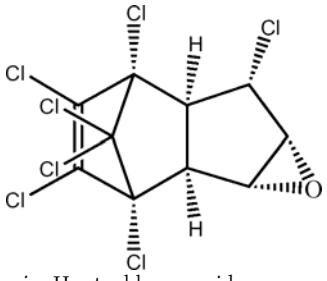


S	141/ 189	150/ 186	182/ 189

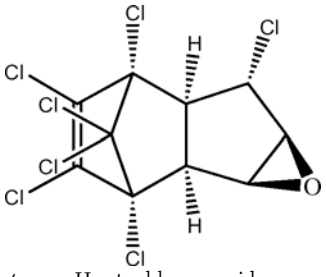
(4) Heptachlors



Heptachlor



cis- Heptachlor epoxide



trans- Heptachlor epoxide

Atmospheric air and precipitation: The persistence of Heptachlor has been monitored since FY2002, and Heptachlor epoxides thereof since FY2003. The persistent concentrations of Heptachlor and *cis*-Heptachlor epoxide in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values of the two substances were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. Heptachlor and *cis*-Heptachlor epoxide had been detected in all the samples from all the monitoring sites since FY2002 and FY2003, and their persistence was still recognised in widespread areas.

Wildlife:

Bivalves: *cis*-Heptachlor had been detected in all the samples from all the monitoring sites since FY2003, and Heptachlor had been detected in most of the samples from almost all the monitoring sites since FY2002, and their persistence was still recognised in widespread areas.

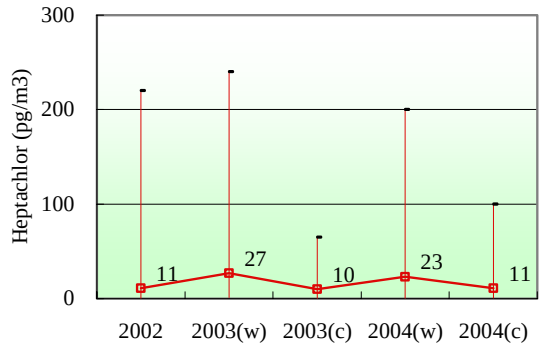
Fish: *cis*-Heptachlor had been detected in all the samples from all the monitoring sites since FY2003, and Heptachlor had been detected in most of the samples from almost all the monitoring sites since FY2002, and their persistence was still recognised in widespread areas.

Birds: Although it is difficult to grasp the tendency of their persistence because of variance of monitoring sites, in addition to the fact that only two sites had been monitored, their persistence was still recognised.

Surface water and bottom sediment: The Heptachlor and *cis*-Heptachlor had been detected in most of the samples from almost all the monitoring sites since FY2002 and FY2003, and their persistence was still recognised in widespread areas.

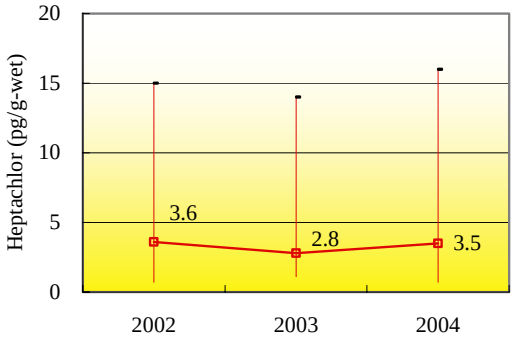
Figure 1-4-4-1 Detected Frequency and Detection Range of Heptachlors (Heptachlor)

Heptachlor (Air and Precipitation)



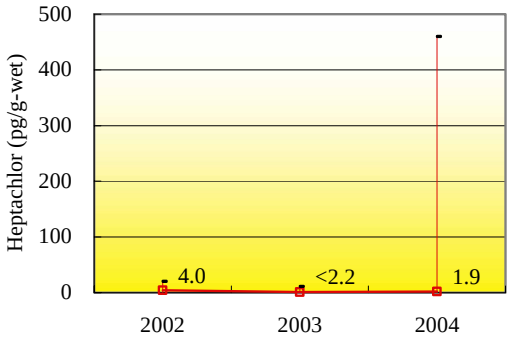
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

Heptachlor (Wildlife/Bivalves)



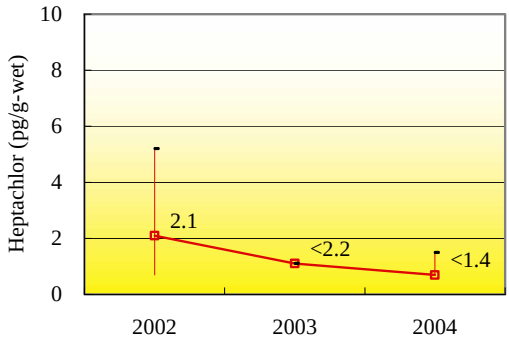
V	28/ 38	16/ 30	23/ 31

Heptachlor (Wildlife/Fish)



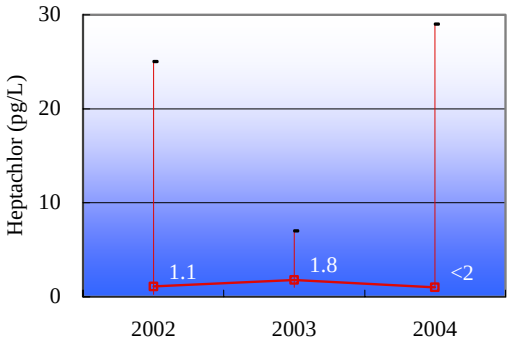
F	57/ 70	29/ 70	50/ 70

Heptachlor (Wildlife/Birds)



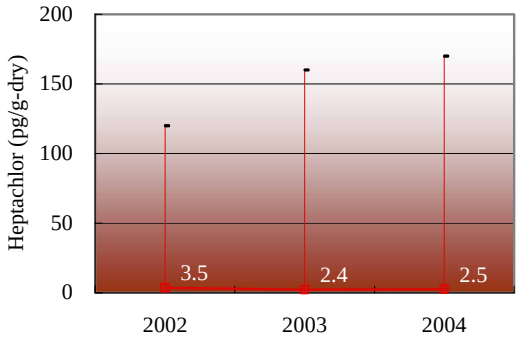
B	7/ 10	0/ 10	1/ 10

Heptachlor (Surface Water)



W	97/ 114	36/ 36	9/ 38

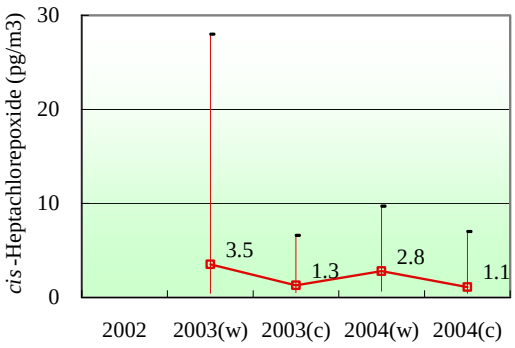
Heptachlor (Bottom Sediment)



S	167/ 189	138/ 186	134/ 189

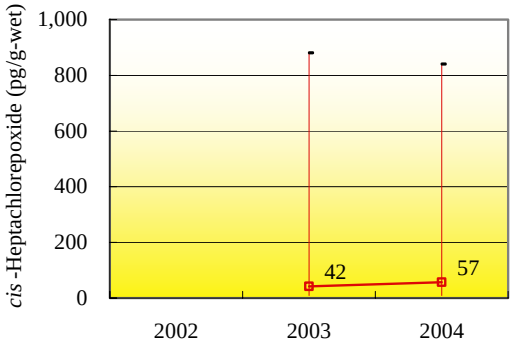
Figure 1-4-4-2 Detected Frequency and Detection Range of Heptachlors (*cis*-Heptachlor epoxide)

cis -Heptachlorepoxide (Air and Precipitation)



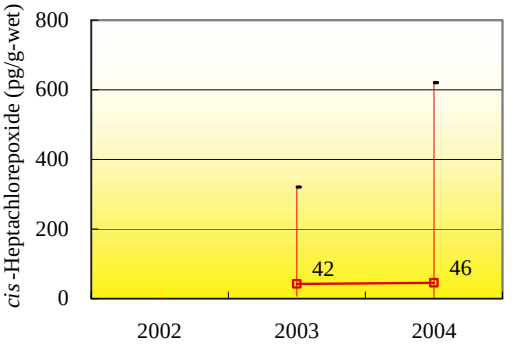
A	-	35/ 35	34/ 34	37/ 37	37/ 37

cis -Heptachlorepoxide (Wildlife/Bivalves)



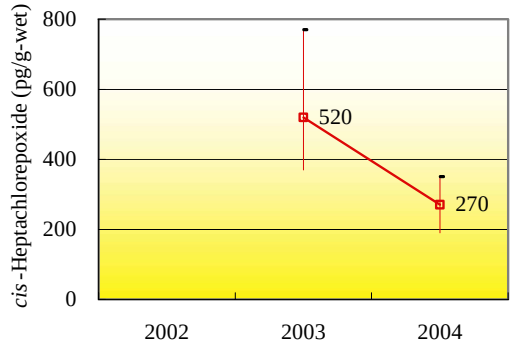
V	-	30/ 30	31/ 31

cis -Heptachlorepoxide (Wildlife/Fish)



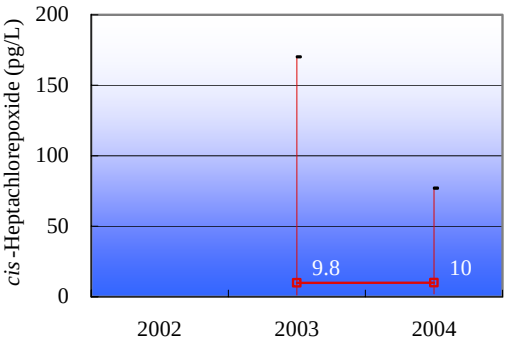
F	-	70/ 70	70/ 70

cis -Heptachlorepoxide (Wildlife/Birds)



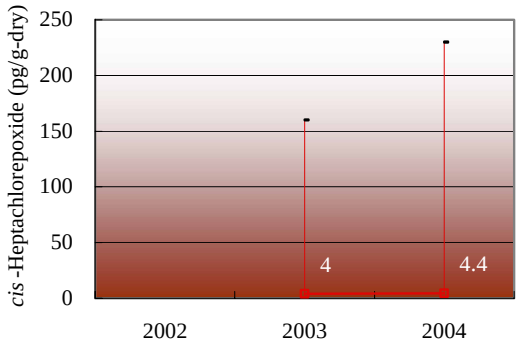
B	-	10/ 10	10/ 10

cis -Heptachlorepoxide (Surface Water)



W	-	36/ 36	38/ 38

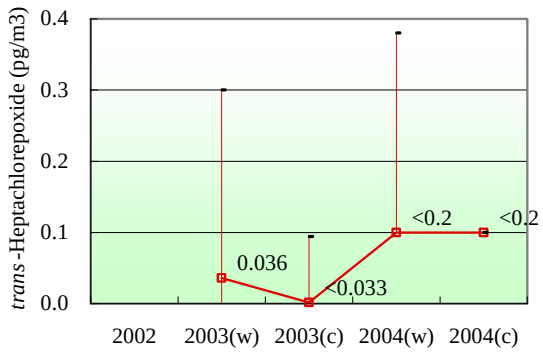
cis -Heptachlorepoxide (Bottom Sediment)



S	-	153/ 186	136/ 189

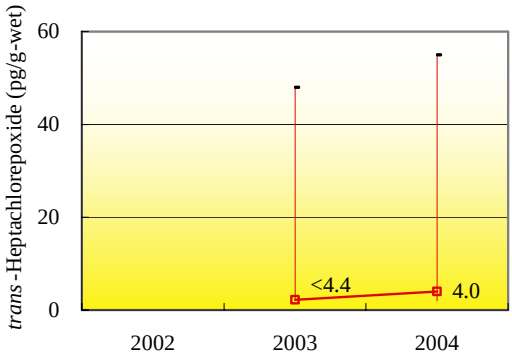
Figure 1-4-4-3 Detected Frequency and Detection Range of Heptachlors (*trans*-Heptachlor epoxide)

trans -Heptachlorepoxide (Air and Precipitation)



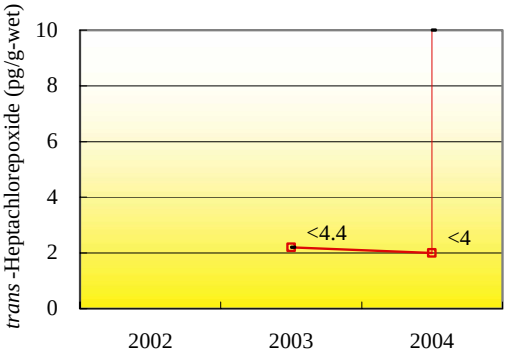
A	-	18/ 35	3/ 34	4/ 37	0/ 37

trans -Heptachlorepoxide (Wildlife/Bivalves)



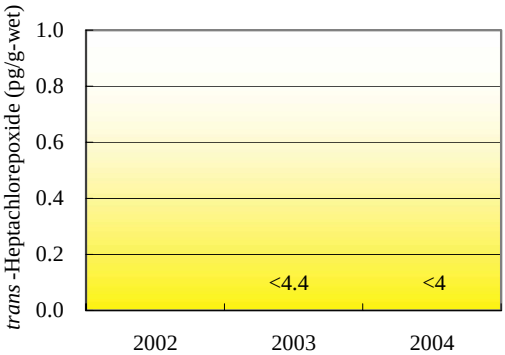
V	-	5/ 30	9/ 31

trans -Heptachlorepoxide (Wildlife/Fish)



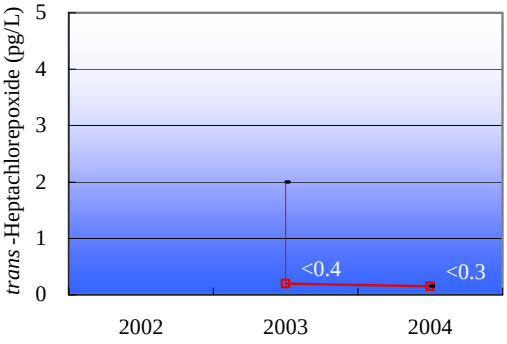
F	-	0/ 70	2/ 70

trans -Heptachlorepoxide (Wildlife/Birds)



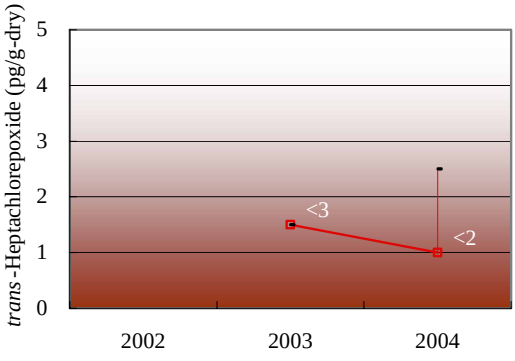
B	-	0/ 10	0/ 10

trans -Heptachlorepoxide (Surface Water)



W	-	4/ 36	0/ 38

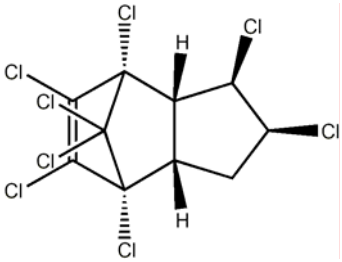
trans -Heptachlorepoxide (Bottom Sediment)



S	-	0/ 186	1/ 189

(5) Chlordanes

A. *cis*-chlordane



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves and fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

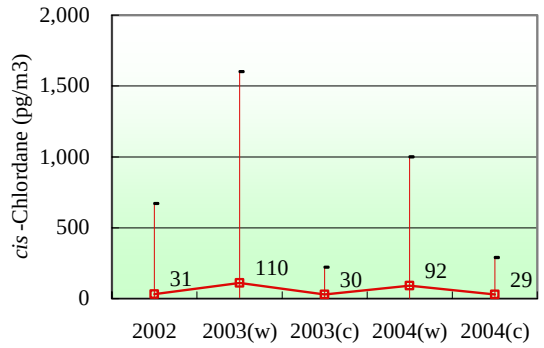
Birds: Although it is difficult to grasp the tendency of its persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

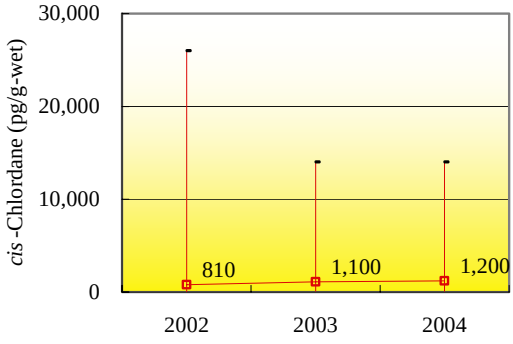
Figure 1-4-5-1 Detected Frequency and Detection Range of Chlordanes (*cis*-Chlordane)

cis -Chlordane (Air and Precipitation)



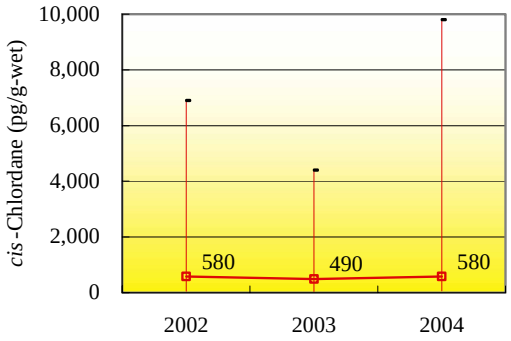
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

cis -Chlordane (Wildlife/Bivalves)



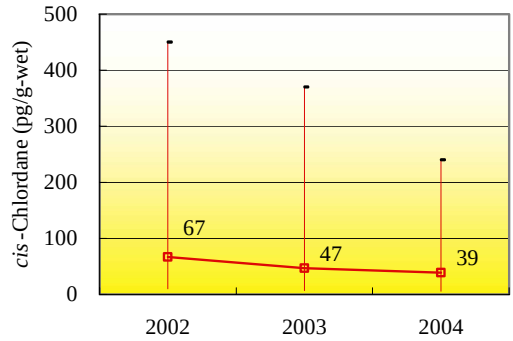
V	38/ 38	30/ 30	31/ 31

cis -Chlordane (Wildlife/Fish)



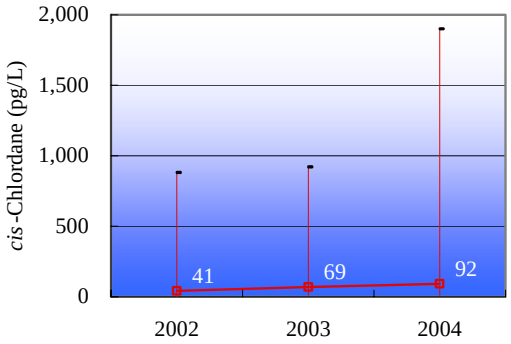
F	70/ 70	70/ 70	70/ 70

cis -Chlordane (Wildlife/Birds)



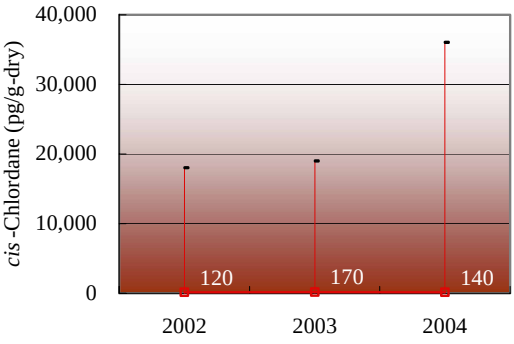
B	10/ 10	10/ 10	10/ 10

cis -Chlordane (Surface Water)



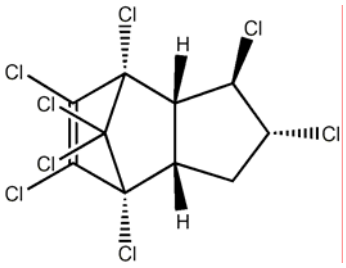
W	114/ 114	36/ 36	38/ 38

cis -Chlordane (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

B. *trans*-chlordane



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves and fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

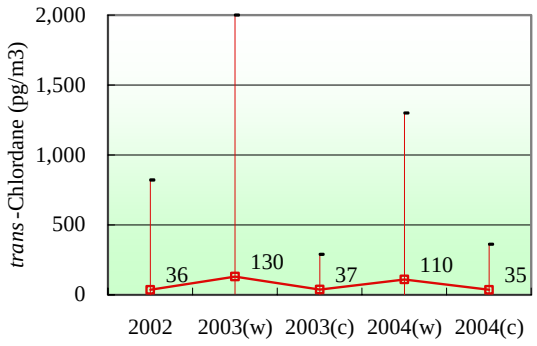
Birds: Although it is difficult to grasp the tendency of its persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

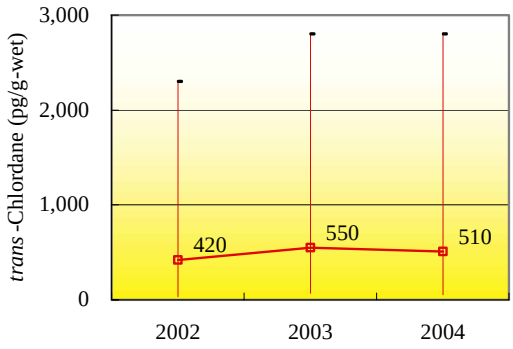
Figure 1-4-5-2 Detected Frequency and Detection Range of Chlordanes (*trans*-Chlordane)

trans -Chlordane (Air and Precipitation)



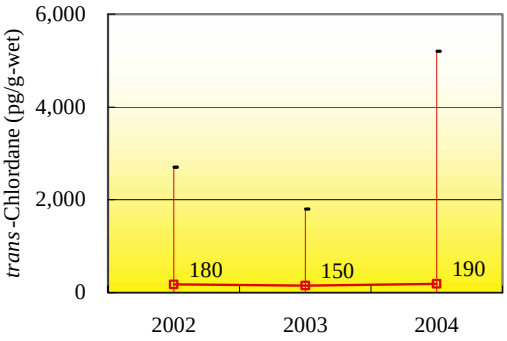
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

trans -Chlordane(Wildlife/Bivalves)



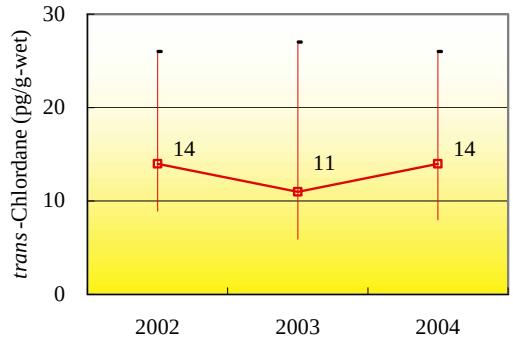
V	38/ 38	30/ 30	31/ 31

trans -Chlordane (Wildlife/Fish)



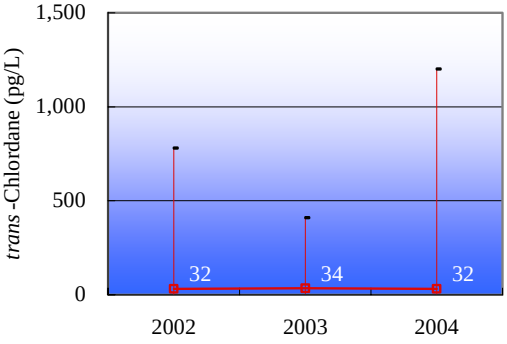
F	70/ 70	70/ 70	70/ 70

trans -Chlordane (Wildlife/Birds)



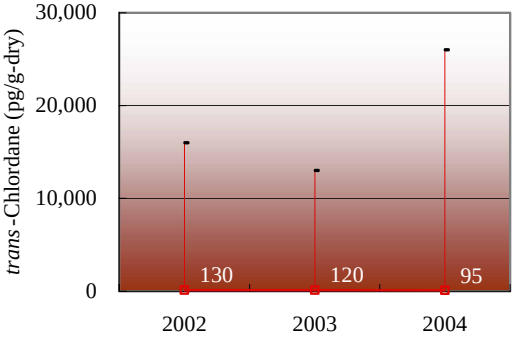
B	10/ 10	10/ 10	5/ 10

trans -Chlordane (Surface Water)



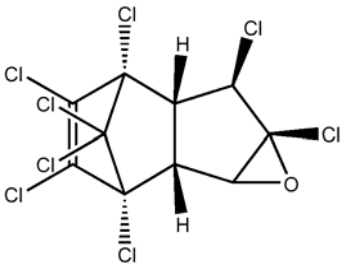
W	114/ 114	36/ 36	38/ 38

trans -Chlordane (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

C. Oxychlordane



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples of all the monitoring sites since FY2002, and their persistence was still recognised in widespread areas.

Wildlife:

Bivalves and fish: The substance had been detected in most of the samples from all the monitoring sites since FY2002, and their persistence was still recognised in widespread areas.

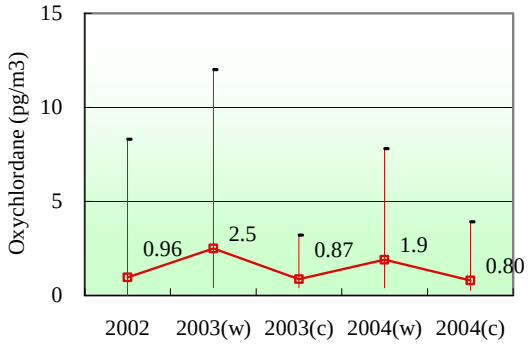
Birds: Although it is difficult to grasp the tendency of the persistence because of variance of the sites, in addition to the fact that only two sites had been monoitored, its persistence was still recognised.

Surface water: The substance had been detected in most of the samples from almost all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance has been detected in most of the samples from almost all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

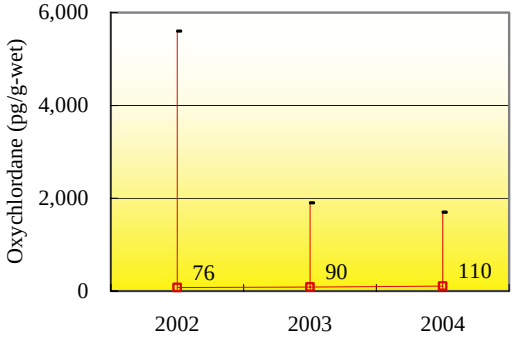
Figure 1-4-5-3 Detected Frequency and Detection Range of Chlordanes (Oxychlordane)

Oxychlordane (Air and Precipitation)



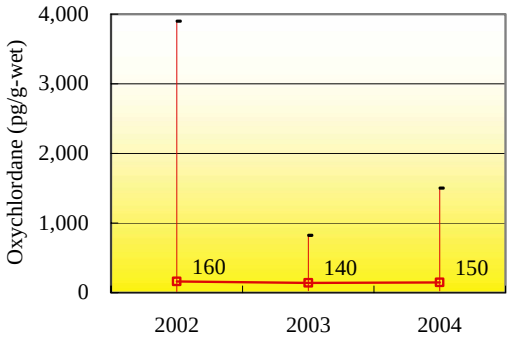
A	101/ 102	35/ 35	34/ 34	37/ 37	37/ 37

Oxychlordane (Wildlife/Bivalves)



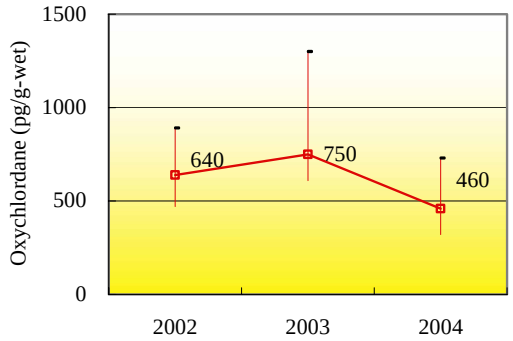
V	37/ 38	30/ 30	31/ 31

Oxychlordane (Wildlife/Fish)



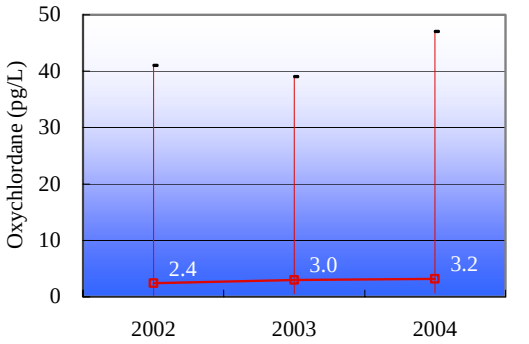
F	70/ 70	70/ 70	70/ 70

Oxychlordane (Wildlife/Birds)



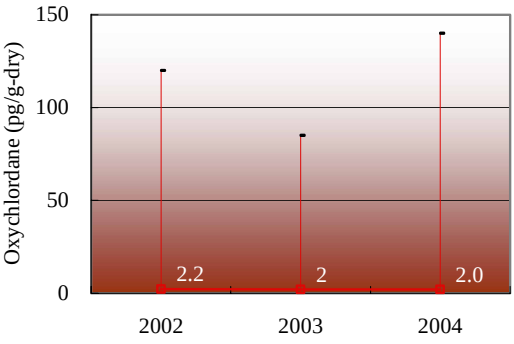
B	10/ 10	10/ 10	10/ 10

Oxychlordane (Surface Water)



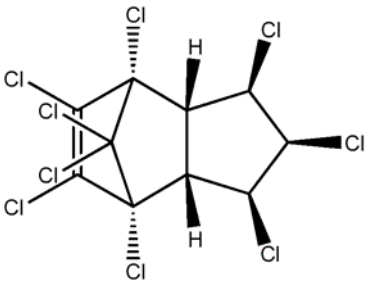
W	96/ 114	36/ 36	38/ 38

Oxychlordane (Bottom Sediment)



S	153/ 189	158/ 186	129/ 189

D. *cis*-nonachlor



Atmospheric air and precipitation: *Cis*-nonachlor had been subject to the monitoring programme since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on the monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves and fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and their persistence was still recognised in widespread areas.

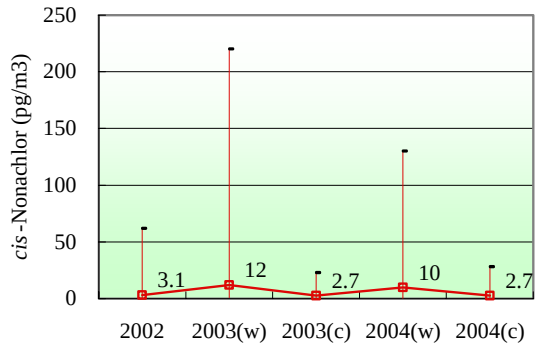
Birds: Although it is difficult to grasp the tendency of their persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in most of the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

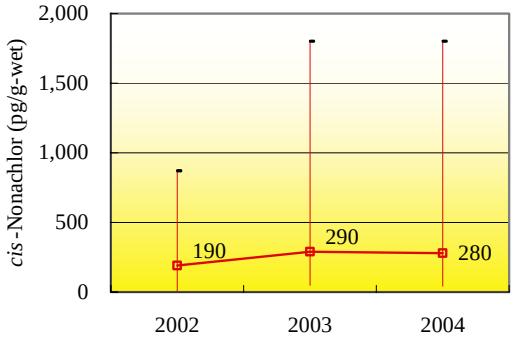
Figure 1-4-5-4 Detected Frequency and Detection Range of Chlordanes (*cis*-Nonachlor)

cis -Nonachlor (Air and Precipitation)



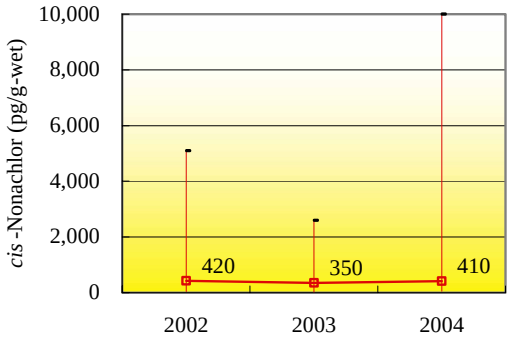
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

cis -Nonachlor (Wildlife/Bivalves)



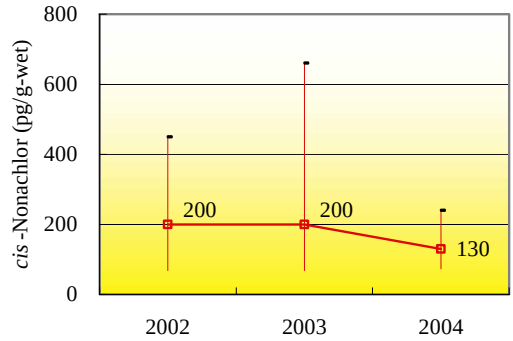
V	38/ 38	30/ 30	31/ 31

cis -Nonachlor (Wildlife/Fish)



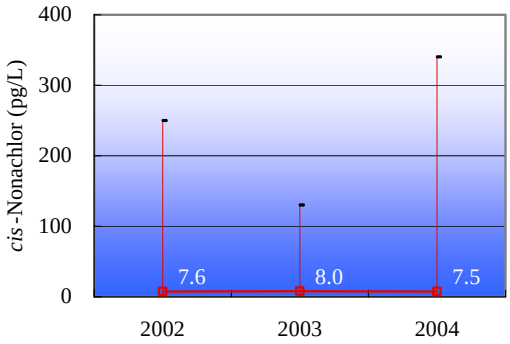
F	70/ 70	70/ 70	70/ 70

cis -Nonachlor (Wildlife/Birds)



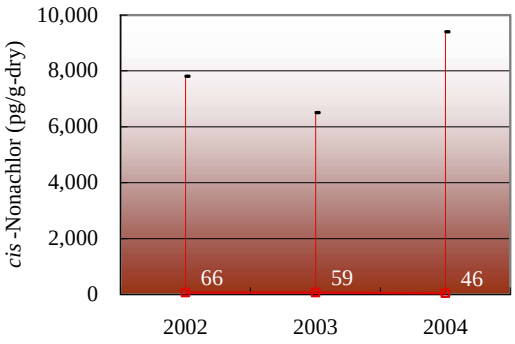
B	10/ 10	10/ 10	10/ 10

cis -Nonachlor (Surface Water)



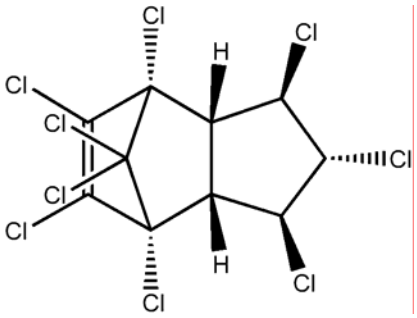
W	114/ 114	36/ 36	38/ 38

cis -Nonachlor (Bottom Sediment)



S	188/ 189	184/ 186	189/ 189

E. *trans*-nonachlor



Atmospheric air and precipitation: *Trans*-nonachlor had been subject to the monitoring programme since FY2002. The persistent concentrations of the the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on the monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves and fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

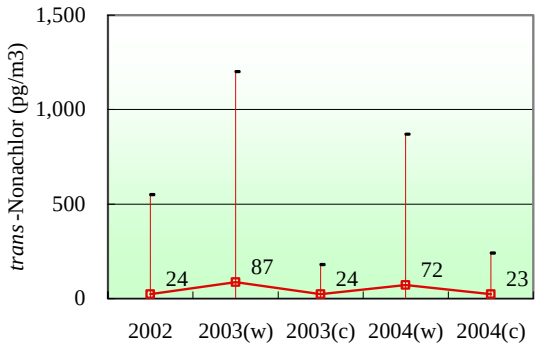
Birds: Although it is difficult to grasp the tendency of the persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

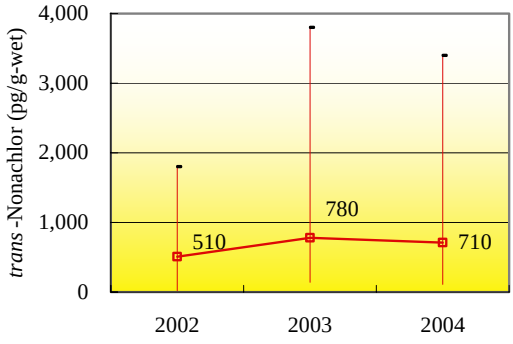
Figure 1-4-5-5 Detected Frequency and Detection Range of Chlordanes (*trans*-Nonachlor)

trans -Nonachlor (Air and Precipitation)



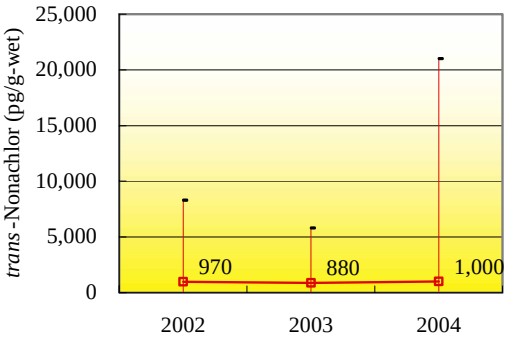
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

trans -Nonachlor (Wildlife/Bivalves)



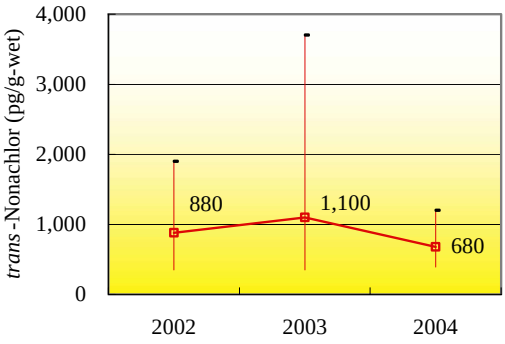
V	38/ 38	30/ 30	31/ 31

trans -Nonachlor (Wildlife/Fish)



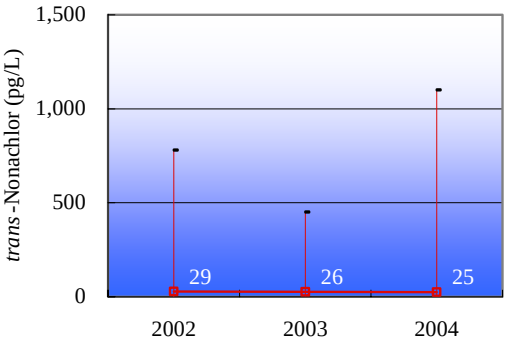
F	70/ 70	70/ 70	70/ 70

trans -Nonachlor (Wildlife/Birds)



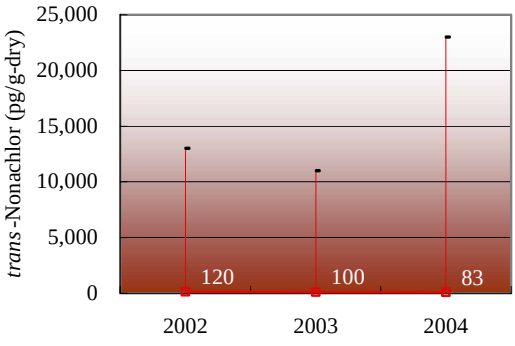
B	10/ 10	10/ 10	10/ 10

trans -Nonachlor (Surface Water)



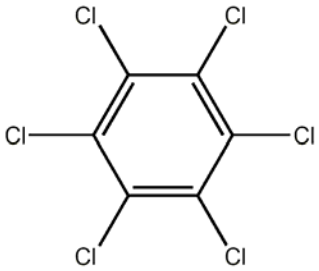
W	114/ 114	36/ 36	38/ 38

trans -Nonachlor (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

(6) HCB



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

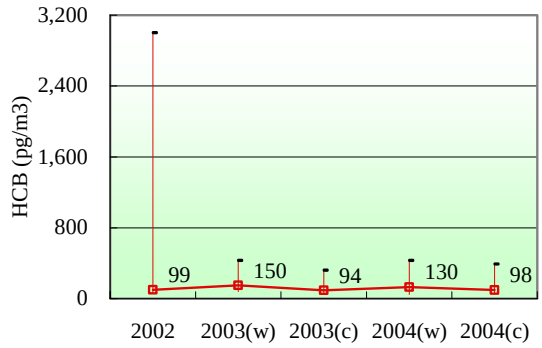
Birds: Although it is difficult to grasp the tendency of its persistence in birds because of vairiance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

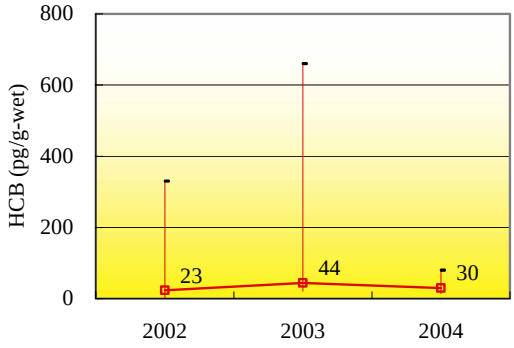
Figure 1-4-6 Detected Frequency and Detection Range of HCB

HCB (Air and Precipitation)



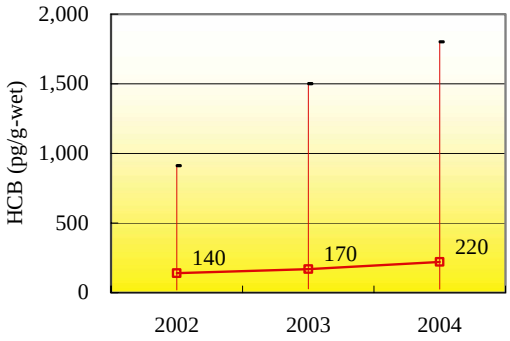
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

HCB (Wildlife/Bivalves)



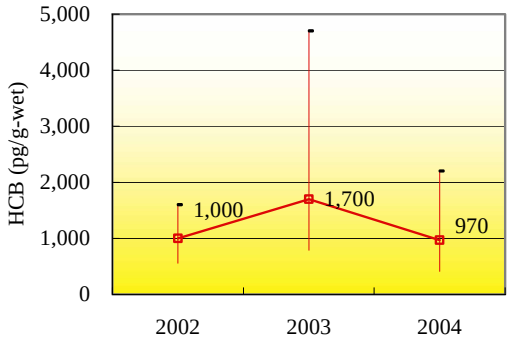
V	38/ 38	30/ 30	31/ 31

HCB (Wildlife/Fish)



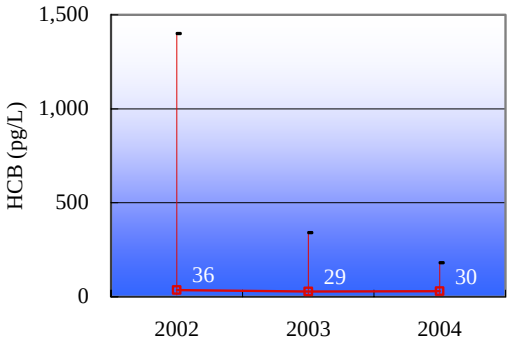
F	70/ 70	70/ 70	70/ 70

HCB (Wildlife/Birds)



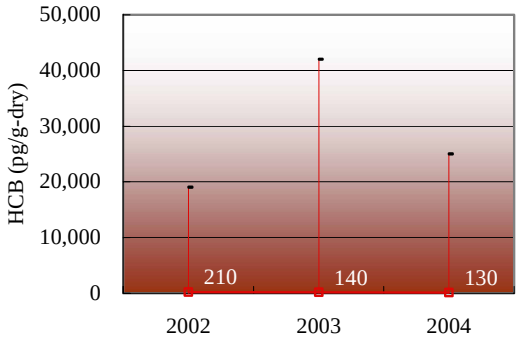
B	10/ 10	10/ 10	10/ 10

HCB (Surface Water)



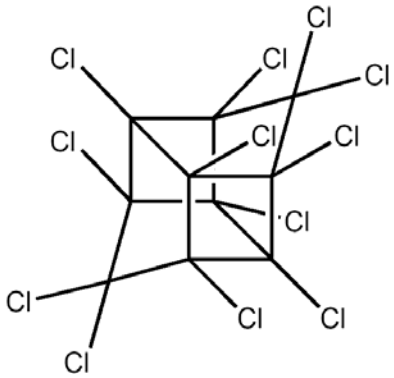
W	114/ 114	36/ 36	38/ 38

HCB (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

(7) Mirex



Monitoring has been carried out since FY2003 to investigate mirex persisting in each of all the media. Japan has never produced or imported mirex. In FY2003 and FY2004, however, it was detected in all the samples of wildlife (bivalves, fish and birds) and atmospheric air from all the monitoring sites, as well as in samples of surface water and bottom sediment from half of the monitoring sites.

Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2003. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2003, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in all the samples from all the monitoring sites since FY2003, and its persistence was still recognised in widespread areas.

Fish: The substance had been detected in all the samples from all the monitoring sites since FY2003, and its persistence was still recognised in widespread areas.

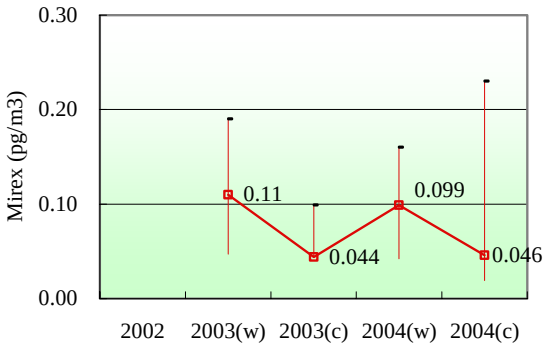
Birds: Although it is difficult to grasp the tendency of its persistence in birds because of vairiance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in most of the samples from most of the monitoring sites since FY2003, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in most of the samples from most of the monitoring sites since FY2003, and its persistence was still recognised in widespread areas.

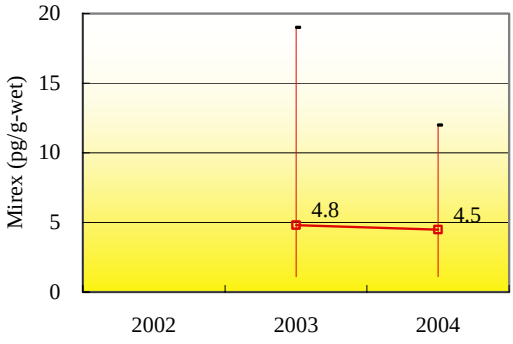
Figure 1-4-7 Detected Frequency and Detection Range of Mirex

Mirex (Air and Precipitation)



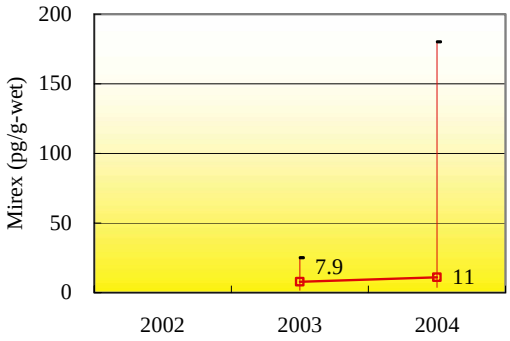
A	-	35/ 35	34/ 34	37/ 37	37/ 37

Mirex (Wildlife/Bivalves)



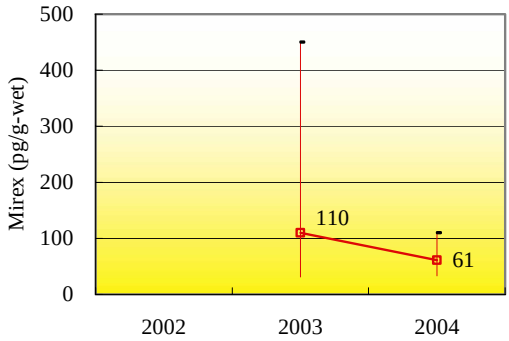
V	-	30/ 30	31/ 31

Mirex (Wildlife/Fish)



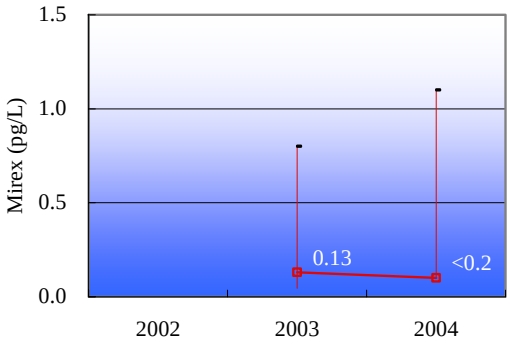
F	-	70/ 70	70/ 70

Mirex (Wildlife/Birds)



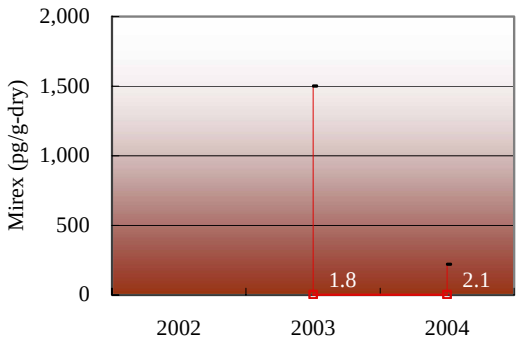
B	-	10/ 10	10/ 10

Mirex (Surface Water)



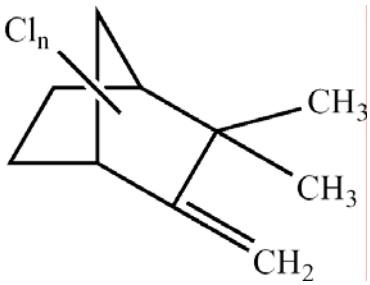
W	-	25/ 36	18/ 38

Mirex (Bottom Sediment)



S	-	137/ 186	153/ 189

(8) Toxaphenes



The persistence of toxaphens in birds is believed to be attributable to their prey and habitat, because Japan has never produced or imported toxaphens and they had not been detected in surface water nor bottom sediment.

Atmospheric air and precipitation: The persistence of the substances has been monitored since FY2003. The persistent concentrations of Parlar-26 in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. Parlar-26 had been detected in all the samples from all the monitoring sites since FY2003, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: Parlar-26 and Parlar-50 had been detected in approvimately a half of the samples from the monitoring sites since FY2003, and their persistence was still recognised in widespread areas.

Fish: Parlar-26 and Parlar-50 had been detected in more than a half of the samples from the monitoring sites since FY2003. Parlar-62 had been also detected in less raio. Their persistence was still recognised in widespread areas.

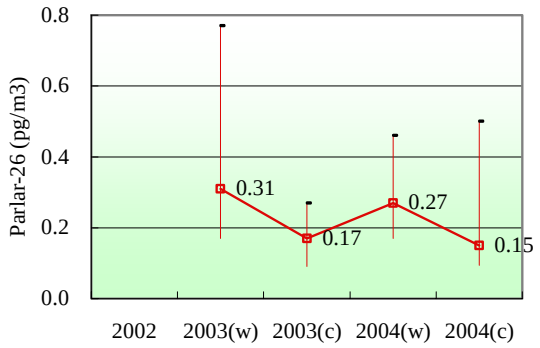
Birds: Although it is difficult to grasp the tendency of their persistence in birds because of vairiance of the sites, in addition to the fact that only two sites had been monitored, their persistence was still recognised.

Surface water: The substances had not been detected in all the samples from all the monitoring sites since FY2003.

Bottom sediment: The substances had not been detected in all the samples from all the monitoring sites since FY2003.

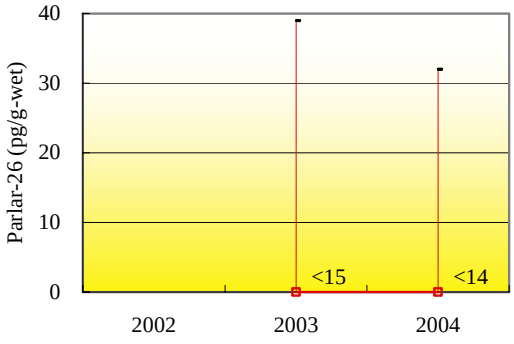
Figure 1-4-8-1 Detected Frequency and Detection Range of Toxaphenes (Parlar-26)

Parlar-26 (Air and Precipitation)



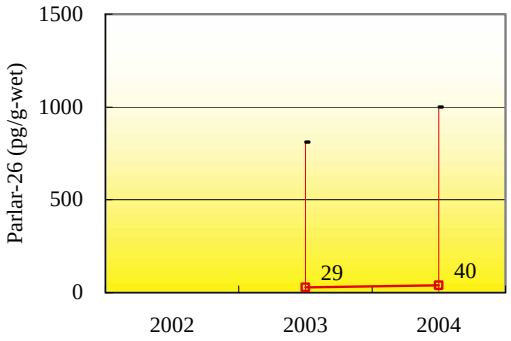
A	-	35/ 35	34/ 34	37/ 37	37/ 37

Parlar-26 (Wildlife/Bivalves)



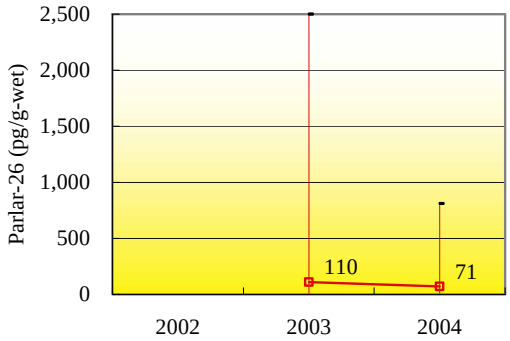
V	-	11/ 30	15/ 31

Parlar-26 (Wildlife/Fish)



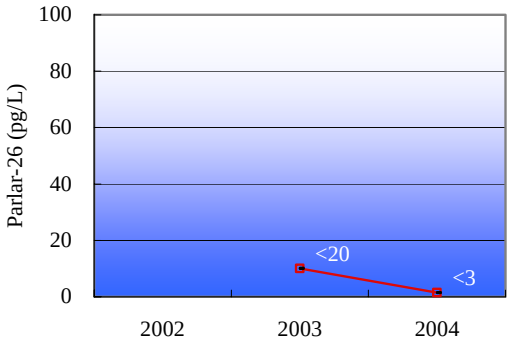
F	-	44/ 70	54/ 70

Parlar-26 (Wildlife/Birds)



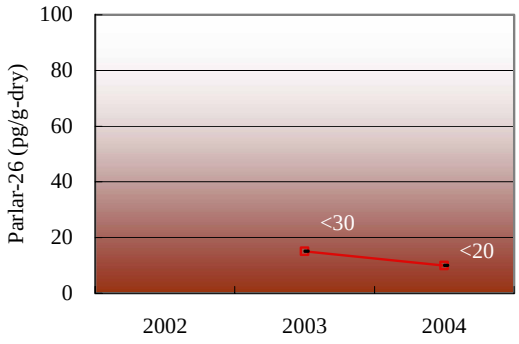
B	-	5/ 10	5/ 10

Parlar-26 (Surface Water)



W	-	0/ 36	0/ 38

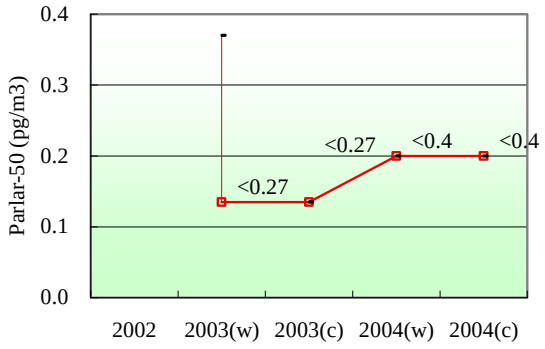
Parlar-26 (Bottom Sediment)



S	-	0/ 186	0/ 189

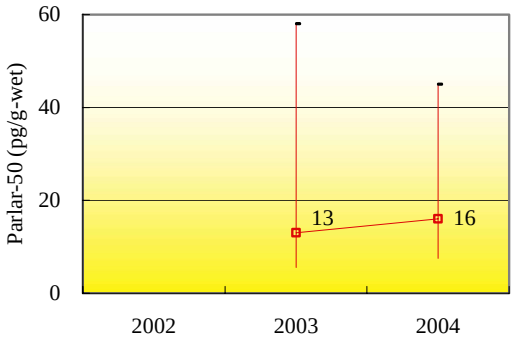
Figure 1-4-8-2 Detected Frequency and Detection Range of Toxaphenes (Parlar-50)

Parlar-50 (Air and Precipitation)



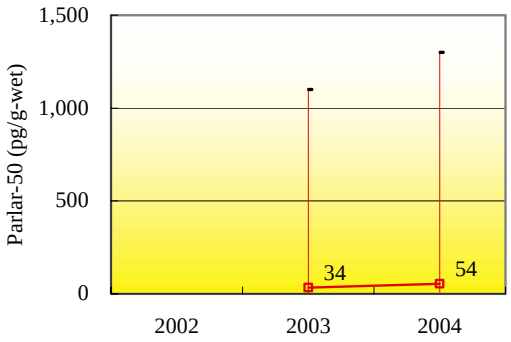
A	-	2/ 35	0/ 34	0/ 37	0/ 37

Parlar-50 (Wildlife/Bivalves)



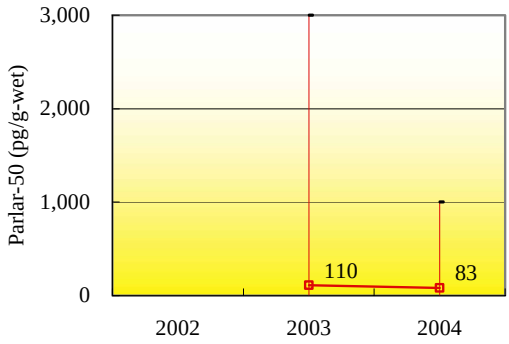
V	-	17/ 30	15/ 31

Parlar-50 (Wildlife/Fish)



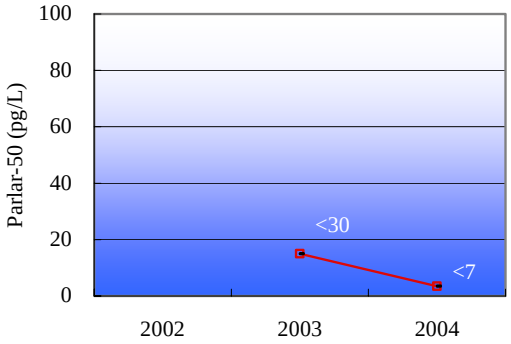
F	-	55/ 70	59/ 70

Parlar-50 (Wildlife/Birds)



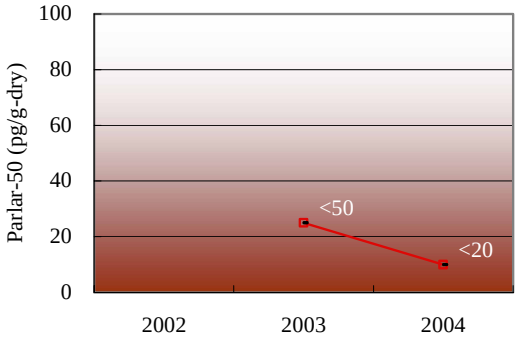
B	-	5/ 10	5/ 10

Parlar-50 (Surface Water)



W	-	0/ 36	0/ 38

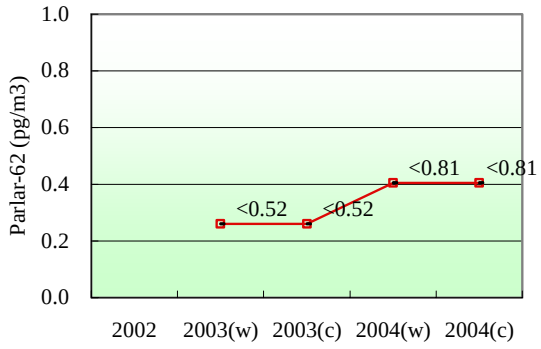
Parlar-50 (Bottom Sediment)



S	-	0/ 186	0/ 189

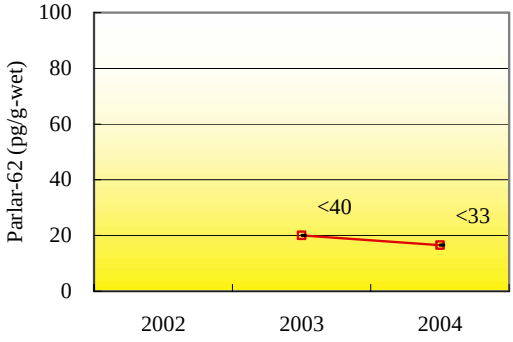
Figure 1-4-8-3 Detected Frequency and Detection Range of Toxaphenes (Parlar-62)

Parlar-62 (Air and Precipitation)



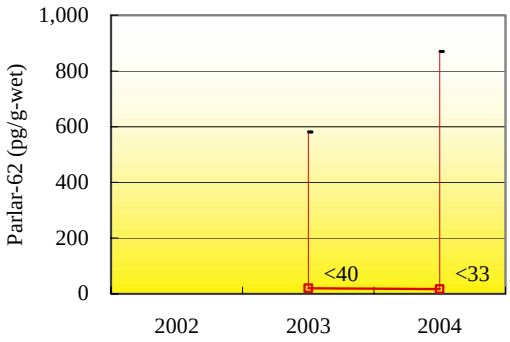
A	-	0/ 35	0/ 34	0/ 37	0/ 37

Parlar-62 (Wildlife/Bivalves)



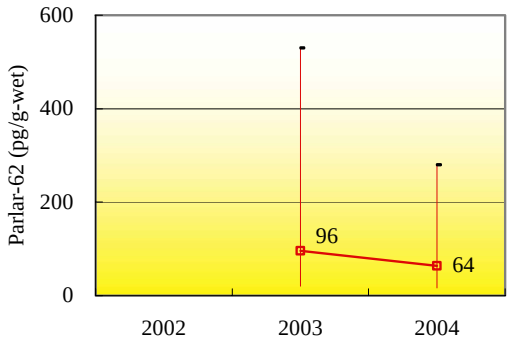
V	-	0/ 30	0/ 31

Parlar-62 (Wildlife/Fish)



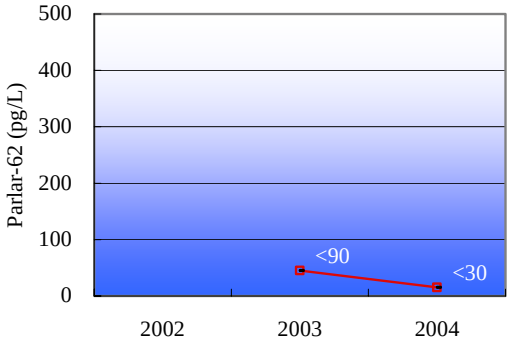
F	-	9/ 70	24/ 70

Parlar-62 (Wildlife/Birds)



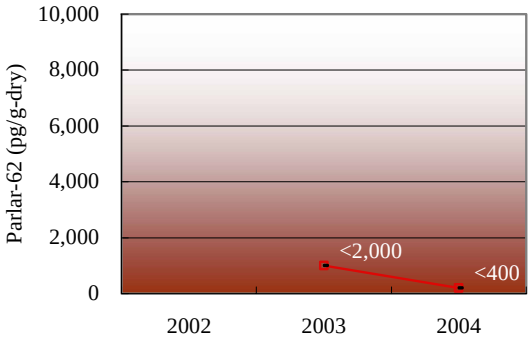
B	-	5/ 10	5/ 10

Parlar-62 (Surface Water)



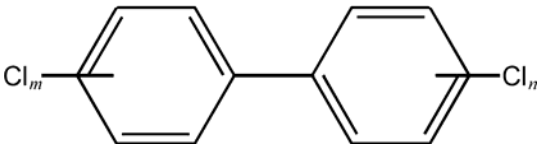
W	-	0/ 36	0/ 38

Parlar-62 (Bottom Sediment)



S	-	0/ 186	0/ 189

(9) PCBs



Atmospheric air and precipitation: The persistence of the substances was monitored during FY2002 to FY2004. The persistent concentrations of the substances in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substances were detected in all the samples from all the monitoring sites in FY2002, FY2003 and FY2004, and their persistence was still recognised in widespread areas.

Wildlife:

Bivalves: Comparable detection limits were used in FY2002 and later, which allow the continuous evaluation of the results. Changes were made to the monitoring sites as follows: two sites were excluded in FY2003 (*Mytilus edulis galloprovincialis* [blue mussel] at the Miura Peninsula, and *Septifer virgatus* [purplish bifurcate mussel] at Mishima); one site was added in FY2004 (*Mytilus edulis galloprovincialis* [blue mussel] at Takamatsu Port in Kagawa Prefecture); and monitored species were changed at one monitoring site (*Mytilus edulis galloprovincialis* [blue mussel] → *Septifer virgatus* [purplish bifurcate mussel] at Dokai Bay in Kitakyushu City). The substances were detected in all the samples from all the monitoring sites during FY2002-FY2004, and their persistence was still recognised in widespread areas.

Fish: The substances were detected in all the samples from all the monitoring sites during FY2002-FY2004, and their persistence was still recognised in widespread areas.

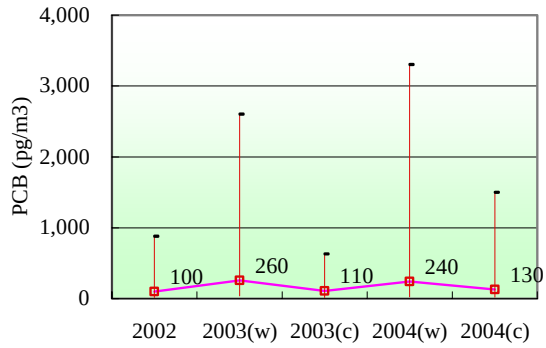
Birds: Although it is difficult to grasp the tendency of their persistence in birds because of variance of the sites, in addition to the fact that only two sites had been monitored, their persistence was still recognised.

Surface water: The substances were detected in all the samples from all the monitoring sites during FY2002-FY2004, and their persistence was still recognised in widespread areas.

Bottom sediment: The geometric means showed decreases in FY2002, FY2003 and FY2004. The substances were detected in all the samples from all the monitoring sites during FY2002-FY2004, and their persistence was still recognised in widespread areas.

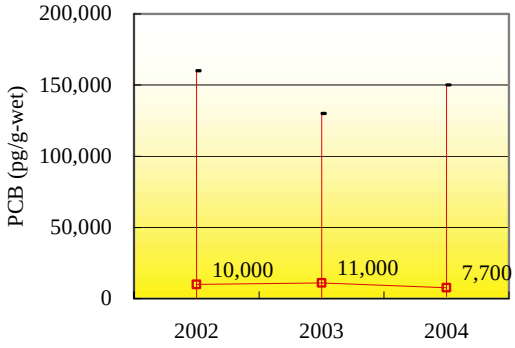
Figure 1-4-9 Detected Frequency and Detection Range of PCBs (total)

PCB (Air and Precipitation)



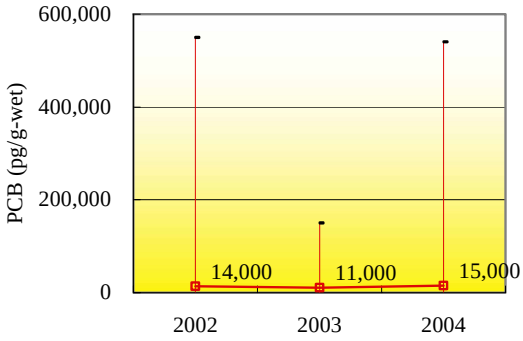
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

PCB (Wildlife/Bivalves)



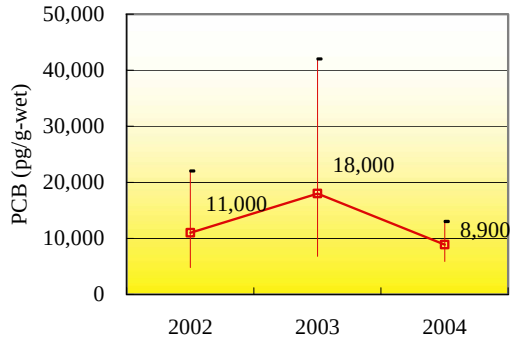
V	38/ 38	30/ 30	31/ 31

PCB (Wildlife/Fish)



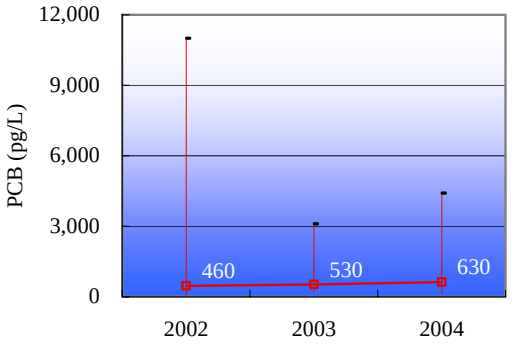
F	70/ 70	70/ 70	70/ 70

PCB (Wildlife/Birds)



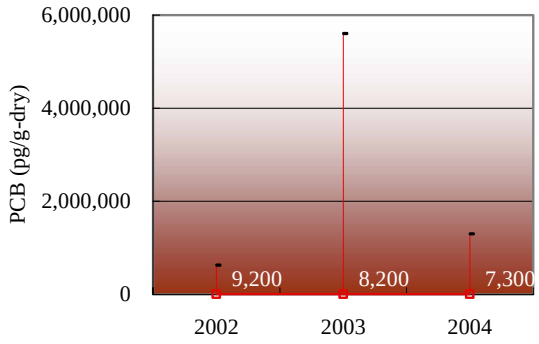
B	10/ 10	10/ 10	10/ 10

PCB (Surface Water)



W	114/ 114	36/ 36	38/ 38

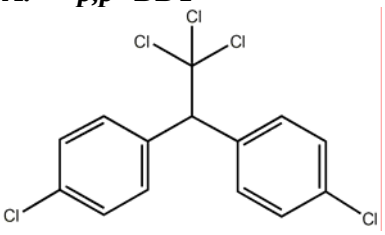
PCB (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

(10) DDTs

A. *p,p'*-DDT



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

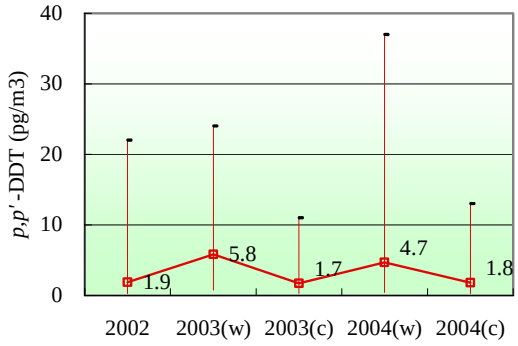
Birds: Although it is difficult to grasp the tendency of its persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance has been detected in most of the samples from almost all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

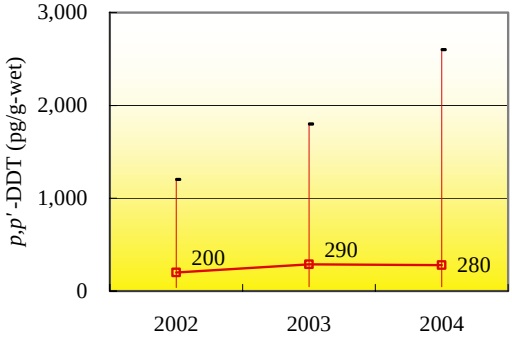
Figure 1-4-10-1 Detected Frequency and Detection Range of DDTs (*p,p'*-DDT)

p,p'-DDT (Air and Precipitation)



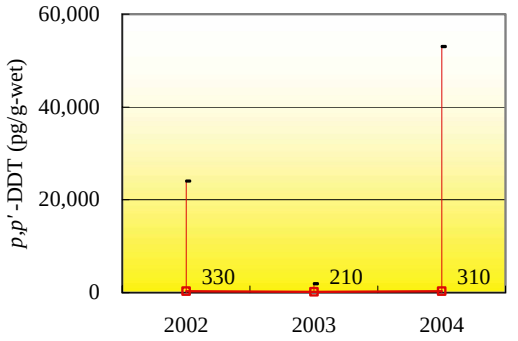
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

p,p'-DDT (Wildlife/Bivalves)



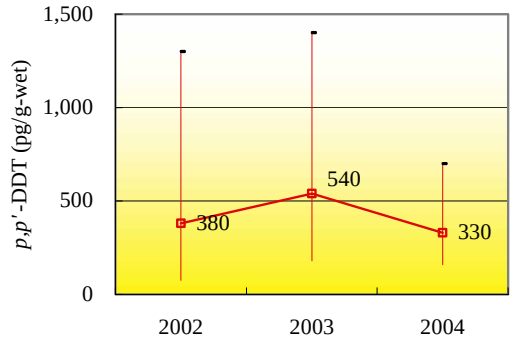
V	38/ 38	30/ 30	31/ 31

p,p'-DDT (Wildlife/Fish)



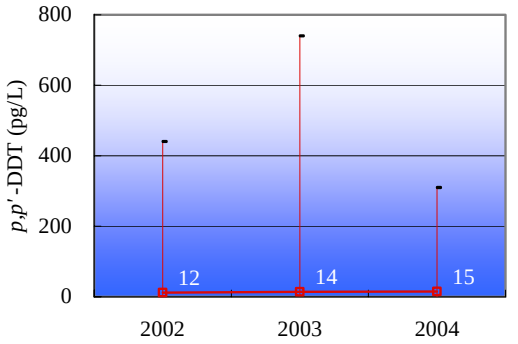
F	70/ 70	70/ 70	70/ 70

p,p'-DDT (Wildlife/Birds)



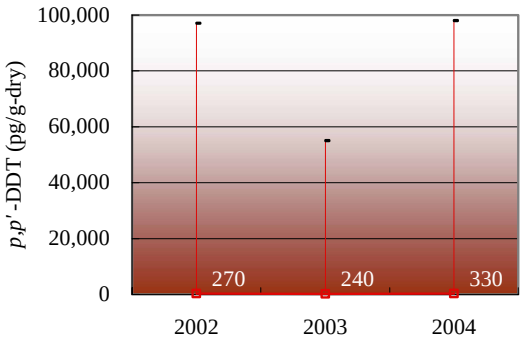
B	10/ 10	10/ 10	10/ 10

p,p'-DDT (Surface Water)



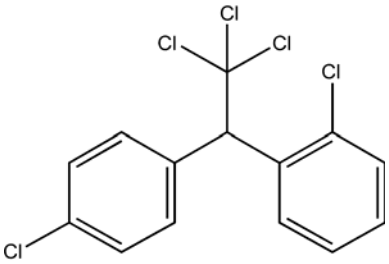
W	114/ 114	36/ 36	36/ 38

p,p'-DDT (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

B. *o,p'*-DDT



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

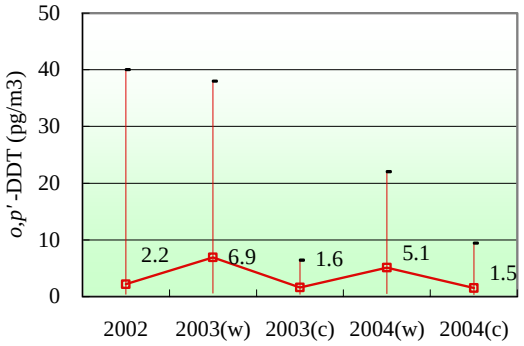
Fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Birds: Although it is difficult to grasp the tendency of its persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water and bottom sediment: The substance had been detected in most of the samples from mostly all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

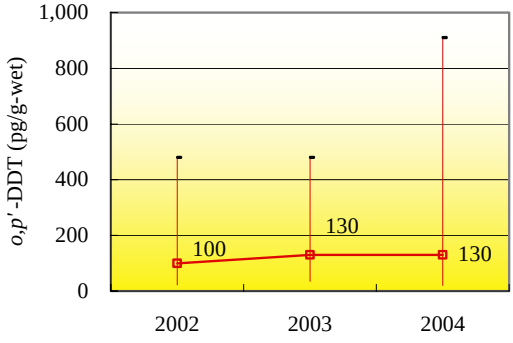
Figure 1-4-10-2 Detected Frequency and Detection Range of DDTs (*o,p'*-DDT)

o,p'-DDT (Air and Precipitation)



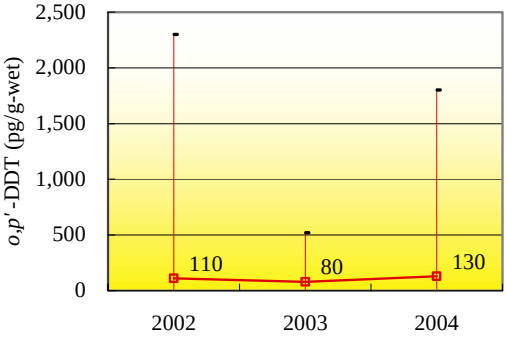
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

o,p'-DDT (Wildlife/Bivalves)



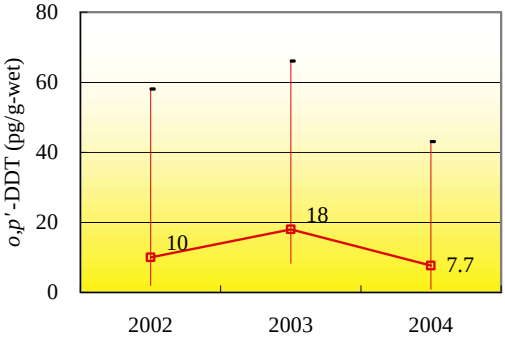
V	38/ 38	30/ 30	31/ 31

o,p'-DDT (Wildlife/Fish)



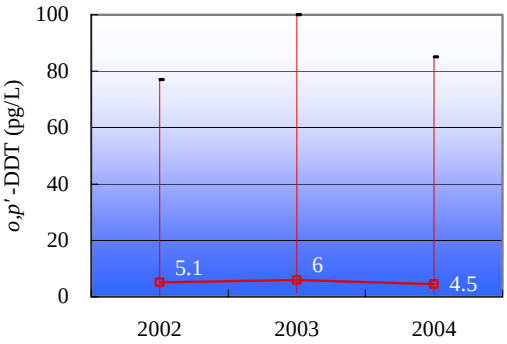
F	70/ 70	70/ 70	70/ 70

o,p'-DDT (Wildlife/Birds)



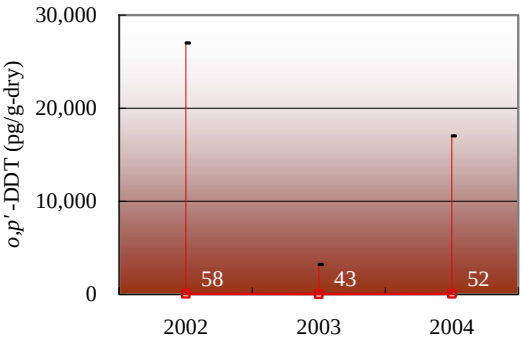
B	8/ 10	10/ 10	10/ 10

o,p'-DDT (Surface Water)



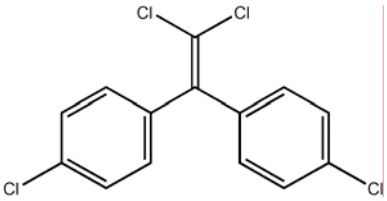
W	114/ 114	36/ 36	29/ 38

o,p'-DDT (Bottom Sediment)



S	183/ 189	185/ 186	189/ 189

C. *p,p'*-DDE



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

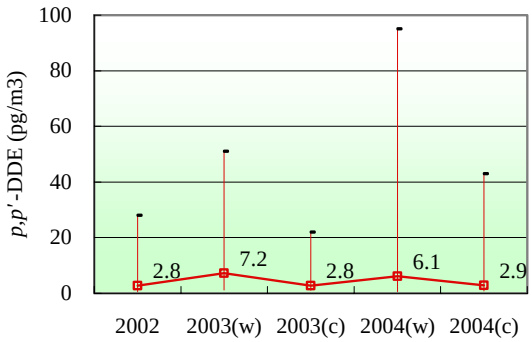
Birds: Although it is difficult to grasp the tendency of its persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

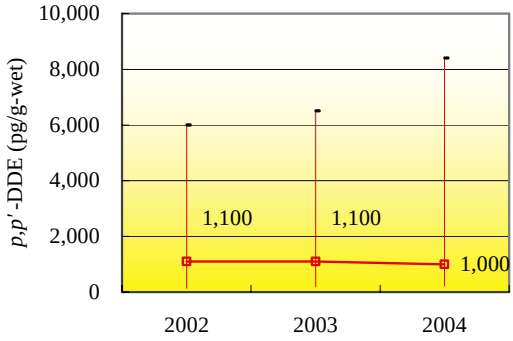
Figure 1-4-10-3 Detected Frequency and Detection Range of DDTs (*p,p'*-DDE)

p,p'-DDE (Air and Precipitation)



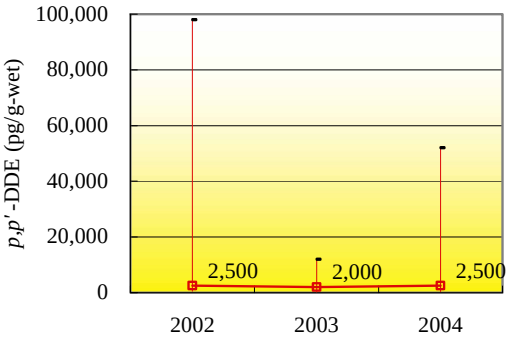
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

p,p'-DDE (Wildlife/Bivalves)



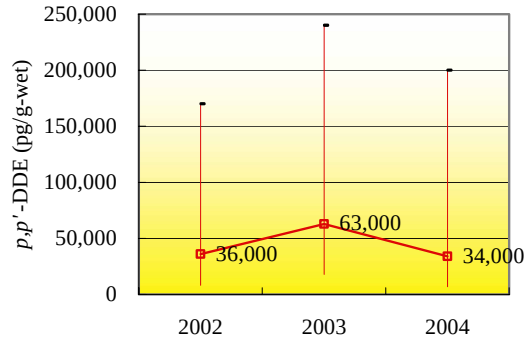
V	38/ 38	30/ 30	31/ 31

p,p'-DDE (Wildlife/Fish)



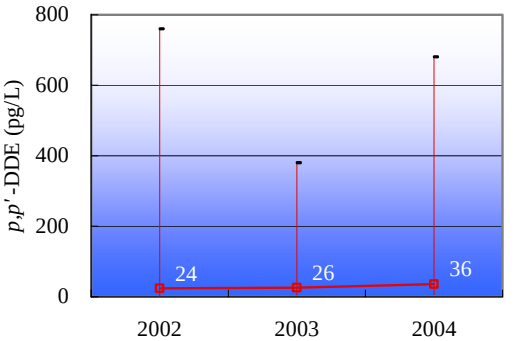
F	70/ 70	70/ 70	70/ 70

p,p'-DDE (Wildlife/Birds)



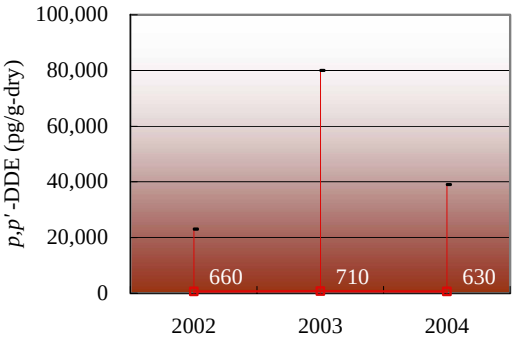
B	10/ 10	10/ 10	10/ 10

p,p'-DDE (Surface Water)



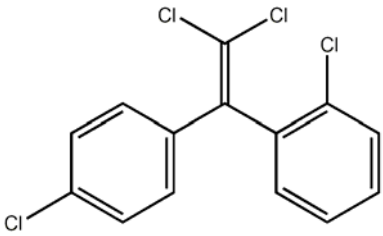
W	114/ 114	36/ 36	38/ 38

p,p'-DDE (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

D. *o,p'*-DDE



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

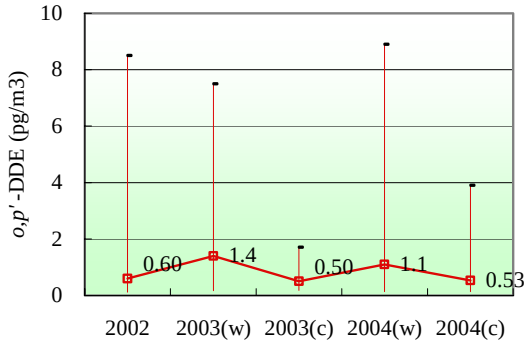
Fish: The substance had been detected in most of the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Birds: Although it is difficult to grasp the tendency of its persistence because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water and bottom sediment: The substance had been detected in most of the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

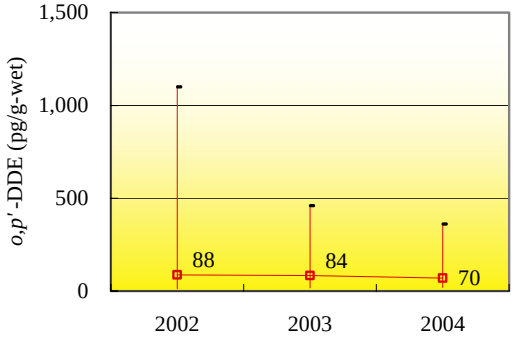
Figure 1-4-10-4 Detected Frequency and Detection Range of DDTs (*o,p'*-DDE)

o,p'-DDE (Air and Precipitation)



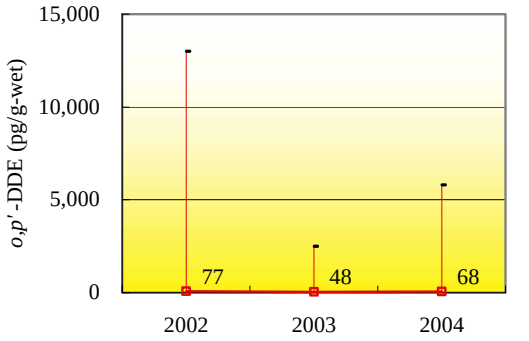
A	102/ 102	35/ 35	34/ 34	37/ 37	37/ 37

o,p'-DDE (Wildlife/Bivalves)



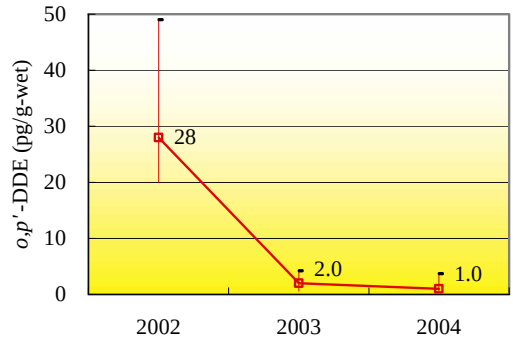
V	38/ 38	30/ 30	31/ 31

o,p'-DDE (Wildlife/Fish)



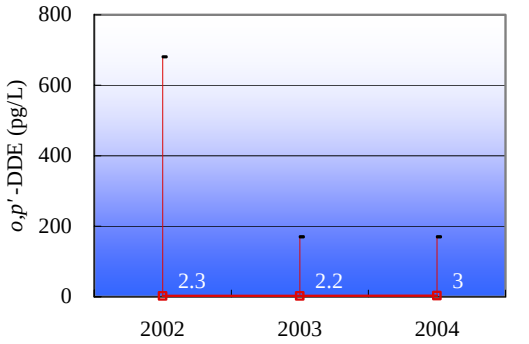
F	70/ 70	67/ 70	70/ 70

o,p'-DDE (Wildlife/Birds)



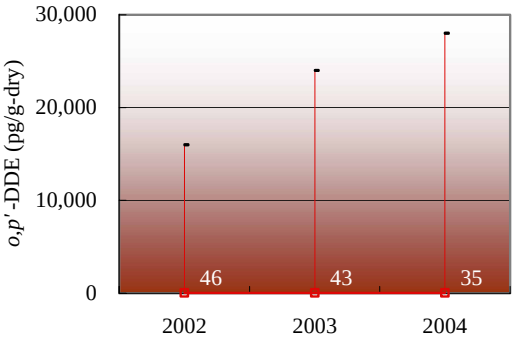
B	10/ 10	9/ 10	5/ 10

o,p'-DDE (Surface Water)



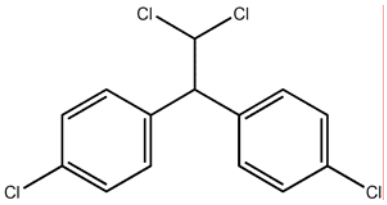
W	113/ 114	36/ 36	38/ 38

o,p'-DDE (Bottom Sediment)



S	188/ 189	186/ 186	184/ 189

E. *p,p'*-DDD



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in almost all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Fish: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

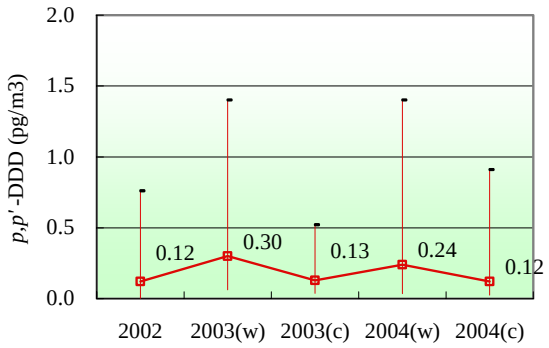
Birds: Although it is difficult to grasp the tendency of its persistence in birds because of variance of the sites, in addition to the fact that only two sites had been monitored, its persistence was still recognised.

Surface water: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Bottom sediment: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

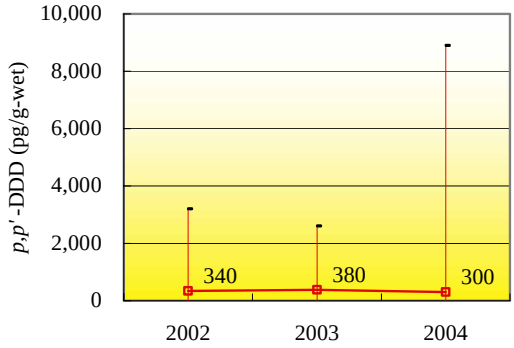
Figure 1-4-10-5 Detected Frequency and Detection Range of DDTs (*p,p'*-DDD)

p,p'-DDD (Air and Precipitation)



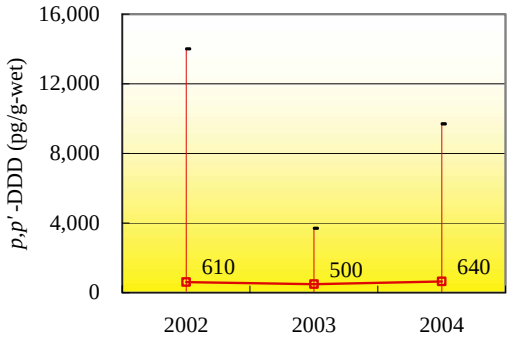
A	101/ 102	35/ 35	34/ 34	37/ 37	37/ 37

p,p'-DDD (Wildlife/Bivalves)



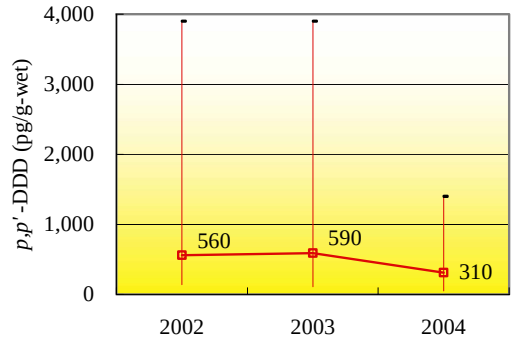
V	38/ 38	30/ 30	31/ 31

p,p'-DDD (Wildlife/Fish)



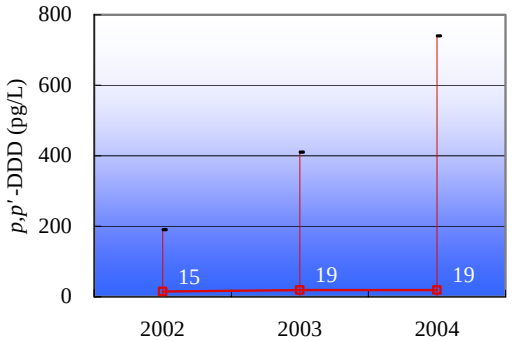
F	70/ 70	70/ 70	70/ 70

p,p'-DDD (Wildlife/Birds)



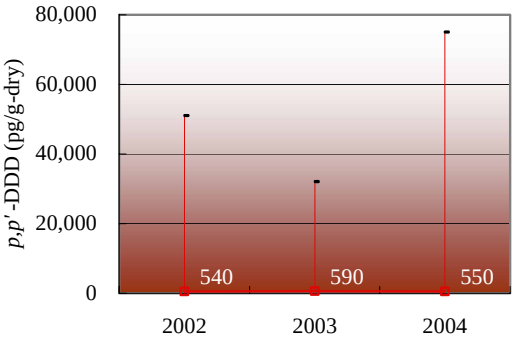
B	10/ 10	10/ 10	10/ 10

p,p'-DDD (Surface Water)



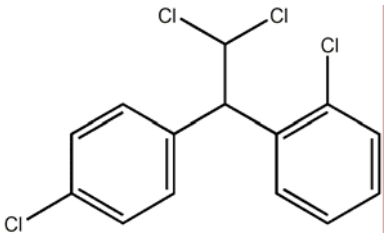
W	114/ 114	36/ 36	38/ 38

p,p'-DDD (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

F. *o,p'*-DDD



Atmospheric air and precipitation: The persistence of the substance has been monitored since FY2002. The persistent concentrations of the substance in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in FY2002 and in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Wildlife:

Bivalves: The substance had been detected in all the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

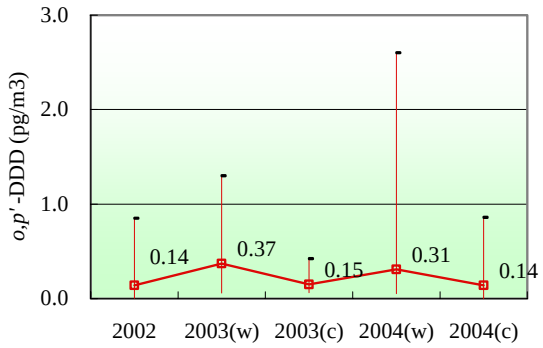
Fish: The substance had been detected in most of the samples from all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

Birds: Although it is difficult to grasp the tendency of their persistence in birds because of variance of the sites, in addition to the fact that only two areas had been monitored, its persistence was still recognised.

Surface water and bottom sediment: The substance had been detected in most of the samples from almost all the monitoring sites since FY2002, and its persistence was still recognised in widespread areas.

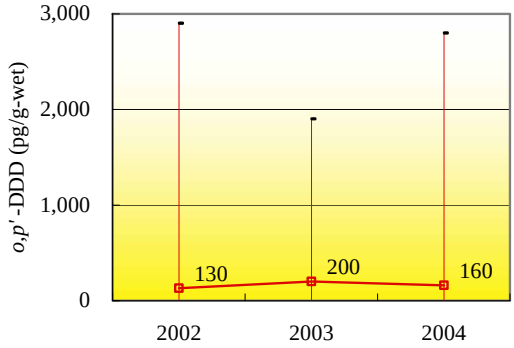
Figure 1-4-10-6 Detected Frequency and Detection Range of DDTs (*o,p'*-DDD)

o,p'-DDD (Air and Precipitaion)



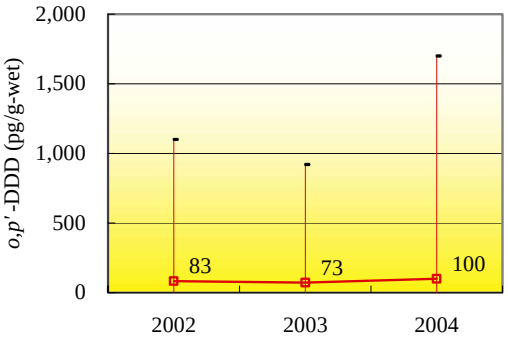
A	97/ 102	35/ 35	34/ 34	37/ 37	37/ 37

o,p'-DDD (Wildlife/Bivalves)



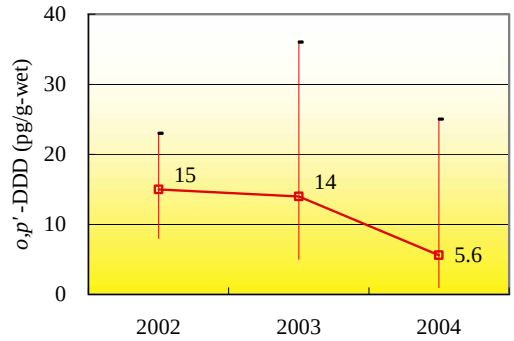
V	38/ 38	30/ 30	31/ 31

o,p'-DDD (Wildlife/Fish)



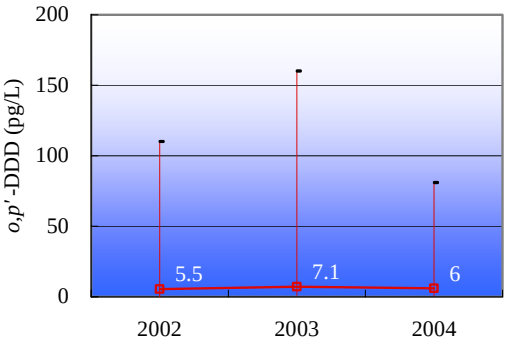
F	70/ 70	66/ 70	68/ 70

o,p'-DDD (Wildlife/Birds)



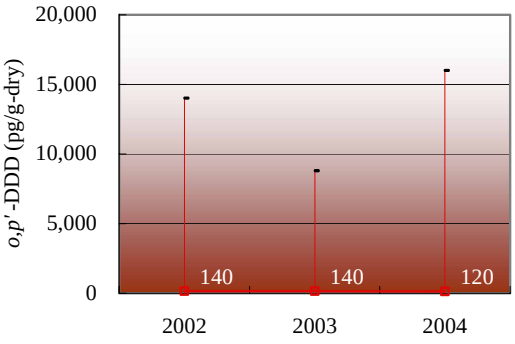
B	10/ 10	10/ 10	9/ 10

o,p'-DDD (Surface Water)



W	113/ 114	36/ 36	38/ 38

o,p'-DDD (Bottom Sediment)



S	184/ 189	186/ 186	189/ 189

(11) PCDDs and PCDFs

Atmospheric air and precipitation:
The monitoring of PCDDs and PCDFs in the environmental air has been conducted in the scheme other than the "Environmental Survey and Monitoring of Chemicals" Programme – Environmental Survey on Dioxins (hereinafter referred to as "Dioxins Survey"). Dioxins Survey was operated under the supervision of other divisions/offices of MOE. In Dioxins Survey, more than nine hundred sites were targeted every year, and 48 sites among them were selected and fixed for continuous monitoring. The present report referrs to the data obtained at the 48 sites. The report of the Dioxins Survey for FY2004 said that the average value – 0.074pg-TEQ/m3 in FY2004 was significantly low comparing to the data in FY1997 (0.54pg-TEQ/m3).

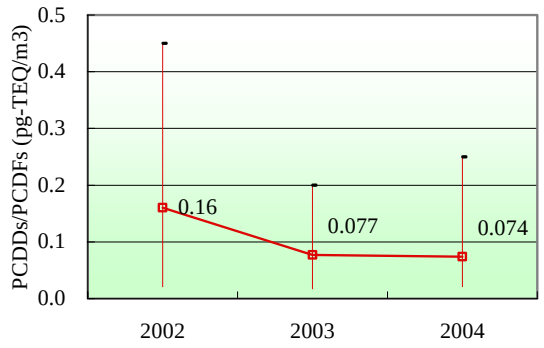
Wildlife: The monitoring of PCDDs and PCDFs has been conducted in the scheme other than the "Environmental Survey and Monitoring of Chemicals" Programme, which does not target bivalves, etc.

Surface water: Dioxins Survey targeted 1,340 sites for continuously monitoring of PCDDs/PCDFs in surface water in FY2004. The average value in FY2004 – 0.22pg-TEQ/L was lower than those in FY2002 and 2003 (0.27 pg-TEQ/L and 0.24pg-TEQ/L, respectively).

Bottom sediment: Dioxins Survey targeted 961 sites for continuously monitoring of PCDDs/PCDFs in bottom sediment in FY2004. The average value in FY2004 – 8.0 pg-TEQ/g was lower than those in FY2002 and 2003 (11 pg-TEQ/g and 8.9 pg-TEQ/g, respectively).

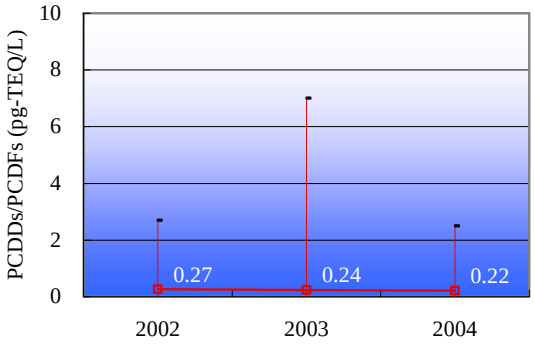
Figure 1-4-11 Detected Frequency and Detection Range of PCDDs/PCDFs

PCDDs/PCDFs (Air and Precipitation)



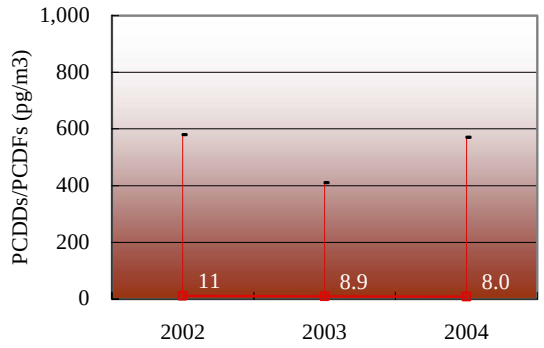
A	48/ 48	48/ 48	48/ 48

PCDDs/PCDFs (Surface Water)



W	1,335/ 1,335	1,397/ 1,397	1,340/ 1,340

PCDDs/PCDFs (Bottom Sediment)



S	978/ 978	1,042/ 1,042	961/ 961

CHAPTER 2

ENVIRONMENTAL SURVEY AND MONITORING OF OTHER POPs IN JAPAN

1. Target substances and areas

This Chapter extracts and summerises the emvironmental survey and/or monitoring data on the chemicals relevant to 5 substances that were proposed for listing in Annex A of Stockholm Convention and considered at the firest meeting of the Persistent Organic Pollutants Review Committee (POPRC) held in November 2005, i.e., Pentabromodiphenyl ether, Chlordecone, Hexabromobiphenyl, Lindane and Perfluorooctane sulfonate (PFOS). Although the proposal was made for Lindane, this Chapter includes the obtained data on alpha, beta, gamma as well as delta isomers of HCH. The media covered by the surveys/monitorings for the substances during FY2002-2004 was as shown in Table 2-1-1.

Table 2-1-1 Target Substances/Media for Other POPs Survey and Monitoring during FY2002-2004

No.	Target Substances	Media			
		Atmospheric Air & Precipitation	Wildlife	Surface Water	Bottom Sediment
1	Chlordecone	X			
2	HCHs α-HCH β-HCH γ-HCH δ-HCH	X	X	X	X
3	Pentabromodiphenylether	X			X
4	Hexabromobiphenyl	X		X	X
5	PFOS	X		X	

2. Survey/monitoring results

Summary of the detection results of the FY2002-2004 surveys and/or monitorings is shown in Table 2-2-1 to 2-2-4.

Table 2-2-1 Results of Other POPs Survey and Monitoring (Air and Precipitation) during FY2002-2004

Air & Precipitation		FY2002				FY2003				FY2004		
Substance		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean
Chlordecone		-	-	-		<0 .5	<0 .5	<0 .5		-	-	-
HCHs												
α-HCH		-	-	-	w	38	5,000	210	w	24	3,200	160
		-	-	-	c	13	1,400	49	c	11	680	68
β-HCH		-	-	-	w	1 .1	97	9 .6	w	0 .53	110	6 .6
		-	-	-	c	14	57	2 .1	c	0 .32	78	2 .6
γ -HCH		-	-	-	w	8 .8	2,200	63	w	4 .5	860	46
		-	-	-	c	14	330	14	c	2 .6	230	19
δ -HCH		-	-	-	w	0 .48	120	5 .1	w	0 .15	93	2 .2
		-	-	-	c	0 .11	47	0 .97	c	0 .07(tr)	18	0 .76
Pentabromodiphenylether		-	-	-		-	-	-		0 .35	5 .4	
Hexabromobiphenyl		-	-	-		-	-	-		<0 .25	<0 .25	<0 .25
PFOS		-	-	-		-	-	-		<0 .09	44	

Legend and Note to this Table
Unit is pg/m3.
tr = value less than Method Quantification Limit (MQL) but over than Method Detection Limit (MDL), **w** = warm season (Aug.-Oct.), **c** = cold season (Nov.-Dec.)
mean = geographical mean assuming the data less than MDL as a half of MDL.

Table 2-2-2 Results of Other POPs Survey and Monitoring (Wildlife) during FY2002-2004

Wildlife		FY2002				FY2003				FY2004		
Substance		Min	Max	Mean		Min	Max	Mean		Min	Max	Mean
Chlordecone		-	-	-		-	-	-		-	-	-
HCHs												
α-HCH	v	12	1,100	65	v	9 .9	610	45	v	12 (tr)	1,800	35
	f	1 .9(tr)	6,500	51	f	2 .6	590	41	f	<4 .3	2,900	57
	b	93	360	160	b	30	230	70	b	58	1,600	120
β-HCH	v	32	1,700	89	v	23	1,100	77	v	22	1,800	69
	f	5 (tr)	1,800	99	f	3 .5(tr)	1,100	78	f	3 .9(tr)	1,100	100
	b	1,600	7,300	3,000	b	1,800	5,900	3,400	b	1,100	4,800	2,200
γ-HCH	v	<1,000	<1,000	<1,000	v	5 .2	130	19	v	<10	230	19 (tr)
	f	<1,000	<1,000	<1,000	f	1 .7(tr)	130	16	f	<10	660	27 (tr)
	b	<1,000	<1,000	<1,000	b	3 .7	40	14	b	11 (tr)	1,200	34
δ-HCH	v	<1,000	<1,000	<1,000	v	<1 .3	1,300	7 .2	v	<1 .5	1,500	3 .0(tr)
	f	<1,000	<1,000	<1,000	f	<1 .3	16	3 .5(tr)	f	<1 .5	270	4 .1(tr)
	b	<1,000	<1,000	<1,000	b	12	31	18	b	6 .4	260	16
Pentabromodiphenylether		-	-	-		-	-	-		-	-	-
Hexabromobiphenyl		-	-	-		-	-	-		-	-	-
PFOS		-	-	-		-	-	-		-	-	-

Legend and Note to this Table
Unit is pg/g-wet.
tr = value less than Method Quantification Limit (MQL) but over than Method Detection Limit (MDL).
v = bivalves (*Mytilus edulis, Septifer virgatus* or *Mytilus coruscus).*
f = fish (*Hexagrammos otakii, H. lagocephalus, Cololabis saira, Lateolabrax japonicus, Acanthopagrus sivicolus* or *Tribolodon hakonensis*).
b = birds (*Strunus cineraceus* or *Larus crassirostris*).
mean = geographical mean assuming the data less than MDL as a half of MDL.

Table 2-2-3 Results of Other POPs Survey and Monitoring (Surface Water) during FY2002-2004

Surface Water	FY2002			FY2003			FY2004		
Substance	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Chlordecone	-	-	-	-	-	-	-	-	-
HCHs									
α-HCH	1 .9	6,500	84	13	970	120	13	5,700	150
β-HCH	24	1,600	210	14	1,700	250	31	3,400	260
γ-HCH	-	-	-	32	370	92	21	8,200	91
δ-HCH	-	-	-	1 .1(tr)	200	14	1 .4(tr)	670	24
Pentabromodiphenylether	-	-	-	-	-	-	-	-	-
Hexabromobiphenyl	-	-	-	<15	<15	<15	-	-	-
PFOS	70	24,000	1,400	-	-	-	-	-	-

Legend and Note to this Table
Unit is pg/L.
tr = value less than Method Quantification Limit (MQL) but over than Method Detection Limit (MDL).
mean = geographical mean assuming the data less than MDL as a half of MDL.

Table 2-2-4 Results of Other POPs Survey and Monitoring (Bottom Sediment) during FY2002-2004

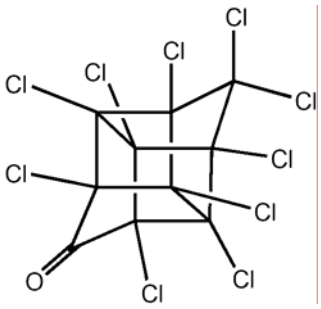
Bottom Sediment	FY2002			FY2003			FY2004		
Substance	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Chlordecone	-	-	-	-	-	-	-	-	-
HCHs									
α-HCH	2 .0	8,200	130	2	9,500	140	1 .5(tr)	5,700	140
β-HCH	3 .9	11,000	200	5	39,000	220	4	53,000	220
γ-HCH	-	-	-	1 .4(tr)	4,000	45	0 .8(tr)	4,100	46
δ-HCH	-	-	-	<0 .7	5,400	37	0 .5(tr)	5,500	48
Pentabromodiphenylether	-	-	-	-	-	-	50	50	50
Hexabromobiphenyl	-	-	-	<8 .7	<8 .7	<8 .7	-	-	-
PFOS	-	-	-	-	-	-	-	-	-

Legend and Note to this Table
Unit is pg/g-dry.
tr = value less than Method Quantification Limit (MQL) but over than Method Detection Limit (MDL).
mean = geographical mean assuming the data less than MDL as a half of MDL.

3. Assessment of survey and/or monitoring results

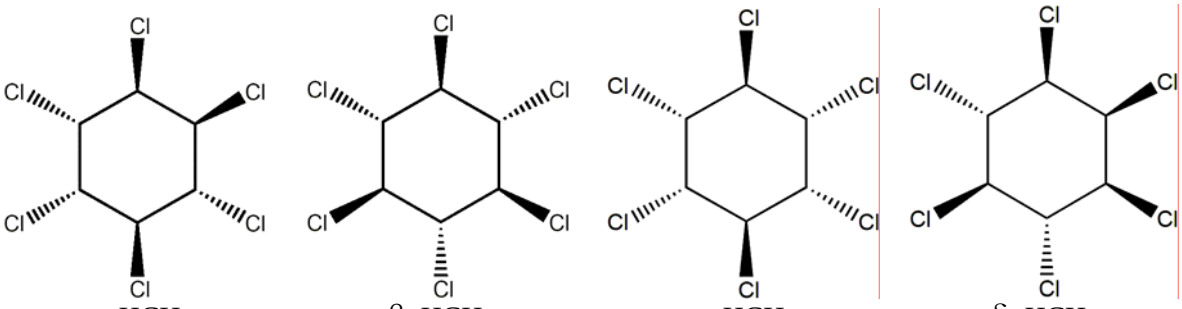
The "Environmental Survey and Monitoring of Chemicals" Programme covered in its surveys and/or monitorings the 5 substances proposed for listing in Annex A of Stockholm Convention and considered at the firest meeting of the POPRC – Pentabromodiphenyl ether, Chlordecone, Hexabromobiphenyl, HCHs and Perfluorooctane sulfonate (PFOS). Results and assessment of the environment survey and/or monitoring for each substance (group) are described below.

(1) Chlordecone



A survey of chlordecone in the environmental air was conducted in FY2003 for the first time in Japan. The detection limit was 0.5pg/m^3. The sampling was done at 1 site, and the substance was not detected. No surveys and/or monitoring has been done for chlordane for other matrices – wildlife, surface water nor bottom sediment – in the Programme.

(2) HCHs



α -HCH β -HCH γ -HCH δ -HCH

Atmospheric air and precipitation: The persistence of the substances has been monitored since FY2003. The persistent concentrations of the substances in the warm season of FY2004 were comparable to those in the warm season of FY2003, while the values in the cold season of FY2004 were comparable to those in the cold season of FY2003. In FY2004, the values were higher in warm season than in cold season, as also seen in FY2003, showing differences in persistent concentrations depending on monitoring seasons and meteorological conditions. Each of α-HCH, β-HCH, γ-HCH and δ-HCH had been detected in all the samples from all the monitoring sites, and their persistence was recognised in widespread areas.

Wildlife

Bivalves and fish: The substances had been detected in more than a half of the samples from most of the monitoring sites since FY2003, and their persistence was still recognised in widespread areas. Till FY2002, ideal detection limits for γ-HCH and δ-HCH were not achieved, thus both substances were not detected in FY2002.

Birds: α-HCH and β-HCH were detected in all the samples from all the monitoring sites in FY2002-FY2004, and their persistence was still recognised. No monitorings were conducted on γ-HCH and δ-HCH in FY2002 for the same reason as described in "Bivalves and fish" above. γ-HCH and δ-HCH were detected in all the samples from all the monitoring sites in FY2004 as well as in FY2003, and their persistence was recognised in widespread areas.

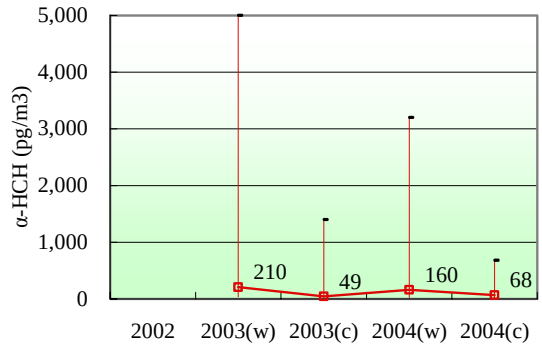
Surface water: The substances had been detected in all the samples from all the monitoring sites since FY2002 (since FY2003 for γ-HCH and δ-HCH), and their persistence was still recognised in widespread areas.

Bottom sediment: α-HCH and β-HCH had been detected in all the samples from all the monitoring sites since FY2002, and their persistence was still recognised in widespread areas.

γ-HCH and δ-HCH were detected in most of the samples from nearly all the monitoring sites in FY2003 and in all the samples from all the monitoring sites in FY2004. Their persistence was recognised in widespread areas.

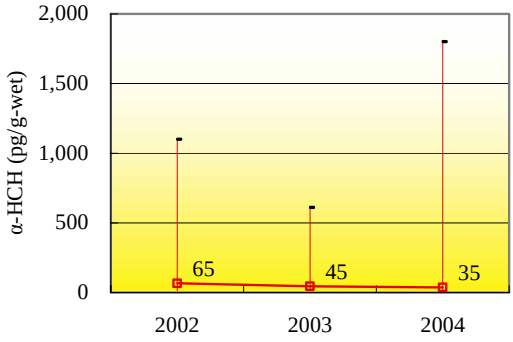
Figure 2-3-2-1 Detected Frequency and Detection Range of HCHs (α -HCH)

α-HCH (Air and Precipitation)



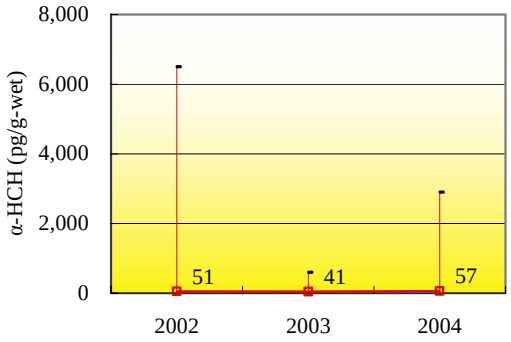
A	-	35/ 35	34/ 34	37/ 37	37/ 37

α-HCH (Wildlife/Bivalves)



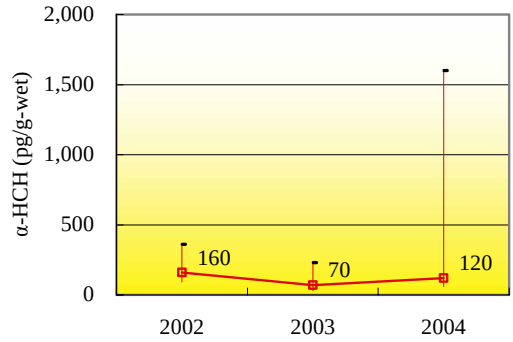
V	38/ 38	30 30	31 31

α-HCH (Wildlife/Fish)



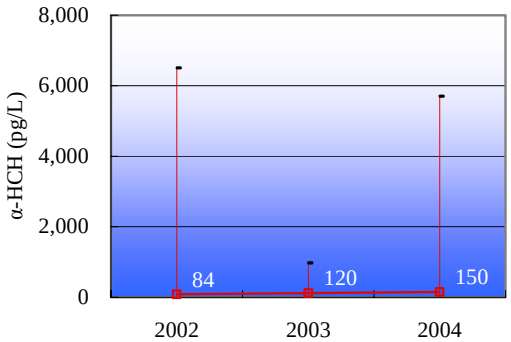
F	70/ 70	70/ 70	63/ 70

α-HCH (Wildlife/Birds)



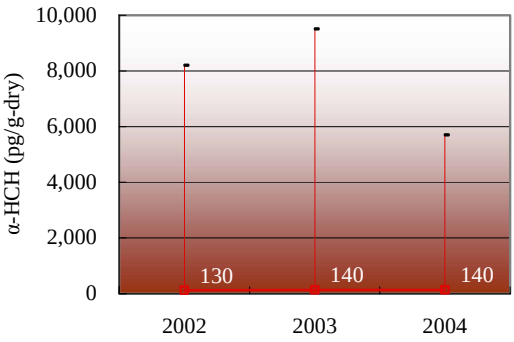
B	10/ 10	10/ 10	10/ 10

α-HCH (Surface Water)



W	114/ 114	36/ 36	38/ 38

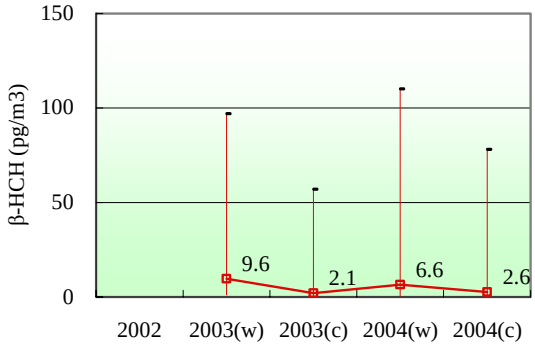
α-HCH (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189

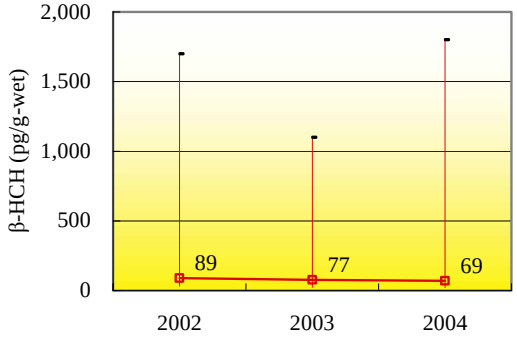
Figure 2-3-2-2 Detected Frequency and Detection Range of HCHs (β -**HCH**)

β-HCH (Air and Precipitation)



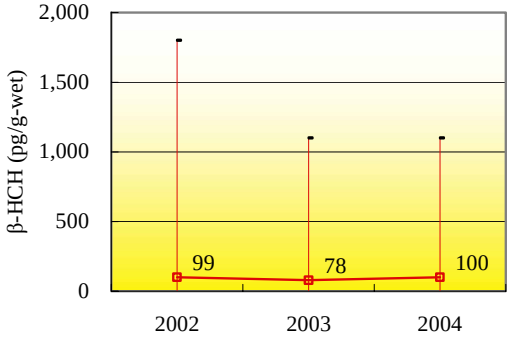
A	-	35/ 35	34/ 34	37/ 37	37/ 37

β-HCH(Wildlife/Bivalves)



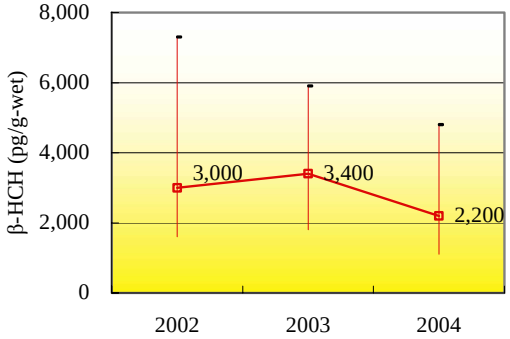
V	38/ 38	30/ 30	31/ 31	

β-HCH (Wildlife/Fish)



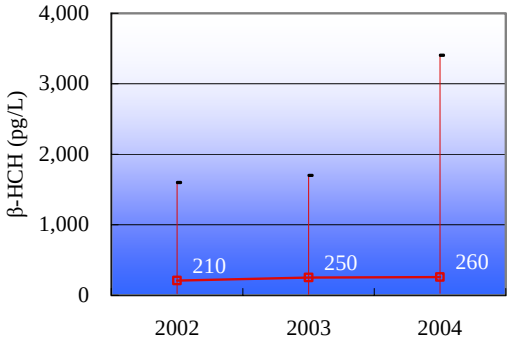
F	70/ 70	70/ 70	70/ 70	

β-HCH (Wildlife/Birds)



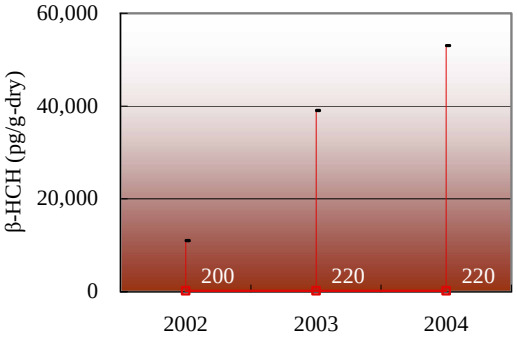
B	10/ 10	10/ 10	10/ 10	

β-HCH (Surface Water)



W	114/ 114	36/ 36	38/ 38	

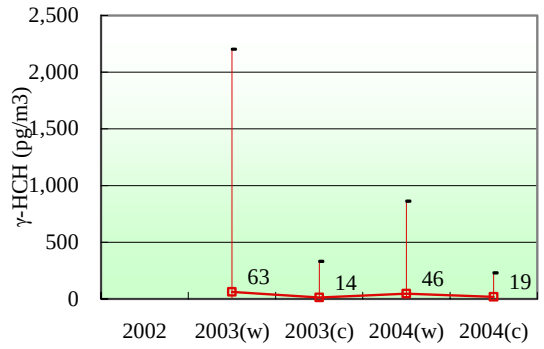
β-HCH (Bottom Sediment)



S	189/ 189	186/ 186	189/ 189	

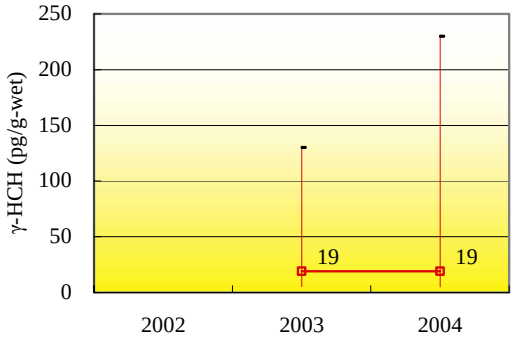
Figure 2-3-2-3 Detected Frequency and Detection Range of HCHs (**γ -HCH**)

γ-HCH (Air and Precipitation)



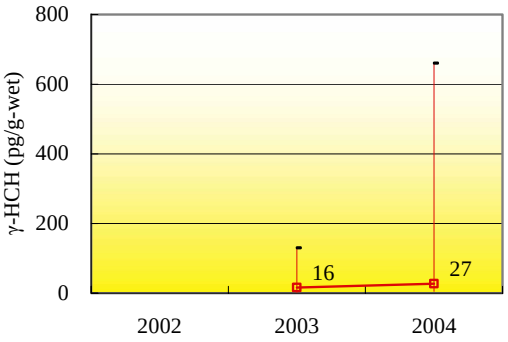
A	-	35/ 35	34/ 34	37/ 37	37/ 37

γ-HCH (Wildlife/Bivalves)



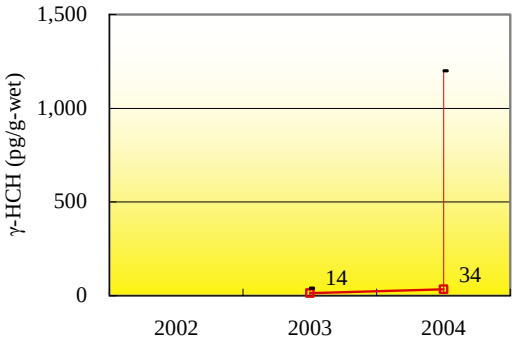
V	-	30/ 30	28/ 31

γ-HCH (Wildlife/Fish)



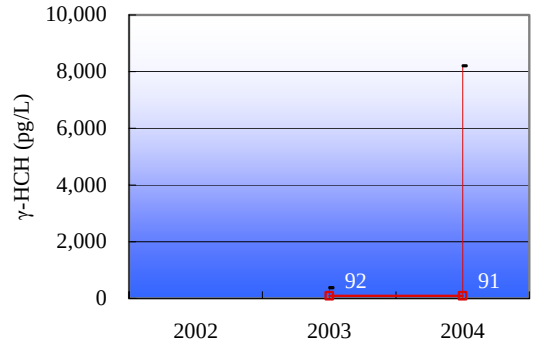
F	-	70/ 70	55/ 70

γ-HCH (Wildlife/Birds)



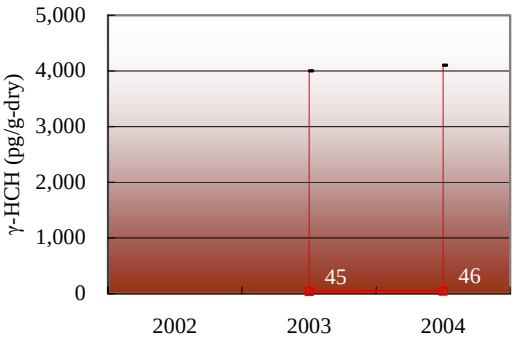
B	-	10/ 10	10/ 10

γ-HCH (Surface Water)



W	-	36/ 36	38/ 38

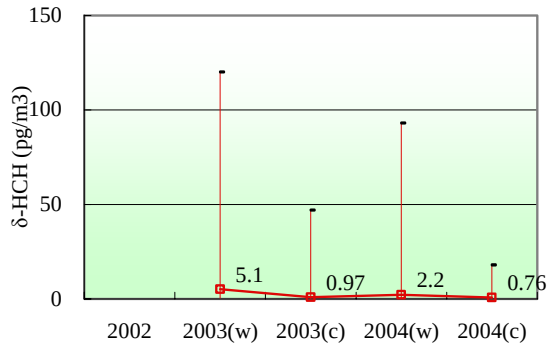
γ-HCH (Bottom Sediment)



S	-	186/ 186	189/ 189

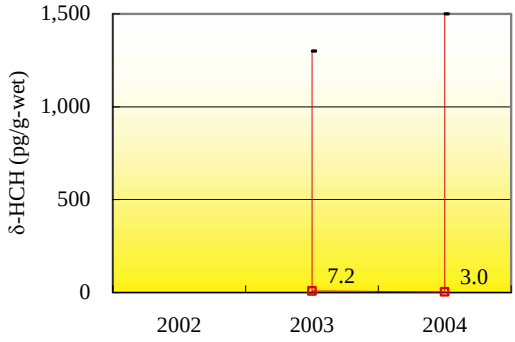
Figure 2-3-2-4 Detected Frequency and Detection Range of HCHs (δ -**HCH**)

δ-HCH (Air and Precipitation)



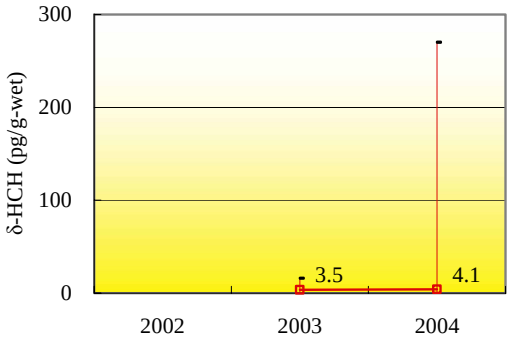
A	-	35/ 35	34/ 34	37/ 37	37/ 37

δ-HCH (Wildlife/Bivalves)



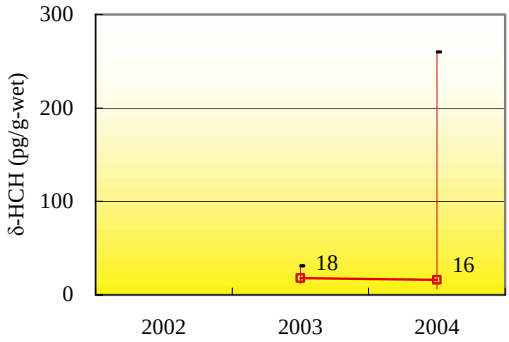
V	-	29/ 30	25/ 31

δ-HCH (Wildlife/Fish)



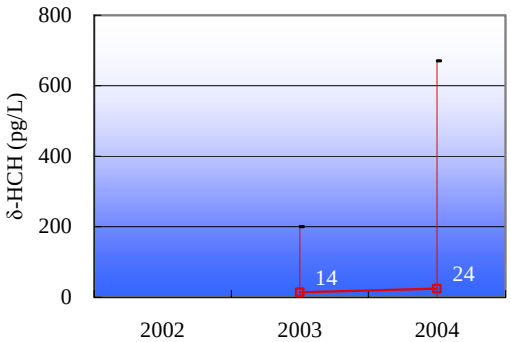
F	-	59/ 70	54/ 70

δ-HCH (Wildlife/Birds)



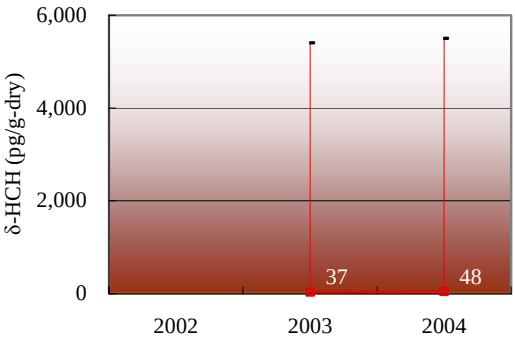
B	-	10/ 10	10/ 10

δ-HCH (Surface Water)



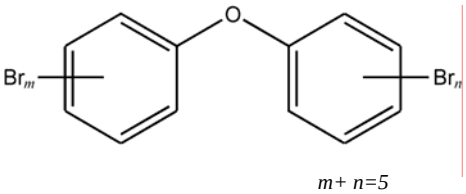
W	-	36/ 36	38/ 38

δ-HCH (Bottom Sediment)



S	-	180/ 186	189/ 189

(3) **Pentabromodiphenyl ether**



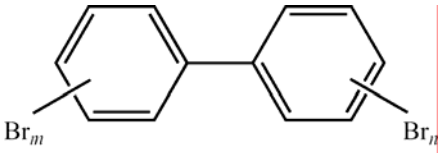
m+ n=5

Atmospheric air and precipitation: A survey was conducted in FY2001 with a detection limit of 0.09 pg/m^3, and the substance was detected at all of the surveyed sites (12 sites) with a detection range between 0.10-9.3 pg/m^3. The survey conducted in FY2004 with a detection limit of 0.06 pg/m^3 detected the substance at all of the surveyed sites (3 sites) with a detection range between 0.35-5.4 pg/m^3. The persistence levels of the substance were comparable to the previous data.

Bottom sediment: A Survey of the substance in bottom sediment was conducted for the first time in FY2004 with a detection limit of 0.035 ng/g-dry, and the substance was detected at one of the four survey sites with a detection value of 0.050 ng/g-dry.

Pentabromodiphenyl ether has not been surveyed nor monitored for other media – wildlife and bottom sediment in the "Environmental Survey and Monitoring of Chemicals" Programme.

(4) **Hexabromobiphenyl**



m+n=6

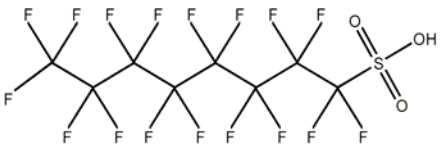
Atmospheric air and precipitation: A survey of this substance in the environmental air was conducted for the first time in FY2004 with a detection limit of 0.25 pg/m^3. The substance was not detected at the surveyed site (1 site only).

Surface water: A survey for hexabromobiphenyl in the surface water was conducted in FY2003. The detection limit was15pg/L. The substance was not detected any of the surveyed sites (4sites).

Bottom sediment: A Survey of the substance in bottom sediment was conducted in FY2003 with a detection limit of 8,700 pg/g-dry, and the substance was not detected at any of the two surveyed sites.

Hexabromobiphenyl has not been surveyed mor monitored for biota in the "Environmental Survey and Monitoring of Chemicals" Programme.

(5) **PFOS**

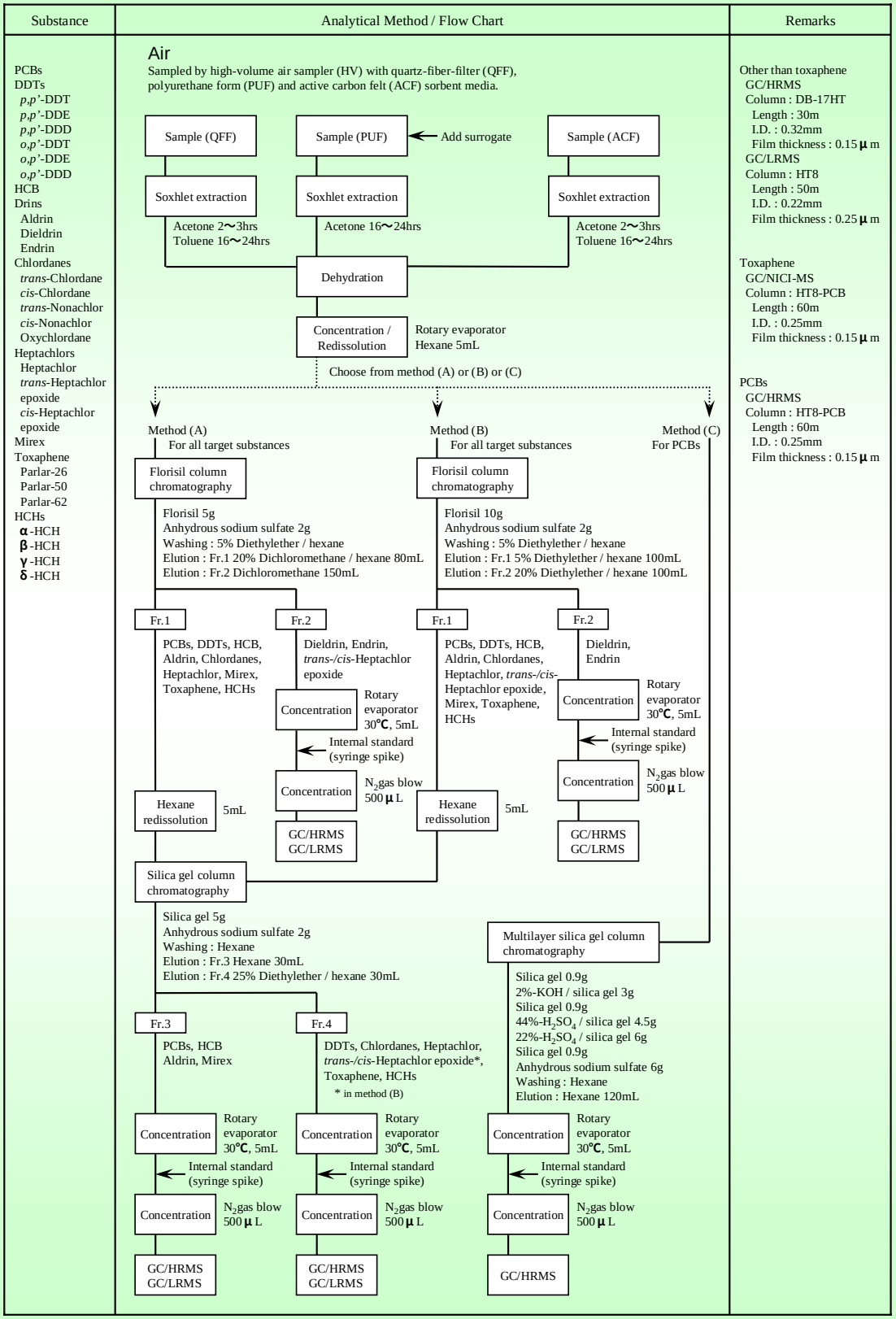


Atmospheric air and precipitation: This was the first survey to investigate the substance persisting in atmospheric air. The survey was conducted with a detection limit of 0.09 pg/m^3, and the substance was detected in 57 of the 60 samples from all the 20 survey sites, with a maximum detection concentration of 44 pg/m^3.

Surface water: A survey for PFOS in the surface water, which was the first environmental survey/monitoring for the substance in Japan, was conducted in FY2002. The detection limit was 40 ng/L. The substance was detected at all the surveyed sites (20 sites). Maximum concentration was 24,000pg/L.

PFOS has not been surveyed nor monitored for biota and bottom sediment in the "Environmental Survey and Monitoring of Chemicals" Programme.

Appendix Analytical Methods for “12 POPs” Monitoring



Substance	Analytical Method / Flow Chart	Remarks
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs **α**-HCH **β**-HCH **γ**-HCH **δ**-HCH	**Wildlife (1)** Method (A) For all target substances Sample — 20g (wet base) Dehydration / grinding — Anhydrous sodium sulfate ← Add surrogate Soxhlet extraction — Dichloromethane 6hrs Dehydration — Anhydrous sodium sulfate Concentration / Redissolution — Rotary evaporator Hexane, 5〜20mL Choose from method (A-1) or (A-2) or (A-3) **Method (A-1)** Florisil column chromatography Florisil 5g Anhydrous sodium sulfate 2g Washing : 5% Diethylether / hexane Elution : Fr.1 20% Dichloromethane / hexane 80mL Elution : Fr.2 Dichloromethane 150mL Fr.1 — PCBs, DDTs, HCB, Aldrin, Chlordanes, Heptachlor, Mirex, Toxaphene, HCHs Hexane redissolution — 5mL Fr.2 — Dieldrin, Endrin, *trans-/cis*-Heptachlor epoxide Concentration — Rotary evaporator 30℃, 5mL ← Internal standard (syringe spike) Concentration — N_2gas blow 500 μL GC/HRMS GC/LRMS **Method (A-2)** Florisil column chromatography Florisil 10g Anhydrous sodium sulfate 2g Washing : 5% Diethylether / hexane Elution : Fr.1 5% Diethylether / hexane 100mL Elution : Fr.2 20% Diethylether / hexane 100mL Fr.1 — PCBs, DDTs, HCB, Aldrin, Chlordanes, Heptachlor, *trans-/cis*-Heptachlor epoxide, Mirex, Toxaphene, HCHs Hexane redissolution — 5mL Fr.2 — Dieldrin, Endrin Concentration — Rotary evaporator 30℃, 5mL ← Internal standard (syringe spike) Concentration — N_2gas blow 500 μL GC/HRMS GC/LRMS Silica gel column chromatography Silica gel 5g Anhydrous sodium sulfate 2g Washing : Hexane Elution : Fr.3 Hexane 30mL Elution : Fr.4 25% Diethylether / hexane 30mL Fr.3 — PCBs, HCB, Aldrin, Mirex Concentration — Rotary evaporator 30℃, 5mL ← Internal standard (syringe spike) Concentration — N_2gas blow 500 μL GC/HRMS GC/LRMS Fr.4 — DDTs, Chlordanes, Heptachlor, *trans-/cis*-Heptachlor epoxide*, Toxaphene, HCHs * in method (A-2) Concentration — Rotary evaporator 30℃, 5mL ← Internal standard (syringe spike) Concentration — N_2gas blow 500 μL GC/HRMS GC/LRMS **Method (A-3)** Multilayer silica gel column chromatography Silica gel 0.9g 2%-KOH / silica gel 3g Silica gel 0.9g 44%-H_2SO_4 / silica gel 4.5g 22%-H_2SO_4 / silica gel 6g Silica gel 0.9g Anhydrous sodium sulfate 6g Washing : Hexane Elution : Hexane 120mL Concentration — Rotary evaporator 30℃, 5mL ← Internal standard (syringe spike) Concentration — N_2gas blow 500 μL GC/HRMS	Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15 μm GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25 μm Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 μm PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 μm

Substance	Analytical Method / Flow Chart	Remarks

Wildlife (2)

PCBs
DDTs
p,p'-DDT
p,p'-DDE
p,p'-DDD
o,p'-DDT
o,p'-DDE
o,p'-DDD
HCB
Drins
Aldrin
Dieldrin
Endrin
Chlordanes
trans-Chlordane
cis-Chlordane
trans-Nonachlor
cis-Nonachlor
Oxychlordane
Heptachlors
Heptachlor
trans-Heptachlor epoxide
cis-Heptachlor epoxide
Mirex
Toxaphene
Parlar-26
Parlar-50
Parlar-62
HCHs
α-HCH
β-HCH
γ-HCH
δ-HCH

Method (B) For all target substances

Sample — 20g (wet base)
Add surrogate
Homogenizer extraction — 33% Acetone / hexane 80mL, 2min
Shaft of homogenizer
Washing — 33% Acetone / hexane 20mL
Centrifugal separation — 2500rpm, 5min
residual
Extract
Shaking — Purified water 200mL, Slowly
Still standing
Hexane phase / Aqueous phase
Shaking — Purified water 100mL, Slowly
Still standing
Hexane phase / Aqueous phase
Dehydration — Anhydrous sodium sulfate
Concentration — Rotary evaporator, Hexane 5mL
Choose from method (B-1) or (B-2)

Homogenizer extraction — 33% Acetone / hexane 100mL, 2min
Centrifugal separation — 2500rpm, 5min

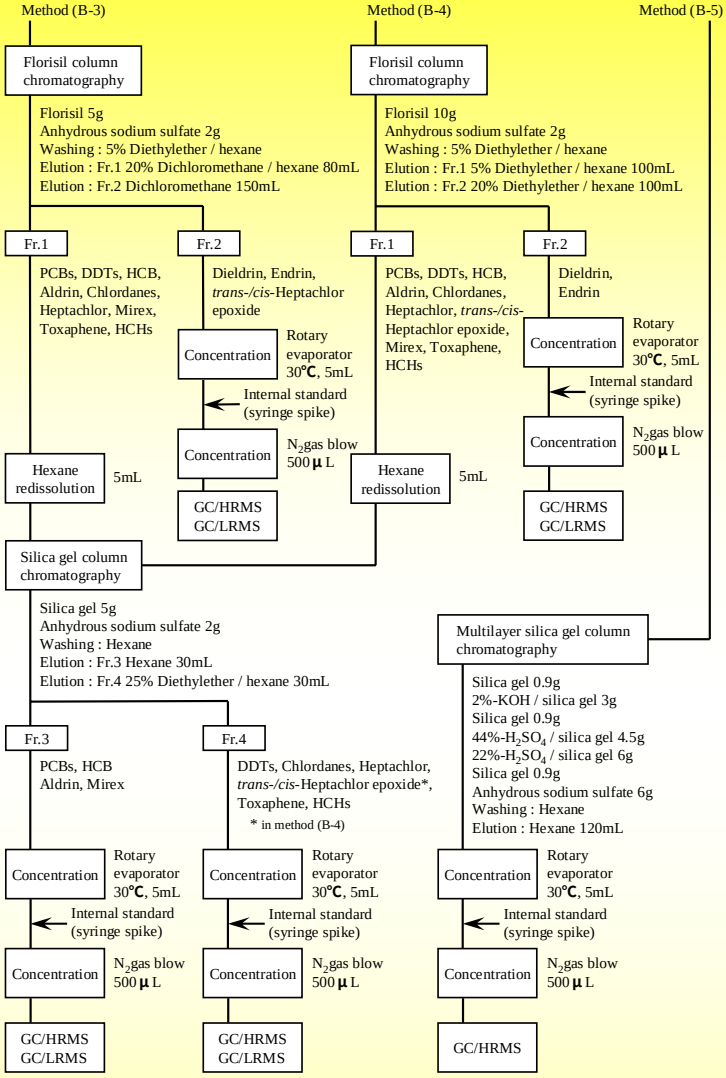
Method (B-2)*
* There is a possibility of decreasing HCB recovery rate.
Shaking — Saturated acetonitrile with hexane 50mL, 5min
Still standing — 5min
Acetonitrile phase / Hexane phase
Shaking — Saturated acetonitrile with hexane 50mL, 5min
Still standing — 5min
Acetonitrile phase / Hexane phase
Shaking — 2% NaCl 500mL, Hexane 50mL, 5min
Still standing — 5min
Hexane phase / Aqueous phase
Shaking — Hexane 50mL, 5min
Still standing — 5min
Hexane phase / Aqueous phase
Dehydration — Anhydrous sodium sulfate
Concentration — Rotary evaporator, Hexane 5mL

Method (B-1)
Gel permeation chromatography
BioBeads S-X3 50g
50% Dichloromethane / cyclohexane
5mL/min
Concentration — Rotary evaporator, Hexane 5mL
Choose from method (B-3) or (B-4) or (B-5)

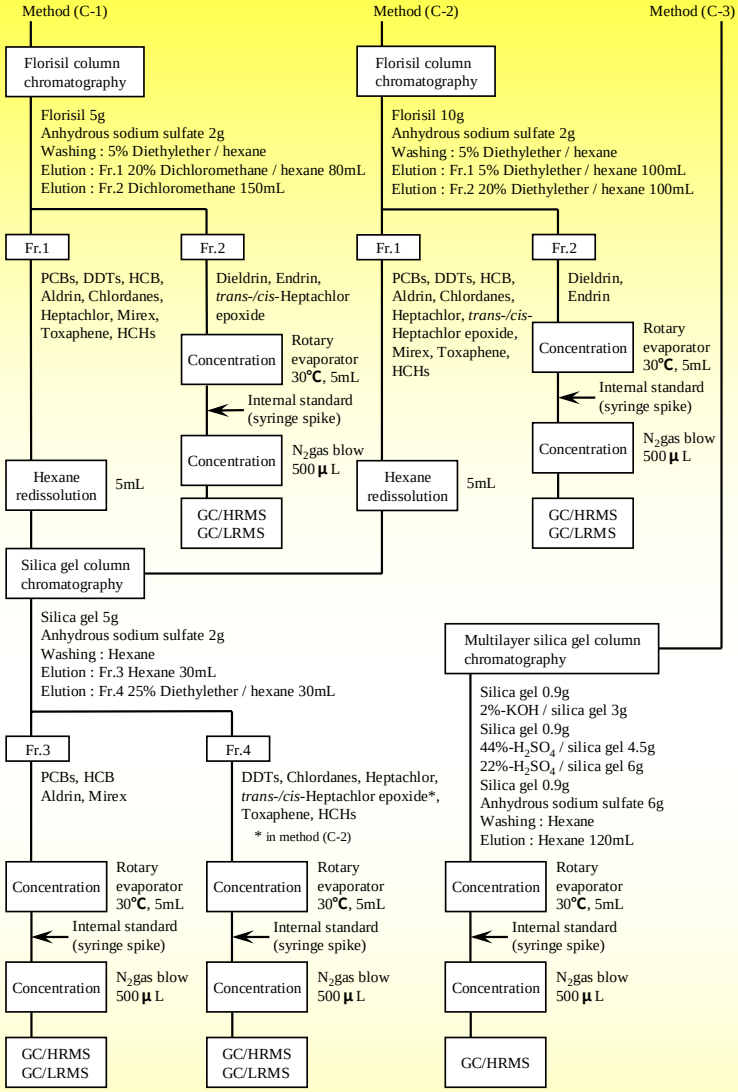
Other than toxaphene
GC/HRMS
Column : DB-17HT
Length : 30m
I.D. : 0.32mm
Film thickness : 0.15 μm
GC/LRMS
Column : HT8
Length : 50m
I.D. : 0.22mm
Film thickness : 0.25 μm

Toxaphene
GC/NICI-MS
Column : HT8-PCB
Length : 60m
I.D. : 0.25mm
Film thickness : 0.15 μm

PCBs
GC/HRMS
Column : HT8-PCB
Length : 60m
I.D. : 0.25mm
Film thickness : 0.15 μm

Substance	Analytical Method / Flow Chart	Remarks
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs **α**-HCH **β**-HCH **γ**-HCH **δ**-HCH	Wildlife (3)  	Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15μm GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25μm Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15μm PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15μm

Substance	Analytical Method / Flow Chart	Remarks
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs **α**-HCH **β**-HCH **γ**-HCH **δ**-HCH	Wildlife (4) Method (C) For PCBs Sample — 20g (wet base) Add surrogate alkaline degradation — 1.2mol/L KOH / ethanol 50mL, 12hrs at room temperature or 1hr at 80°C Liquid solution / Residual Washing — 50% Ethanol / hexane 20ml, Hexane 30mL, Hexane 50mL Filtration — Glass fiber filter Filtrate Transfer — 500mL separating funnel Shaking — Purified water 100mL, 10min Still standing Hexane phase / Aqueous phase Shaking — Hexane 50mL Extract Shaking — Concentrated sulfuric acid 10mL Still standing Remove sulfuric acid phase — Repeat until color of hexane phase fade out and sulfuric acid phase become clear Shaking — Saturated NaCl solution, Equal amount of hexane Still standing Remove aqueous phase — Repeat 3times Dehydration — Anhydrous sodium sulfate Concentration — Rotary evaporator 30°C, 3mL Choose from method (C-1) or (C-2) or (C-3)	Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15 μm GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25 μm Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 μm PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 μm

Substance	Analytical Method / Flow Chart	Remarks
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs **α**-HCH **β**-HCH **γ**-HCH **δ**-HCH	Wildlife (5)  	Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15μm GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25μm Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15μm PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15μm

Substance	Analytical Method / Flow Chart	Remarks
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs **α**-HCH **β**-HCH **γ**-HCH **δ**-HCH	Surface water (1) Sample — 10L Add surrogate Filtration / Solid phase extraction — Filter : GMF150 (Pore size : 2 **μ** m) Extraction disc : C18(FF) Choose from method (A) or (B) Sample container Washing — Dichloromethane 100mL, twice Dehydration / Concentration — Anhydrous sodium sulfate Hexane redissolution Method (A) Pressurized Fluid Extraction — Acetone, twice Toluene, twice Method (B) Elution — Methanol 10mL, 3times Acetone 10mL, 3times Toluene 10mL, 3times Ultrasonic extraction — Acetone 50mL 20min, 3times Dehydration — Anhydrous sodium sulfate Concentration / Redissolution — Rotary evaporator Hexane 5mL Choose from method (D) or (E) or (F) Method (D) Method (E) Method (F)	Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15 **μ** m GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25 **μ** m Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 **μ** m PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 **μ** m

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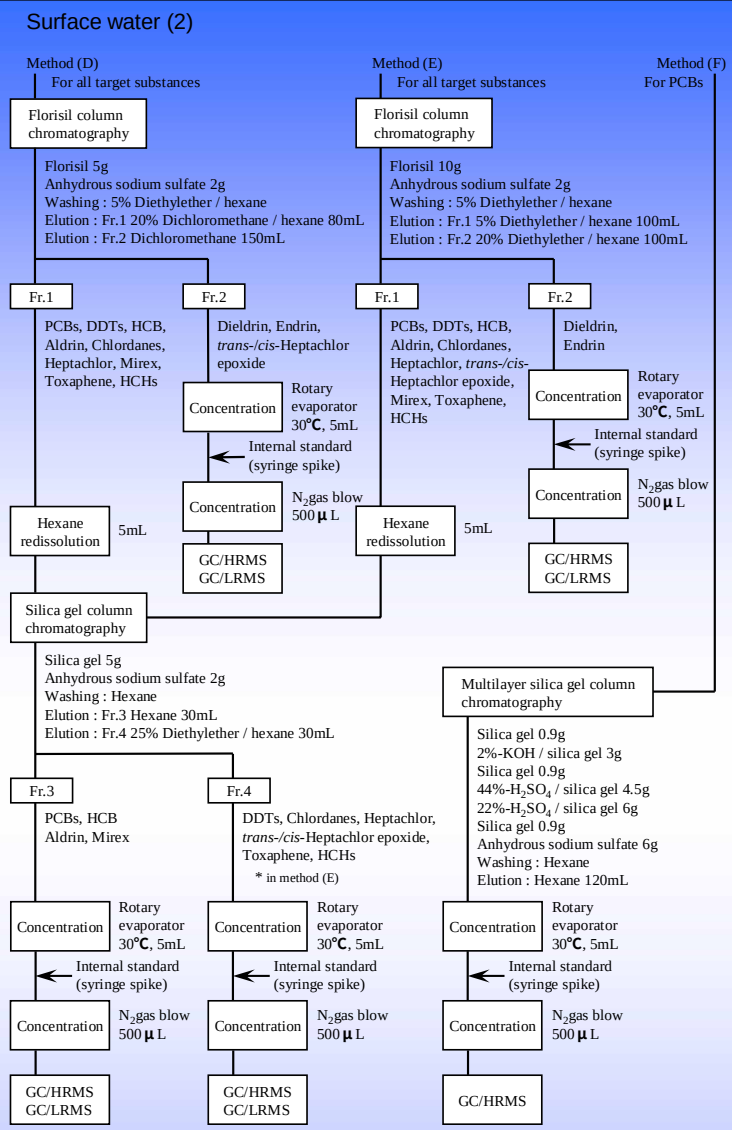
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs **α**-HCH **β**-HCH **γ**-HCH **δ**-HCH		Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15 μm GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25 μm Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 μm PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 μm

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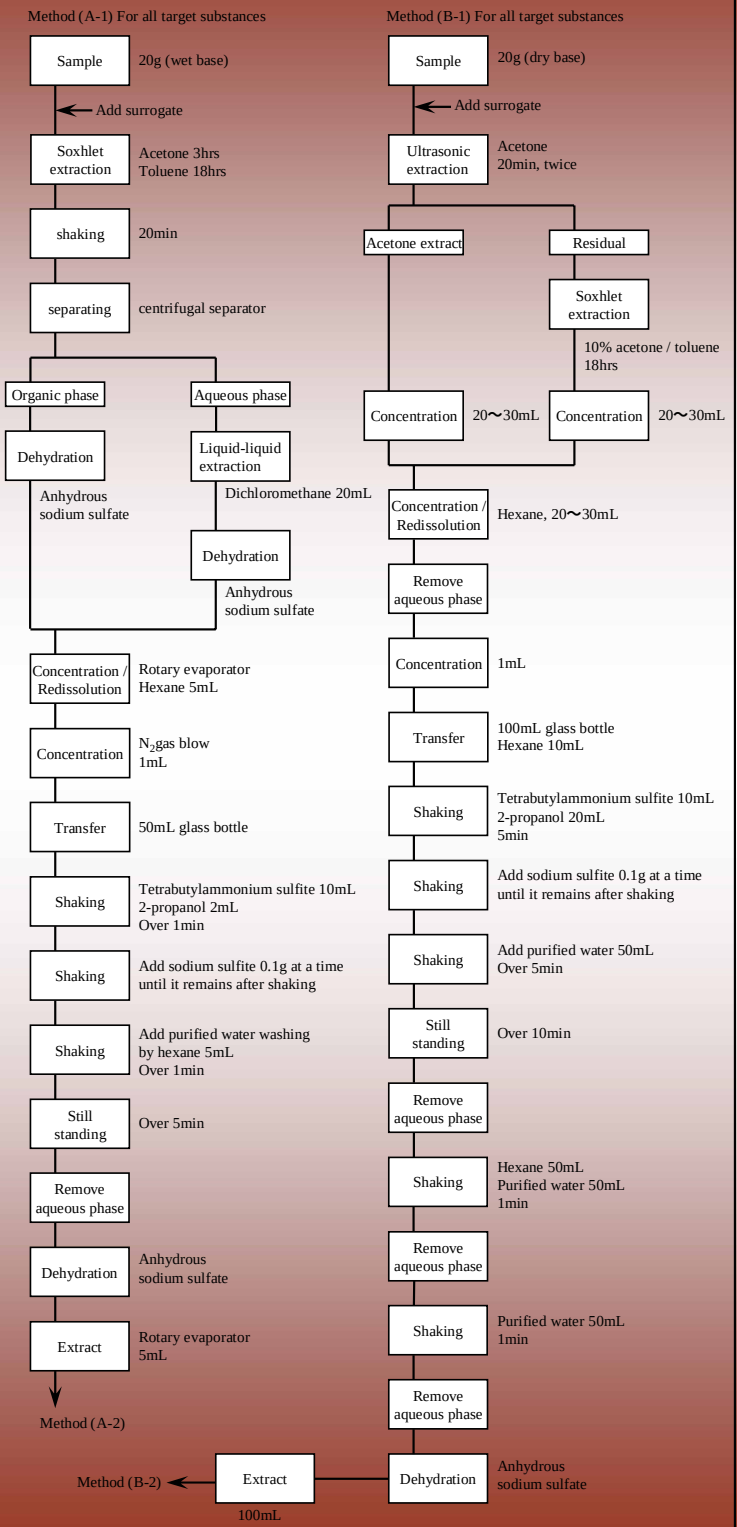
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs **α**-HCH **β**-HCH **γ**-HCH **δ**-HCH	**Bottom sediment (1)**  	Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15 μm GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25 μm Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 μm PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 μm

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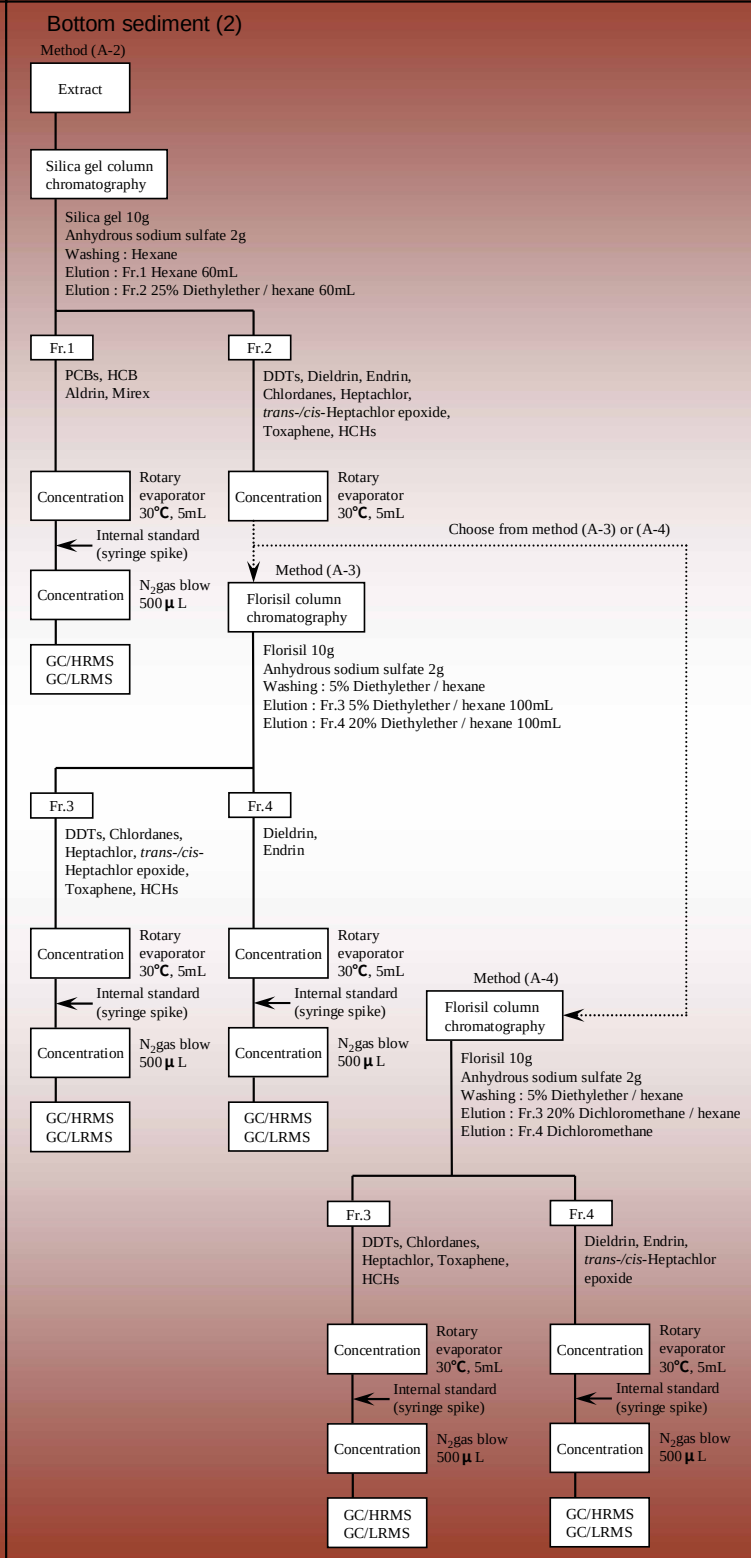
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs α-HCH β-HCH γ-HCH δ-HCH		Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15μm GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25μm Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15μm PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15μm

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PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs **α**-HCH **β**-HCH **γ**-HCH **δ**-HCH	**Bottom sediment (3)** Method (B-2) Extract Aliquot of 1/2 — 50mL Multilayer silica gel column chromatography 50%-H_2SO_4 / silica gel 5g Anhydrous sodium sulfate 2g Washing : Hexane Elution : Hexane 200mL PCBs, HCB, Mirex, DDTs, Chlordanes, HCHs and the others Concentration ← Internal standard (syringe spike) Concentration — 500 **μ** L GC/HRMS GC/LRMS Aliquot of 1/4 — 25mL Silica gel column chromatography Silica gel 10g Anhydrous sodium sulfate 2g Washing : Hexane Elution : 5% Diethylether / hexane 100mL Concentration / Redissolution — Hexane 1mL Carbon column chromatography ENVI-carb 250mg Washing : Hexane Elution : Hexane 10mL Aldrin, Dieldrin, Endrin, *trans-/cis*-Heptachlor epoxide and the others Concentration ← Internal standard (syringe spike) Concentration — 50 **μ** L GC/HRMS GC/LRMS	Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15 **μ** m GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25 **μ** m Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 **μ** m PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15 **μ** m

Substance	Analytical Method / Flow Chart	Remarks
PCBs DDTs *p,p'*-DDT *p,p'*-DDE *p,p'*-DDD *o,p'*-DDT *o,p'*-DDE *o,p'*-DDD HCB Drins Aldrin Dieldrin Endrin Chlordanes *trans*-Chlordane *cis*-Chlordane *trans*-Nonachlor *cis*-Nonachlor Oxychlordane Heptachlors Heptachlor *trans*-Heptachlor epoxide *cis*-Heptachlor epoxide Mirex Toxaphene Parlar-26 Parlar-50 Parlar-62 HCHs α-HCH β-HCH γ-HCH δ-HCH	**Bottom sediment (4)** Method (C) For PCBs Sample — 20g (wet base) Add surrogate alkaline degradation — 1.2mol/L KOH / ethanol 50mL, 12hrs at room temperature or 1hr at 80℃ Liquid solution / Residual Washing — 50% Ethanol / hexane 20ml, Hexane 30mL, Hexane 50mL Filtration — Glass fiber filter Filtrate Transfer — 500mL separating funnel Shaking — Purified water 100mL, 10min Still standing Hexane phase / Aqueous phase Shaking — Hexane 50mL Extract Shaking — Concentrated sulfuric acid 30mL Still standing Remove sulfuric acid phase — Repeat until color of hexane phase fade out and sulfuric acid phase become clear Shaking — Saturated NaCl solution, Equal amount of hexane Still standing Remove aqueous phase — Repeat 3times Dehydration — Anhydrous sodium sulfate Concentration — Rotary evaporator 30℃, 3mL Multilayer silica gel column chromatography Silica gel 0.9g 2%-KOH / silica gel 3g Silica gel 0.9g 44%-H_2SO_4 / silica gel 4.5g 22%-H_2SO_4 / silica gel 6g Silica gel 0.9g Anhydrous sodium sulfate 6g Washing : Hexane Elution : Hexane 120mL Concentration — Rotary evaporator 30℃, 5mL Internal standard (syringe spike) Concentration — N_2gas blow 500μL GC/HRMS	Other than toxaphene GC/HRMS Column : DB-17HT Length : 30m I.D. : 0.32mm Film thickness : 0.15μm GC/LRMS Column : HT8 Length : 50m I.D. : 0.22mm Film thickness : 0.25μm Toxaphene GC/NICI-MS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15μm PCBs GC/HRMS Column : HT8-PCB Length : 60m I.D. : 0.25mm Film thickness : 0.15μm