CHEMICALS
IN THE ENVIRONMENT

Report on Environmental Survey and Monitoring
of Chemicals in FY2004

Environmental Health Department
Ministry of the Environment
Government of JAPAN

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Substance

BHC (HCH)	Benzenehexachloride (Hexachloro cyclohexane)
CFC	Chlorine fluorine carbons
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
HCB	Hexachlorobenzene
PBDD	Polybrominated dibenzo-*p*-dioxin
PBDE	Polybrominated diphenyl ether
PBDF	Polybrominated dibenzofuran
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-*p*-dioxin
PCDF	Polychlorinated dibenzofuran
TBT, DBT	Tributyltin compounds, dibutyltin compounds
TPT, DPT, MPT	Triphenyltin compounds, diphenyltin compounds, monophenyltin compounds

Other

CAS RN	CAS (Chemical Abstracts Service) Registry Number
FY	Fiscal Year (from April to March)
GC/MS	Gas Chromatography / Mass Spectrometry
LC/MS	Liquid Chromatography / Mass Spectrometry
DL, QL	Reporting Detection Limit, Reporting Quantitation Limit (used in Chapter 4)
MOE	Ministry of the Environment, Government of JAPAN
ND	Not Detected
OECD	Organisation for Economic Co-operation and Development
POPs	Persistent Organic Pollutants
PRTR	Pollutant Release and Transfer Register

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Chemicals in the Environment

Introduction

The number of industrially produced chemical substances is estimated to be in the tens of thousands. Chemical substances have become indispensable in our daily lives, but they may also affect human health and the ecosystem, depending on the method employed for their production, use and disposal. Indeed, dioxins, PCBs, endocrine disruptors and other substances have caused serious social problems.

The Ministry of the Environment (MOE), Government of Japan, has been conducting successive investigations on the persistence of chemical substances in the general environment since 1974 and has published the results in "Chemicals in the Environment." The results of environmental surveys of FY2003 are compiled in "Chemicals in the Environment (FY2004)." We hope that those concerned with this issue will utilize this report and that the information provided will be helpful for the environmental preservation of this country.

Scope of investigation included in this report

As a method for selecting target substances, the following three types of surveys, each with their own purpose, were introduced so that the survey results could be effectively utilized for measures against chemical substances in the environment.

Initial Environmental Survey for grasping the status of environmental persistence of chemical substances and others, targeting the Designated Chemical Substances by the Law Concerning the Examination and Manufacture, etc. of Chemical Substances (hereinafter called the Chemical Substances Control Law), candidate substances for the PRTR System, unintentionally formed substances, and the substances required by social factors.

Environmental Survey for Exposure Study for grasping the exposure amount of chemical substances to humans and wildlife, which is necessary for the environmental risk assessment.

Monitoring Investigation for monitoring target substances included in the Stockholm Convention on Persistent Organic Pollutants (hereinafter called the POPs Treaty) and other substances that are possible candidates for target substances of the Treaty; highly persistent substances for which environmental standards are not yet established but grasping their annual environmental status is required from among Class 1 & 2 Specified Chemical Substances and Designated Chemical Substances specified in the Chemical Substances Control Law.

To avoid duplication, the results of chemical substances (dioxins, etc.) that have been monitored by other divisions of MOE are not included in this report (see below).

Environmental Investigation by Other Divisions of MOE

Name of Investigation	*Media*	*Target Chemical Substances*
Monitoring Investigation of Hazardous Air Pollution Substances	Air	Benzene, Aldehydes, Mercury and its compounds, Benzo[*a*]pyrene, etc. (19 species)
Water Quality Monitoring	Surface water, Ground water	Cadmium, Total Cyanogens, etc.
Environmental Investigation on Agrochemicals	Soil, Agricultural products, Air, Surface water	Pesticides
Monitoring of the Precautionary Monitoring Targets	Surface water, Ground water	Chloroform, *trans*-1,2-Dichloroethylene, etc.
Priority Substances for the Survey on Method and Monitoring	Water environment	Zinc, etc.
Investigation of Dioxins	Air, Surface water, Bottom sediment, Soil, Wildlife	PCDDs, PCDFs, Coplanar PCBs, PBDDs, PBDFs

Chapter 1 Outline of Environmental Investigation on the Status of Pollution by Chemical Substances

1. History of the General Inspection Survey

The Chemical Substance Control Law (see Table 1-1 and Appendix A) was enacted in 1973 and in response to the law, the Environment Agency of Japan (the former MOE) initiated successive environmental safety inspections, namely the General Inspection Survey of Chemical Substances on Environmental Safety, for the purpose of grasping the persistence of existing chemical substances in the general environment. In the First (FY1979-1988) and Second Comprehensive Survey of Chemical Substances on Environmental Safety, a total of about 800 substances were selected from among the Priority List (First term: about 2,000, Second term: about 1,100 substances). In addition to the above, Wildlife Monitoring, Follow-up Survey of the Status of Pollution by Unintentionally Formed Chemical Substances, and Monitoring of Surface Water and Bottom Sediment had been undertaken.

In the intervening time, in order to correspond to status change relating to the chemical substances and environmental issues such as the enactment of the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvement Their Management (hereinafter called the PRTR Law), effectuation of the POPs Treaty and efforts to address the endocrine disruptor issue, as well as to cope with the current political issues, it became necessary to reconstruct the survey system based on the new standpoint. Thus, revision work on the survey policy was initiated in FY2001 and the Revision of the General Inspection Survey of Chemical Substances was approved at the Special Committee for the Assessment of Chemical Substances, Central Environment Council held on May 2002.

Surveys have been conducted since FY2002 based on the revision policy, where substances were selected by the Expert Group on Substance Selection (in the General Inspection Survey) corresponding to the needs of various divisions of governmental and other organizations so that the survey results might be utilized for the prevention of pollution by chemical substances in the environment. These surveys have been carried out using methods suitable for the respective purposes of the Initial Environmental Survey, the Environmental Survey for Exposure Study and the Monitoring Investigation.

Table 1-1 Outline of the Chemical Substances Control Law (see also Appendix A)

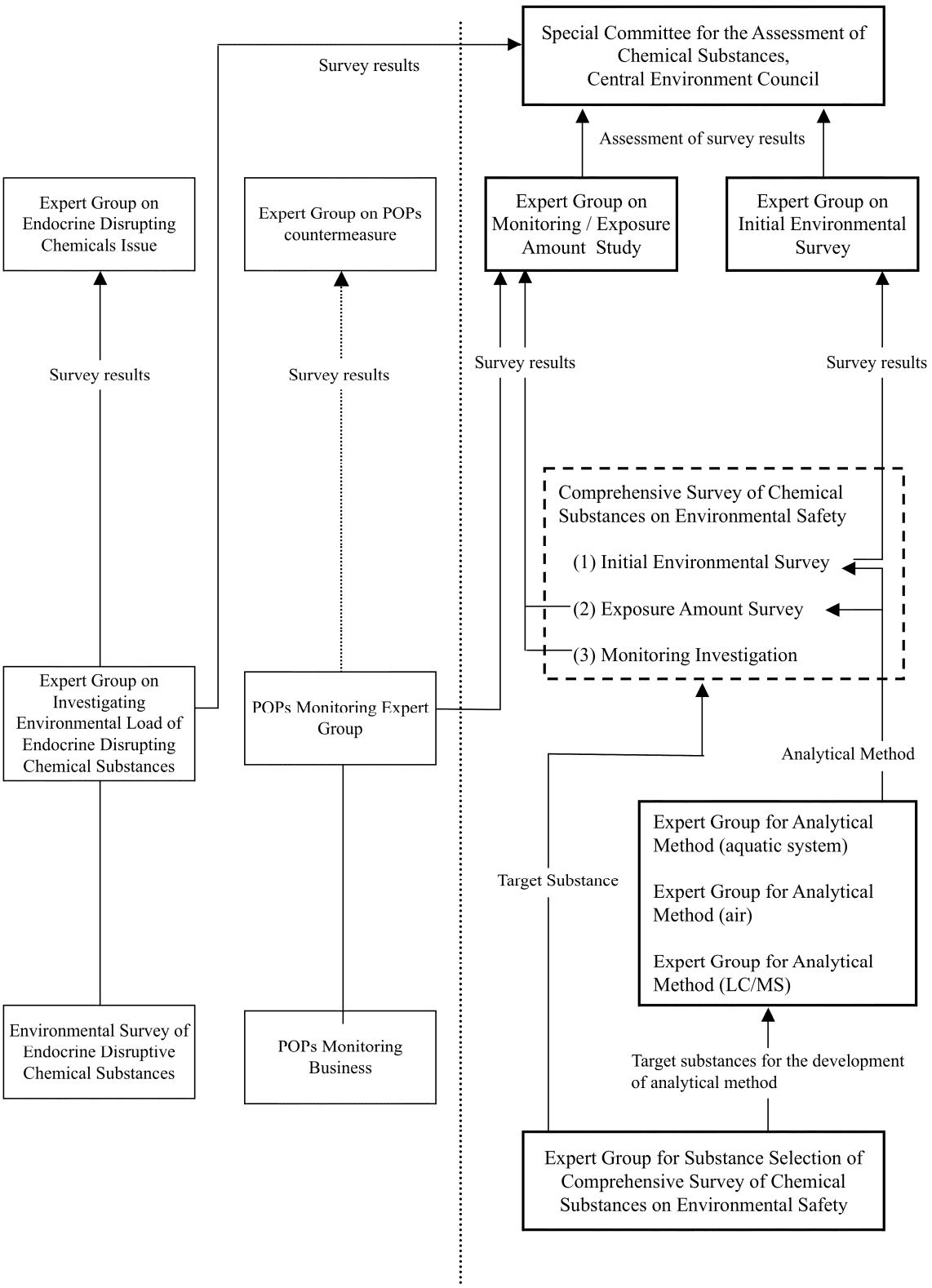
Enactment (amendment): 1973 (1986)

Purpose: 1) Prevention of environmental pollution by chemical substances that are not readily degradable and have the potential to affect human health;

2) Enactment of necessary regulations on the production, import, and use of new chemical substances in response to the examination of their characteristics**.**

Contents: Regulation (substantial prohibition) on production and import of "Class 1 Specified Chemical Substances" that are not readily biodegradable, are highly accumulative and chronically toxic. Regulation (notification of production, import amount, etc.) on production and import of hardly biodegradable and chronically toxic "Class 2 Specified Chemical Substances", and regulation (report of production, import amount, etc.) on "Designated Chemical Substances" that are hardly degradable and suspected as being chronically toxic.

Figure 1-1 System of the Expert Groups for the FY2003 General Inspection Survey of Chemical Substances

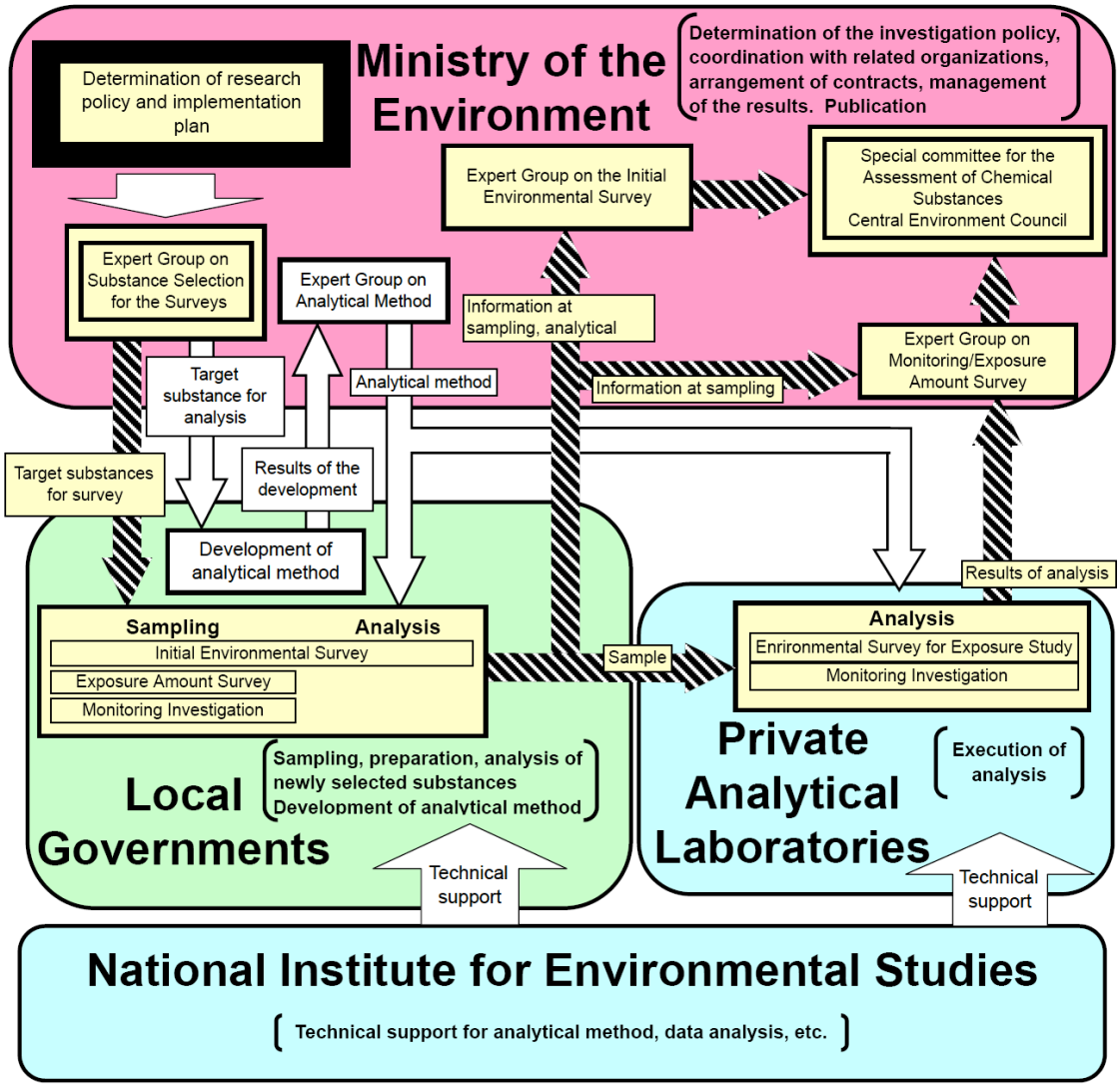


2. FY2003 Expert Group on Substance Selection for the General Inspection Survey

In May 2003, meetings of the Expert Group on Substance Selection were held for the purpose of discussing and selecting target substances, requested from various divisions of governmental organizations, and other substances recommended by scholars and practitioners as substances for which investigation is necessary, based on toxicity information; PRTR data and, if possible, prediction results of environmental persistence; feasibility of establishing analytical methods; and from the standpoint of social and administrative needs.

Survey media was also discussed and selected at the meeting, taking into consideration the relationship between the possible exposure route and media, for instance, selecting multiple media for a specific substance. Consequently, target substances and media for the FY2003 Initial Environmental Survey, Environmental Survey for Exposure Study and Monitoring Investigation in the General Inspection Survey were selected.

Figure 1-2 System of the General Inspection Survey – Organizations and Their Roles



3. Scope of the survey

(1) Initial Environmental Survey

The purpose of this survey is to grasp the status of environmental persistence of chemical substances and others targeting the Designated Chemical Substances specified in the Chemical Substances Control Law, candidate substances for the PRTR System, unintentionally formed substances, and substances required by social factors. Furthermore, development of analytical methods and assessment of the survey results were conducted, when necessary. In FY2003, 15 substances (groups) including HCFCs, linear alkylbenzenesulfonic acid and its salt, isoprene, and chlordecone were selected as the survey target. In addition, development of analytical methods for 17 substances (groups) including 1,3-dichloropropane and 1-bromopropane has been started.

(2) Environmental Survey for Exposure Study

In the FY2003 survey, the 7 substances (groups) octabromodiphenylether, *o*-chloroaniline, 1-chloro-2,4-dinitrobenzene, 2,4-dinitrophenol, phenol, PFOS and PFOA were selected as target substances from among the substances that have been determined or are scheduled to undergo Initial Environmental Risk Assessment.

(3) Monitoring Investigation

In this Monitoring Survey, substances for which environmental persistence is high but environmental standards are not yet established and a grasp of their annual environmental status is required, were selected as the target substances for the survey from among those included in the POPs Treaty, substances that could be candidate target substances of the Treaty, Class 1 & 2 Specified Chemical Substances and Designated Chemical Substances specified in the Chemical Substances Control Law. In the FY2003 survey, 11 POPs* targeted in the POPs Treaty (8 substances (groups) in this survey), together with 3 substances (groups) including organotin compounds were selected.

* In the POPs listed under the POPs Treaty, the survey and monitoring on PCDDs and PCDFs were conducted from FY1989 through FY1997 in this survey, but have been conducted in other surveys since FY1998.

4. Status of detection in the survey

A total of 823 substances (groups) were surveyed in the past General Inspection Survey (from FY1974 to FY2003), of which 367 substances (groups) were detected in the general environment.

Table 1-2 Summary of Results of the Environmental Survey

	Surface water	*Bottom sediment*	*Aquatic wildlife*	*Air*	*Total*
Number of surveyed substances	774	742	253	264	823
Number of detected substances	159	239	105	176	367
Ratio of detection (%)	20.5	32.2	41.5	66.7	44.6

Chapter 2 Summary of the FY2003 Initial Environmental Survey

1. Purpose of the Survey

The purpose of this Initial Environmental Survey is to grasp the status of environmental persistence of those substances such as Designated Chemical Substances specified in the Chemical Substances Control Law, candidate substances for the PRTR system, unintentionally formed chemical substances and the substances required by social factors.

2. Surveyed substances, media and areas

In the FY2003 Initial Environmental Survey, the following 15 substances (groups) totaling 20 substances-media, which had been discussed and selected from among substances and media given priority at the FY2003 Expert Group on Substance Selection for the Comprehensive Survey of Chemical Substances on Environmental Safety were surveyed.

Table 2-1 Target Substances and Media for the FY2003 Initial Environmental Survey

Survey No.	*Target substance*	*Number of surveyed areas per media*			
		Surface water	*Bottom sediment*	*Aquatic wildlife*	*Air*
1	HCFCs (HCFC-141b, HCFC-22, HCFC-123, HCFC-142b, HCFC-225ca, HCFC-225cb, HFC-134a were analyzed)				20
2	Linear alkylbenzene sulfonic acid and its salt (LAS, carbon number of alkyl group: 10 – 14)	9			
3	Isoprene				5
4	Chlordecone				2
5	Chlorpyrifos			12	7
6	Chloropicrin				8
7	Diethylenetriamine and an another substance (Triethylenetetramine was simultaneously analyzed)	14			
8	1,4-Dichloro-2-nitrobenzene and 3 other substances (1,3-Dichloro-4-nitrobenzene, 1-Chloro-3-nitrobenzene, 1,4-Dinitro-benzene) were simultaneously analyzed	25	24		
9	3,3'-Dichlorobenzidine	19			
10	Pyridine-triphenylborane	6			
11	2,4,6-Tri-*tert*-butylphenol				11
12	Bromomethane				4
13	1,2,5,6,9,10-Hexabromocyclododecane	20	20		
14	Hexabromobiphenyl	4	4		
15	Polybromodiphenyl ethers (hexa and deca bromides were analyzed)		7	3	

Surveys for surface water were conducted on 1 to 7 substances (groups) at 34 areas; for bottom sediment on 1 to 4 substances (groups) at 27 areas; for aquatic wildlife on 1 to 2 substances (groups) at 12 areas; and for air on 1 to 7 substances (groups) at 24 areas.

Surveyed areas of the FY2003 Initial Environmental Survey are shown in Figure 2-1 (surface water, bottom sediment), Figure 2-2 (aquatic wildlife) and Figure 2-3 (air).

3. Sampling and analytical method

Suggested sampling and analytical methods are shown in Appendix C and Appendix D, respectively.

4. Survey results

In the FY2003 Initial Environmental Survey, 2 substances (groups) in 6 areas (LAS: 5 areas out of 6, 3,3'-dichlorobenzidine: 1 area out of 19) for surface water, 3 substances (groups) in 3 areas (1,3-dichloro-4-nitrobenzene: 1 area out of 21, 1,2,5,6,9,10-hexabromocyclododecane: 1 area out of 21, decabromodiphenyl ethers: 2 areas out of 5) for bottom sediment, 1 substance in 1 area (chlorpyrifos: 1 area out of 9) for aquatic wildlife, and 3 substances (groups) in 21 areas (HCFCs: in all 20 surveyed areas, isoprene: in all 5 surveyed areas, bromomethane: in all 4 surveyed areas) for air were detected.

Five substances (groups) in surface water, 4 substances (groups) in bottom sediment, 2 substances (groups) in aquatic wildlife, and 5 substances (groups) in air were detected.

Detection results of the FY2003 Initial Environmental Survey are shown in Table 2-2.

5. Evaluation of the survey results

Targeting 15 substances (groups), 26 substances that can be analyzed simultaneously were investigated in the FY2003 survey, and 2 substances (LAS and 3,3'-dichlorobenzidine) out of 11 for surface water, 3 substances (1,3-dichloro-4-nitrobenzene, 1,2,5,6,9,10-hexabromocyclododecane and decabromodiphenyl ethers) out of 8 for bottom sediment, 1 substance (chlorpyrifos) out of 3 for aquatic wildlife, and 9 substances (HCFC-141b, HCFC-22, HCFC-123, HCFC-142b, HCFC-225ca, HCFC-225cb, HFC-134a, isoprene and bromomethane) out of 13 for air were detected.

Survey number	*Target substance*	*Status of survey (✓: detected, n: not detected, --: not surveyed)*			
		Surface water	*Bottom sediment*	*Aquatic wildlife*	*Air*
1	HCFC-141b	--	--	--	✓
	HCFC-22	--	--	--	✓
	HCFC-123	--	--	--	✓
	HCFC-142b	--	--	--	✓
	HCFC-225ca	--	--	--	✓
	HCFC-225cb	--	--	--	✓
	HFC-134a	--	--	--	✓

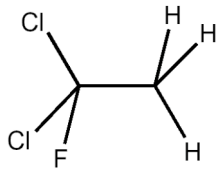
Survey number	*Target substance*	*Status of survey (✓: detected, n: not detected, --: not surveyed)*			
		Surface water	*Bottom sediment*	*Aquatic wildlife*	*Air*
2	LAS	✓	--	--	--
3	Isoprene	--	--	--	✓
4	Chlordecone	--	--	--	n
5	Chlorpyrifos	--	--	✓	n
6	Chloropicrin	--	--	--	n
7	Diethylenetriamine	n	--	--	--
	Triethylenetetramine	n	--	--	--
8	1,4-Dichloro-2-nitrobenzene	n	n	--	--
	1,3-Dichloro-4-nitrobenzene	n	✓	--	--
	1-Chloro-3-nitrobenzene	n	n	--	--
	1,4-Dinitrobenzene	n	n	--	--
9	3,3'-Dichlorobenzidine	✓	--	--	--
10	Pyridine-triphenylborane	n	--	--	--
11	2,4,6-Tri-*tert*-butylphenol	--	--	--	n
12	Bromomethane	--	--	--	✓
13	1,2,5,6,9,10-Hexabromocyclododecane	n	✓	--	--
14	Hexabromobiphenyl	n	n	--	--
15	Hexabromodiphenyl ethers	--	n	n	--
	Decabromodiphenyl ethers	--	✓	n	--

Evaluations of survey results for each substance (group) are described below.

[1] HCFCs (Hydrochlorofluorocarbons; surveyed media in FY2003: air)

HCFC-141b was selected as target substance for the FY2003 survey. In the actual survey, HCFC-22, HCFC-123, HCFC-142b, HCFC-225ca, HCFC-225cb and HFC-134a, which can be analyzed simultaneously, were also measured.

[1.1] HCFC-141b (1,1-Dichloro-1-fluoroethane) (CAS RN: 1717-00-6)



Chemical formula / molecular weight: $C_2H_3C\ell_2F$ / 116.95
Melting point: -103.5°C [1), 2)]
Boiling point: 32°C [1), 2)]
Water solubility (Sw): 2637 mg/L(25°C) [1)], 2632 mg/L(25°C) [2)]
Specific gravity: Unknown
n-Octanol/water partition coefficient (LogPow): 2.041 [1)], 2.37(calculated value) [2)], 2.3 [3)]
Degradability: Unknown
Accumulativeness: Unknown
Use: Detergent, foaming agent [34)]
Production / import amount: 10,000 - 100,000 t in FY2001 [35)]

Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	5,307,693	1,855,377	0	7,163,070
FY2002	5,943,605	1,763,611	340	7,707,556

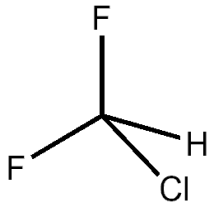
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

A survey of HCFC-141b in air was conducted in FY2003 for the first time and, under the detection limit of 4 ng/m^3, it was detected in all samples (all samples in 17 areas) with the range of 73 – 1,400 ng/m^3, geometric mean of 460 ng/m^3 and median value of 360 ng/m^3 (geometric mean and median value of all samples. the same hereinafter). The trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past.

○ Survey Results of HCFC-141b

Survey year	*Air* *17 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	73 - 1,400 (17/17)	4

[1.2] HCFC-22 (Chlorodifluoromethane) (CAS RN: 75-45-6)



Chemical formula / molecular weight: $CHC\ell F_2$ / 86.47
Melting point: -157.4°C [1)]
Boiling point: -40.7°C [1)]
Water solubility (Sw): 2770 mg/L (25°C) [1)]
Specific gravity: 1.194 (25°C) [1)]
n-Octanol/water partition coefficient (LogPow): 1.13 (observed value) [4)], 1.07 (calculated value) [5)], 1.08 [6)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Refrigerant [34)]
Production / import amount: 39,983 t (production: 39,858 t, import: 125 t) in FY1993 [38)]
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	8,817,048	1,163,585	2,400	9,983,033
FY2002	8,384,717	683,596	2,400	8,441,547

†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

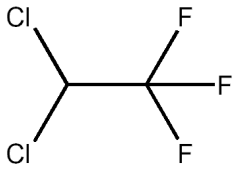
In FY2002, a survey of HCFC-22 in air was conducted in 15 areas and, under the detection limit of 6 ng/m^3, it was detected in all areas with the range of 340 - 4,600 ng/m^3. In the FY2003 survey under the

detection limit of 6 ng/m^3 it was detected in all samples (all samples in 19 areas) with the range of 550 - 4,500 ng/m^3, geometric mean of 1,400 ng/m^3 and median value of 1,100 ng/m^3. Concentrations of HCFC-22 in the environment were confirmed to be nearly at the same level as in the previous year.

○ Survey Results of HCFC-22

Survey year	*Air* *19 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	550 - 4,500 (19/19)	6
FY2002	340 - 4,600 (15/15)	6

[1.3] HCFC-123 (1,1-Dichloro-2,2,2-trifluoroethane) (CAS RN: 306-83-2)



Chemical formula / molecular weight: $C_2HC\ell_2F_3$ / 152.93
Melting point: -107°C [7)]
Boiling point: 27.82°C [7)]
Water solubility (Sw): 21 mg/L (25°C) [6)]
Specific gravity: 1.4638 (25°C) [7)]
n-Octanol/water partition coefficient (LogPow): 2.3 - 2.9 [8)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Refrigerant [34)]
Production / import amount: Unknown
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	12,125	66,610	0	78,735
FY2002	12,297	54,725	0	67,022

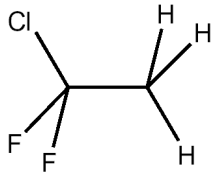
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

A survey of HCFC-123 in air was conducted in FY2003 for the first time and, under the detection limit of 3 ng/m^3, it was detected in 5 areas out of 10 with the range of 3 - 320 ng/m^3. The trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past.

○ Survey Results of HCFC-123

Survey year	*Air* *10 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	3 - 320 (5/10)	3

[1.4] HCFC-142b (1-Chloro-1,1-difluoroethane) (CAS RN: 75-68-3)



Chemical formula / molecular weight: $C_2H_3C\ell F_2$ / 100.49
Melting point: -130.8°C [1),2)]
Boiling point: -9.2°C [1)], -9.7°C [2)]
Water solubility (Sw): 1400 mg/L (25°C) [1),2)]
Specific gravity: 1.107 (25°C) [1)]
n-Octanol/water partition coefficient (LogPow): 2.05 (calculated value) [2)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Foaming agent [34)]
Production / import amount: Over 10,000 t [39)]
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	827,040	1,580,697	0	2,407,737
FY2002	847,231	1,341,382	0	1,533,277

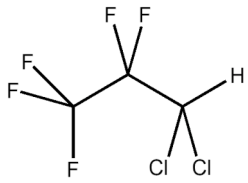
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

A survey of HCFC-142b in air was conducted in FY2003 for the first time and, under the detection limit of 3 ng/m^3, it was detected in all samples (all samples in 20 areas) with the range of 54 - 1,100 ng/m^3, geometric mean of 180 ng/m^3 and median value of 120 ng/m^3. The trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past.

○ Survey Results of HCFC-142b

Survey year	*Air* *20 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	54 - 1,100 (20/20)	3

[1.5] HCFC-225ca (1,1-Dichloro-2,2,3,3,3-pentafluoropropane) (CAS RN: 422-56-0)



Chemical formula / molecular weight: $C_3HC\ell_2F_5$ / 202.94
Melting point: -94°C [9)]
Boiling point: 45.5°C [7)]
Water solubility (Sw): Unknown

Specific gravity: 1.54 (25°C) [7)]
n-Octanol/water partition coefficient (LogPow): 3.2 [10)]
Degradability: Unknown
Accumulativeness: Unknown
Use: Detergent [34)]
Production / import amount: Unknown
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	1,363,197	502,576	0	1,865,773
FY2002	1,150,940	413,095	220	1,564,255

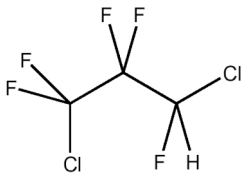
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

A survey of HCFC-225ca in air was conducted in FY2003 for the first time and, under the detection limit of 4 ng/m^3, it was detected in 15 areas out of 16 with the range of 8.5 - 4,500 ng/m^3. The trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past.

○ Survey Results of HCFC-225ca

Survey year	*Air* *16 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	8.5 - 4,500 (15/16)	4

[1.6] HCFC-225cb (1,3-Dichloro-1,2,2,3,3-pentafluoropropane) (CAS RN: 507-55-1)



Chemical formula / molecular weight: $C_3HC\ell_2F_5$ / 202.94
Melting point: -97°C [9)]
Boiling point: 52°C [7)]
Water solubility (Sw): Unknown
Specific gravity: 1.55 (25°C) [7)]
n-Octanol/water partition coefficient (LogPow): 3.1 [1)]
Degradability: Unknown
Accumulativeness: Unknown
Use: Detergent [34)]
Production / import amount: Unknown
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	1,363,197	502,576	0	1,865,773
FY2002	1,150,940	413,095	220	1,564,255

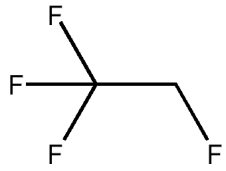
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

A survey of HCFC-225cb in air was conducted in FY2003 for the first time and, under the detection limit of 15 ng/m^3, it was detected in 13 areas out of 19 with the range of 17 - 4,400 ng/m^3. The trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past.

○ Survey Results of HCFC-225cb

Survey year	*Air* *19 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	17 - 4,400 (13/19)	15

[1.7] HFC-134a (1,1,1,2-Tetrafluoroethane) (CAS RN: 811-97-2)



Chemical formula / molecular weight: $C_2H_2F_4$ / 102.03
Melting point: -101°C [11], -103.3°C [7]
Boiling point: -26.08°C [7], -26.15°C (760mmHg) [11]
Water solubility (Sw): 67 mg/L (25°C) (estimated value) [12]
Specific gravity: 1.202 (25°C) [11], 1.2072 (25°C) [7]
n-Octanol/water partition coefficient (LogPow): 1.68 (estimated value) [12], 1.06 [6]
Degradability: Unknown
Accumulativeness: Unknown
Use: Refrigerant, foaming agent [34]
Production / import amount: 1,000 - 10,000 t in FY2001 [35]
Released amount (Reported by PRTR): No report

A survey of HFC-134a in air was conducted in FY2003 for the first time and, under the detection limit of 7 ng/m^3, it was detected in all samples (all samples in 20 areas) with the range of 100 - 1,800 ng/m^3, geometric mean of 510 ng/m^3 and median value of 420 ng/m^3. The trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past.

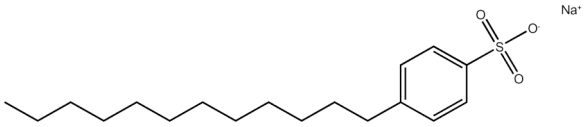
○ Survey Results of HFC-134a

Survey year	*Air* *20 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	100 - 1,800 (20/20)	7

[2] Linear alkylbenzene sulfonic acid and its salt (LAS; carbon number of alkyl group: 10 - 14; surveyed media in FY2003: surface water)

LAS_{10}: Sodium decylbenzene sulfonate (CAS RN: 1322-98-1; carbon number of alkyl group: 10)
LAS_{11}: Sodium undecylbenzene sulfonate (CAS RN: 27636-75-5; carbon number of alkyl group: 11)
LAS_{12}: Sodium dodecylbenzene sulfonate (CAS RN: 25155-30-0; carbon number of alkyl group: 12)
LAS_{13}: Sodium tridecylbenzene sulfonate (CAS RN: 26248-24-8; carbon number of alkyl group: 13)
LAS_{14}: Sodium tetradecylbenzene sulfonate (CAS RN: 28348-61-0; carbon number of alkyl group: 14)

(Characteristics of LAS_{12})



Chemical formula / molecular weight: $C_{18}H_{29}SO_3Na$ / 348.48
Melting point: >300°C [6)]
Boiling point: Unknown
Water solubility (Sw): 200 g/L (25°C) [6)]
Specific gravity: 1.0 (d_4^{20}) (60% slurry) [1)]
n-Octanol/water partition coefficient (LogPow): 1.96 (observed value) [13)]
Degradability: Easily degradable [18)]
Accumulativeness: Unknown
Use: Detergent [39)], laundry detergent, dyeing assistant for the textile industry, general-use detergent, emulsifier for agrochemicals, detergent for fruits/vegetables, detergent for wool/synthetic fibers, scouring agent, pitch dispersant, detergent for metal plating, detergent for cleaning, dishwashing detergent, anti-caking agent for fertilizers [53)]
Production / import amount: LAS_{12}: 64,446 t (Production 64,120 t, Import 326 t) in FY1998 [54)]
Released amount (Total of LAS_{10} - LAS_{14} reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	33,052,902	8,607	37,591	33,099,100
FY2002	20,160,029	5,528	35,308	20,200,865

†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

A survey of LAS in surface water was conducted in FY1977 under the detection limit of 10 μg/L and it was detected in 3 areas out of the surveyed 23 areas with the range of 280 - 2,900 μg/L. In FY2003, a survey was conducted lowering the detection limit to 0.2 μg/L and it was detected in 5 areas out of 9 with the range of 0.2 - 67 μg/L (total of LAS_{10} - LAS_{14}). Furthermore, in the Monitoring of the Precautionary Monitoring Targets, a survey was conducted using the same analytical method and it was detected widely in 68 areas out of 76 (public water bodies).

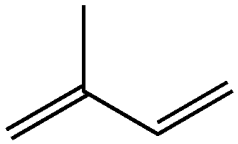
○ Survey Results of Linear alkylbenzene sulfonic acid and its salt (LAS)

Survey year	*Substance*	*Surface water 9 areas in total*	
		Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*
FY2003	Total of LAS_{10} - LAS_{14}	0.2 - 67 (5/9)	0.2
	LAS_{10}	0.32 - 28 (3/9)	0.2
	LAS_{11}	0.32 - 17 (4/9)	0.2
	LAS_{12}	0.2 - 16 (4/9)	0.2
	LAS_{13}	0.25 - 6.1 (4/9)	0.2
	LAS_{14}	ND (0/9)	0.2
FY1977	LAS	280 - 2,900 (3/23)	10

<*Reference*> Results of LAS (Total of LAS_{10} - LAS_{14}) from the Monitoring of the Precautionary Monitoring Targets

Survey year	*Media*	*Sampling area*	*Detected range (μg/L) (Detection frequency (areas))*	*Detection limit (μg/L)*
FY2000	Surface water	All	0.2 - 1,100 (68/76)	0.2
		River	0.3 - 1,100 (53/59)	0.2
		Lake	1.3 - 21 (5/6)	0.2
		Sea	0.2 - 11 (10/11)	0.2

[3] **Isoprene** (CAS RN: 78-79-5; surveyed media in FY2003: air)



Chemical formula / molecular weight: C_5H_8 / 68.12

Melting point: -146.7°C [15], -145.95°C [16]

Boiling point: 34.067°C [16]

Water solubility (Sw): 300 mg/L (20°C) [14]

Specific gravity: 0.681, 0.6805 [16]

n-Octanol/water partition coefficient (LogPow): 2.30 (observed value) [6]

Degradability: Not easily degradable [18]

Accumulativeness: Low concentration [18]

Use: Mainly as raw material for synthetic rubber, raw material for geraniol/linalool, etc., raw material for perfume, raw material for agrochemical intermediates such as chrysanthemic acid, raw material for isophytol [56]

Production / import amount: 72,069 t in FY2000, 61,240 t in FY2001, 89,250 t in FY2002 [55]

Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	1	122,138	0	122,139
FY2002	837,980	77,943	0	915,923

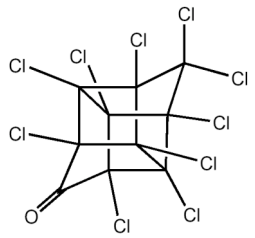
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

A survey of isoprene in air was conducted in FY2003 for the first time and, under the detection limit of 12 ng/m^3, it was detected in all samples (all samples in 5 areas) with the range of 88 - 1,300 ng/m^3, geometric mean of 480 ng/m^3 and median value of 380 ng/m^3. The trend of its concentration change in the environment cannot grasped as no survey was conducted in the past.

○ Survey Results of Isoprene

Survey year	*Air* *5 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	88 - 1,300 (5/5)	12

[4] Chlordecone (CAS RN: 143-50-0; surveyed media in FY2003: air)



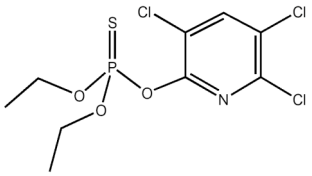
Chemical formula / molecular weight: $C_{10}C\ell_{10}O$ / 490.63
Melting point: Unknown
Boiling point: 350°C (decomposition) [17)]
Water solubility (Sw): 7.6 mg/L (24°C, observed value) [12)]
Specific gravity: 1.61 (25°C) [7)]
n-Octanol/water partition coefficient (LogPow): 3.45 [6)]
Degradability: Not easily degradable [96)]
Accumulativeness: High concentration [96)]
Use: Insecticide [62)]
Production / import amount: Unknown
Released amount (Reported by PRTR): No report

A survey of chlordecone in air was conducted in FY2003 for the first time and, under the detection limit of 0.0005 ng/m^3 (= 0.5 pg/m^3), it was not detected in the surveyed 1 area. Although the trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past, it was confirmed that chlordecone was not detected in air in this survey.

○ Survey Results of Chlordecone

Survey year	*Air* *1 area*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	ND (0/1)	0.0005

[5] Chlorpyrifos (CAS RN: 2921-88-2; surveyed media in FY2003: aquatic wildlife and air)



Chemical formula / molecular weight: $C_9H_{11}C\ell_3NO_3PS$ / 350.58
Melting point: 41 - 42°C [1)]
Boiling point: 160°C (decomposition) [1)]
Water solubility (Sw): 0.4 mg/L (23°C) [1)]
Specific gravity: 1.398 (43.5°C) [1)]
n-Octanol/water partition coefficient (LogPow): 5.27 [1)]
Degradability: Not easily degradable [18)]
Accumulativeness: Mediate concentration [18)]
Use: Pesticide [39)]
Production / import amount: Hydrate 244.4 t, hydrate FD 6.0 t, emulsion 58.8 kL, granule 442.1 t in 2002 Agrochemical Year [34)]
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	105,263	0	0	105,263
FY2002	95,571	0	0	95,571

†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

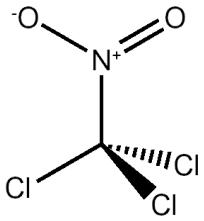
Chlorpyrifos in aquatic wildlife was surveyed in FY1988 under the detection limit of 5 ng/g-wet in 21 areas but it was not detected. In FY2003, a survey was conducted under the detection limit of 3 ng/g-wet and it was detected in 1 area out of 9 with the detected value of 10 ng/g-wet. Although it was not detected in the past survey, the trend of its persistence cannot be grasped as no survey had been conducted in the past at the area where it was detected this time.

Chlorpyrifos in air was surveyed in FY1988 under the detection limit of 10 ng/m^3 in 21 areas but it was not detected. In FY2003, a survey was conducted under the detection limit of 2 ng/m^3 and it was not detected in all of the surveyed 7 areas. Chlorpyrifos was not detected in air in the past surveys and it was confirmed that it was also not detectable under the detection limit in this survey. However, although its concentration was below the detection limit, there are some reports indicated the detection of chlorpyrifos (0.27 - 0.51 ng/m^3).

○ Survey Results of Chlorpyrifos

Survey year	*Aquatic wildlife 9 areas in total*		*Air 7 areas in total*	
	Detected range (ng/g-wet) (Detection frequency (areas))	*Detection limit (ng/g-wet)*	*Detected range (ng/m^3) (detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	10 (1/9)	3	ND (0/7)	2
FY1988	ND (0/21)	5	ND (0/21)	10

[6] Chloropicrin (CAS RN: 76-06-2; surveyed media in FY2003: air)



Chemical formula / molecular weight: $CC\ell_3NO_2$ / 164.37
Melting point: -64°C [1)]
Boiling point: 112°C (757 mmHg) [1)]
Water solubility (Sw): 1621 mg/L (25°C) [1)]
Specific gravity: 1.6558 (20°C) [1)]
n-Octanol/water partition coefficient (LogPow): 2.09 [1)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Agrochemicals (insecticide) [39)]
Production / import amount:
Production: Active ingredient 6,888.8 t, medical products 3,904.3 t (80%), 4,683.7 t (99.5%), tablets 39.0 t in 2002 Agrochemical Year
Import: 2,613.0 t (active ingredient) in 2002 Agrochemical Year [34)]
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	7,256,144	2,421	0	7,258,565
FY2002	7,320,300	3,010	0	7,323,310

†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

Chloropicrin in air was surveyed in FY1994 under the detection limit of 5,000 ng/m^3 and it was not detected in any of the surveyed 17 areas. In FY2003, a survey was conducted under the lowered detection limit of 220 ng/m^3 and it was not detected in any of the surveyed 8 areas. Chloropicrin was not detected in air in the past surveys and it was also confirmed that chloropicrin was not detectable under the detection limit adopted in this survey. In addition, as chloropicrin is used for agrochemicals (insecticide), the season of the survey should be considered carefully.

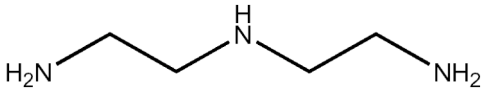
○ Survey Results of Chloropicrin

Survey year	*Air* *8 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	ND (0/8)	220
FY1994	ND (0/17)	5,000

[7] Diethylenetriamine and an another substance (surveyed media in FY2003: surface water)

Diethylenetriamine was selected as a target substance in the FY2003 survey and in the actual survey triethylenetetramine, which can be analyzed simultaneously, was measured.

[7.1] Diethylenetriamine (CAS RN: 111-40-0; surveyed media in FY2003: surface water)



Chemical formula / molecular weight: $C_4H_{13}N_3$ / 103.15
Melting point: -39°C [1)]
Boiling point: 207°C [1)]
Water solubility (Sw): 1000 g/L (observed value) [12)]
Specific gravity: 0.89586 (d_{20}^{20}) [1)]
n-Octanol/water partition coefficient (LogPow): <-3 (observed value) [18)], -2.13 (calculated value) [19)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Anti-creasing agent, detergent, dye fixing agent, wet-strength agent for paper, raw material for agrochemicals, rubber chemicals [53)]
Production / import amount: 7,585 t (production 6,753 t, import 832 t) in FY1998 [54)], 7,207 t in FY2000, 7,863 t in FY2001, 8,303 t in FY2002 [55)].
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	16,797	944	120,023	137,764
FY2002	0	928	110,004	110,932

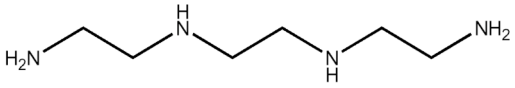
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

A survey of diethylenetriamine in surface water was conducted in FY2003 for the first time and, under the detection limit of 2 μg/L, it was not detected in any of the surveyed 13 areas. Although the trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past, it was confirmed that diethylenetriamine was not detected in surface water under the detection limit adopted in this survey.

○ Survey Results of Diethylenetriamine

Survey year	*Surface water 13 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*
FY2003	ND (0/13)	2

[7.2] Triethylenetetramine (CAS RN: 112-24-3)



Chemical formula / molecular weight: $C_6H_{18}N_4$ / 146.21
Melting point: 12°C [15),16)]
Boiling point: 266 - 267°C [15),16)]
Water solubility (Sw): 4770 g/L (observed value) [12)]
Specific gravity: 0.9818 (d_{20}^{20}) [1)]
n-Octanol/water partition coefficient (LogPow): 1.66 (calculated value) [20)], 1.4 - 1.66 (calculated value) [6)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Mainly as raw material for epoxy resin hardener, and as wet-strength agent for paper [71)]
Production / import amount: 3,186 t (production 2,533 t, import 653 t) in FY1996 [72)], 1,000 - 10,000 t in FY2001 [35)]
Released amount (Reported by PRTR): No report

A survey of triethylenetetramine in surface water was conducted in FY2003 for the first time and, under the detection limit of 8 μg/L, it was not detected in any of the surveyed 13 areas. Although the trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past, it was confirmed that triethylenetetramine was not detected in surface water under the detection limit adopted in this survey.

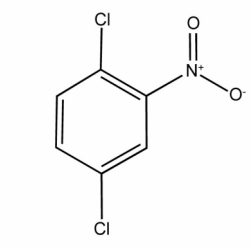
○ Survey Results of Triethylenetetramine

Survey year	*Surface water 13 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*
FY2003	ND (0/13)	8

[8] 1,4-Dichloro-2-nitrobenzene and 3 other substances (surveyed media in FY2003: surface water and bottom sediment)

1,4-Dichloro-2-nitrobenzene was selected as a target substance in the FY2003 survey and in the actual survey 1,3-dichloro-4- nitrobenzene, 1-chloro-3-nitrobenzene and 1,4-dinitrobenzene, which can be measured simultaneously, were analyzed.

[8.1] 1,4-Dichloro-2-nitrobenzene (CAS RN: 89-61-2)



Chemical formula / molecular weight: $C_6H_3C\ell_2NO_2$ / 191.99
Melting point: 52.8°C [21)]
Boiling point: 267°C [21)]
Water solubility (Sw): 83 mg/L (20°C) [21),22)]
Specific gravity: 1.439 (d_4^{75}) [22)]
n-Octanol/water partition coefficient (LogPow): 2.9 (observed value) [23)], 3.3 (calculated value) [23)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Raw material for dye / organic pigment, raw material for ultraviolet-ray absorbent
Production / import amount: 1,266 t (production 1,139 t, import 127 t) in FY1996 [72)]
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	0	200	2	202
FY2002	0	2	0	2

†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

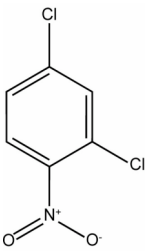
1,4-Dichloro-2-nitrobenzene in surface water was surveyed in FY1981 under the detection limit of 0.02 μg/L and it was not detected in any of the surveyed 7 areas. It was also not detected in the surveyed 9 areas in the FY1994 survey under the detection limit of 0.05 μg/L. In FY2003, a survey was conducted under the detection limit of 0.05 μg/L and it was not detected in any of the surveyed 24 areas. 1,4-Dichloro-2-nitrobenzene was not detected in surface water in the past surveys and it was also confirmed that 1,4-dichloro-2-nitrobenzene was not detected under the detection limit adopted in this survey.

1,4-Dichloro-2-nitrobenzene in bottom sediment was surveyed in FY1981 under the detection limit of 1 ng/g-dry and it was not detected in any of the surveyed 7 areas. It was also not detected in the surveyed 9 areas in the FY1994 survey under the detection limit of 12 ng/g-dry. In FY2003, a survey was conducted under the detection limit of 2.5 ng/g-dry and it was not detected in any of the surveyed 20 areas. 1,4-Dichloro-2-nitrobenzene was not detected in bottom sediment in the past surveys and it was also confirmed that 1,4-dichloro-2-nitrobenzene was not detected under the detection limit adopted in this survey.

○ Survey Results of 1,4-Dichloro-2-nitrobenzene

Survey year	*Surface water 24 areas in total*		*Bottom sediment 20 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (Detection frequency (areas))*	*Detection limit (ng/g-dry)*
FY2003	ND (0/24)	0.05	ND (0/20)	2.5
FY1994	ND (0/9)	0.05	ND (0/9)	12
FY1981	ND (0/7)	0.02	ND (0/7)	1

[8.2] 1,3-Dichloro-4-nitrobenzene (CAS RN: 611-06-3)



Chemical formula / molecular weight: $C_6H_3C\ell_2NO_2$ / 191.99
Melting point: 30°C [23)]
Boiling point: 258.5°C [1),6),23),24)]
Water solubility (Sw): 188 mg/L (20°C) [23),25)]
Specific gravity: 1.551 (d_4^{78}) [15)]
n-Octanol/water partition coefficient (LogPow): 3.09 (observed value) [5)], 3.11(calculated value) [5)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Mainly as raw material for medical products (antipyretics and analgesics) and other uses as raw material for herbicide, dye and pigment intermediates, and raw material for photographic chemicals[76)]
Production / import amount: 1,678 t (production 1,316 t, import 362 t) as dichloronitrobenzene in FY1996[72)]
Released amount (Reported by PRTR): No report

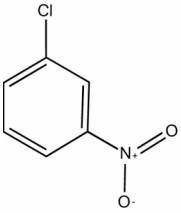
1,3-Dichloro-4-nitrobenzene in surface water was surveyed in FY1981 under the detection limit of 0.02 μg/L and it was not detected in any of the surveyed 7 areas. It was also not detected in the surveyed 9 areas in the FY1994 survey under the detection limit of 0.06 μg/L. In FY2003, a survey was conducted under the detection limit of 0.06 μg/L and it was not detected in any of the surveyed 24 areas. 1,3-Dichloro-4-nitrobenzene was not detected in surface water in the past surveys and it was also confirmed that it was not detected under the detection limit adopted in this survey.

1,3-Dichloro-4-nitrobenzene in bottom sediment was surveyed in FY1981 under the detection limit 1 ng/g-dry and it was not detected in any of the surveyed 7 areas. It was also not detected in the surveyed 9 areas in the FY1994 survey under the detection limit of 8.5 ng/g-dry. In FY2003, a survey was conducted under the detection limit of 1.9 ng/g-dry and it was detected in 1 area out of 21 with the detected value of 6.3 ng/g-dry. This area was also surveyed in FY1994 but it was not detected in this year. As 1,3-dichloro-4-nitrobenzene was not detected the past surveys and it was detected in only one area in this survey, the trend of its concentration change in the environment cannot be grasped.

○ Survey Results of 1,3-Dichloro-4-nitrobenzene

Survey year	*Surface water 24 areas in total*		*Bottom sediment 21 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (Detection frequency (areas))*	*Detection limit (ng/g-dry)*
FY2003	ND (0/24)	0.06	6.3 (1/21)	1.9
FY1994	ND (0/9)	0.06	ND (0/9)	8.5
FY1981	ND (0/7)	0.02	ND (0/7)	1

[8.3] 1-Chloro-3-nitrobenzene (CAS RN: 121-73-3)



Chemical formula / molecular weight: $C_6H_4C\ell NO_2$ / 157.55
Melting point: 46°C [11)]
Boiling point: 236°C (760 mmHg) [11)], 117°C (12 mmHg) [11)]
Water solubility (Sw): 273 mg/L (20°C) [1)]
Specific gravity: 1.534 (d_4^{20}) [11)]
n-Octanol/water partition coefficient (LogPow): 2.41 [1)]
Degradability: Unknown
Accumulativeness: Unknown
Use: Dye intermediate [77)]
Production / import amount: Unknown
Released amount (Reported by PRTR): No report

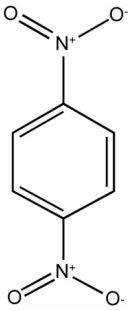
1-Chloro-3-nitrobenzene in surface water was surveyed in FY1975 under the detection limit of 0.1 μg/L and it was not detected in any of the surveyed 19 areas. It was also not detected in the surveyed 9 areas in the FY1994 survey under the detection limit of 0.05 μg/L. In FY2003, a survey was conducted under the detection limit of 0.05 μg/L and it was not detected in any of the surveyed 24 areas. 1-Chloro-3-nitrobenzene was not detected in surface water in the past surveys and it was also confirmed that it was not detected under the detection limit adopted in this survey.

1-Chloro-3-nitrobenzene in bottom sediment was surveyed in FY1994 under the detection limit of 15 ng/g-dry and it was not detected in any of the surveyed 9 areas. In FY2003, a survey was conducted under the detection limit of 3.2 ng/g-dry and it was not detected in any of the surveyed 20 areas. 1-Chloro-3-nitrobenzene was not detected in bottom sediment in the past surveys and it was also confirmed that it was not detected under the detection limit adopted in this survey.

○ Survey Results of 1-Chloro-3-nitrobenzene

Survey year	*Surface water 24 areas in total*		*Bottom sediment 20 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (Detection frequency (areas))*	*Detection limit (ng/g-dry)*
FY2003	ND (0/24)	0.05	ND (0/20)	3.2
FY1994	ND (0/9)	0.05	ND (0/9)	15
FY1975	ND (0/19)	0.1	*No survey*	

[8.4] 1,4-Dinitrobenzene (CAS RN: 100-25-4)



Chemical formula / molecular weight: $C_6H_4N_2O_4$ / 168.09
Melting point: 173-174°C [11)]
Boiling point: 299°C [7)]
Water solubility (Sw): 69 mg/L (25°C) [1)]
Specific gravity: 1.625 (d_4^{18}) [1)]
n-Octanol/water partition coefficient (LogPow): 1.46 [11)], 1.46 - 1.49 [3)]
Degradability: Unknown
Accumulativeness: Unknown
Use: Raw material for organic synthesis and dye (*m*-nitroaniline, *m*-phenylenediamine) [34)]
Production / import amount: Unknown
Released amount (Reported by PRTR): No report

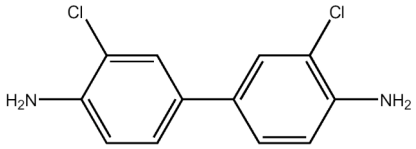
1,4-Dinitrobenzene in surface water was surveyed in FY1994 under the detection limit of 0.054 μg/L and it was not detected in any of the surveyed 9 areas. In FY2003, a survey was conducted under the detection limit of 0.054 μg/L and it was not detected in any of the surveyed 24 areas. 1,4-Dinitrobenzene was not detected in surface water in the past surveys and it was also confirmed that it was not detected under the detection limit adopted in this survey. However, although its concentration was below the detection limit, there are some reports indicated the detection of 1,4-dinitrobenzene (0.016 - 0.039 μg/L).

1,4-Dinitrobenzene in bottom sediment was surveyed in FY1994 under the detection limit of 14 ng/g-dry and it was not detected in any of the surveyed 9 areas. In FY2003, a survey was conducted under the detection limit of 3.1 ng/g-dry and it was not detected in any of the surveyed 21 areas. 1,4-Dinitrobenzene was not detected in bottom sediment in the past surveys and it was also confirmed that it was not detected under the detection limit adopted in this survey.

○ Survey Results of 1,4-Dinitrobenzene

Survey year	*Surface water 24 areas in total*		*Bottom sediment 21 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (Detection frequency (areas))*	*Detection limit (ng/g-dry)*
FY2003	ND (0/24)	0.054	ND (0/21)	3.1
FY1994	ND (0/9)	0.054	ND (0/9)	14

[9] 3,3'-Dichlorobenzidine (CAS RN: 91-94-1; surveyed media in FY2003: surface water)



Chemical formula / molecular weight: $C_{12}H_{10}C\ell_2N_2$ / 253.11
Melting point: 132 - 133°C [16),26)]
Boiling point: 402°C [23)]
Water solubility (Sw): 3.1 mg/L [26)]
Specific gravity: 0.7 [23)]
n-Octanol/water partition coefficient (LogPow): 3.51(observed value) [5)], 3.57 (calculated value) [5)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Pigment intermediate [76)]
Production / import amount: 6,504 t in FY2000, 6,975 t in FY2001, 7,605 t in FY2002 [55)]
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	0	0	0	0
FY2002	0	0	0	0

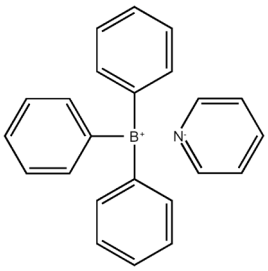
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

3,3'-Dichlorobenzidine in surface water was surveyed in FY1979 under the detection limit of 0.01 - 7 μg/L and it was not detected in any of the surveyed 7 areas. In FY2003, a survey was conducted under the detection limit of 0.010 μg/L and it was detected in 1 area out of 19 with the detected value of 0.014 μg/L. The trend of its concentration change of 3,3'-dichlorobenzidine in the environment cannot be grasped because, although it was not detected in surface water in the past surveys, no survey was conducted in the past at the area where it was detected this time.

○ Survey Results of 3,3'-Dichlorobenzidine

Survey year	*Surface water 19 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*
FY2003	0.014 (1/19)	0.010
FY1979	ND (0/7)	0.01 - 7

[10] Pyridine-triphenylborane (CAS RN: 971-66-4; surveyed media in FY2003: surface water)



Chemical formula / molecular weight: $C_{23}H_{20}BN$ / 321.22
Melting point: ¶
Boiling point: ¶
Water solubility (Sw): ¶
Specific gravity: Unknown
n-Octanol/water partition coefficient (LogPow): Unknown
Degradability: ¶
Accumulativeness: ¶
Use: ¶
Production / import amount: 113 t [55] in FY2002
Released amount (Reported by PRTR): No report

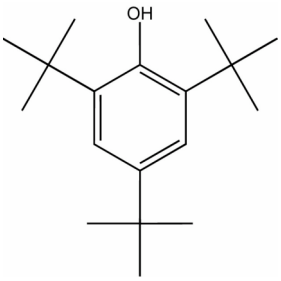
¶: This is proprietary data owned by private corporations contained in the notification dossiers of new chemical substances based on the Chemical Substances Control Law.

A survey of pyridine-triphenylborane in surface water was conducted in FY2003 for the first time and, under the detection limit of 0.12 μg/L, it was not detected in any of the surveyed 5 areas. Although the trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past, it was confirmed that pyridine-triphenylborane was not detected in surface water under the detection limit adopted in this survey.

○ Survey Results of Pyridine-triphenylborane

Survey year	*Surface water 5 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*
FY2003	ND (0/5)	0.12

[11] 2,4,6-Tri-*tert*-butylphenol (CAS RN: 732-26-3; surveyed media in FY2003: air)



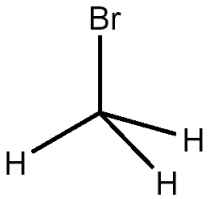
Chemical formula / molecular weight: $C_{18}H_{30}O$ / 262.43
Melting point: 131°C [7], 129 - 132°C [27]
Boiling point: 278°C [7], 277°C [27]
Water solubility (Sw): 35 mg/L (25°C, observed value) [12]
Specific gravity: 0.864 (27°C) [7]
n-Octanol/water partition coefficient (LogPow): 6.06 (observed value) [12]
Degradability: Not easily degradable [18]
Accumulativeness: High concentration [18]
Use: Anti-aging agent for rubber and plastic products [83]
Production / import amount: 11,305 t as trialkylphenol in 1981 [83]
Released amount (Reported by PRTR): No report

A survey of 2,4,6-tri-*tert*-butylphenol in air was conducted in FY2003 for the first time and, under the detection limit of 0.9 ng/m^3, it was not detected in any of the surveyed 9 areas. Although the trend of its concentration change in air cannot be grasped as no survey was conducted in the past, it was confirmed that 2,4,6-tri-*tert*-butylphenol was not detected in air under the detection limit adopted in this survey. Further, there was a report suggesting the detection of it (0.05 ng/m^3), although its concentration was below the detection limit.

○ Survey Results of 2,4,6-Tri-*tert*-butylphenol

Survey year	*Air* *9 areas in total*	
	Detected range(ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	ND (0/9)	0.9

[12] Bromomethane (CAS RN: 74-83-9; surveyed media in FY2003: air)



Chemical formula / molecular weight: CH_3Br / 94.94
Melting point: -93.66°C [1)], -94°C [6),26)]
Boiling point: 3.55°C [1)], 4°C [6),26)]
Water solubility (Sw): 13.4 g/kg (25°C) [1)], 1.5 mL/100 mL (20°C) [6)]
Specific gravity: 1.73 (0°C) [1)], 1.730 [16)], 1.732 [29)]
n-Octanol/water partition coefficient (LogPow): 1.19 [1),6)], 1.19 (observed value)[5)], 1.08 (calculated value)[5)]
Degradability: Not easily degradable [18)]
Accumulativeness: Low concentration [18)]
Use: Raw material for synthesis, and others (fumigant for foodstuff / soil) [39)]
Production / import amount: 1,926 t in FY2000, 837 t in FY2001, 2,804 t in FY2002 [55)]
Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	3,172,498	542,393	24	3,714,915
FY2002	3,856,989	567,468	12	4,424,469

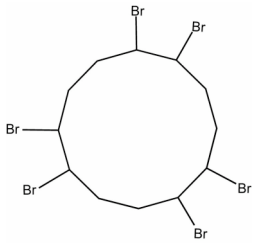
†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

In FY1980 bromomethane in air was surveyed in 8 areas under the detection limit of 64 - 430 ng/m^3 and it was detected in 3 areas out of 8 with the range of 64 - 130 ng/m^3. In FY1998 it was surveyed in 14 areas under the detection limit of 41 ng/m^3 and it was detected in 13 areas out of 14 with the range of 49 - 340 ng/m^3. In FY2003 it was surveyed under the detection limit of 27 ng/m^3 and it was detected in all of the surveyed 4 areas with the range of 33 - 490 ng/m^3. Comparing the results with those in the past surveys, it was confirmed that there was no significant change in the trend of concentration of bromomethane in the environment.

○ Survey Results of bromomethane

Survey year	*Air* *4 areas in total*	
	Detected range (ng/m^3) *(Detection frequency (areas))*	*Detection limit (ng/m^3)*
FY2003	33 - 490 (4/4)	27
FY1998	49 - 340 (13/14)	41
FY1980	64 - 130 (3/8)	64 - 430

[13] 1,2,5,6,9,10-Hexabromocyclododecane (CAS RN: 3194-55-6; surveyed media in FY2003: surface water and bottom sediment)



Chemical formula / molecular weight: $C_{12}H_{18}Br_6$ / 641.70
Melting point: 185 - 195°C [1)], 173 - 177°C [28)]
Boiling point: >250°C (decomposition) [28)]
Water solubility (Sw): 0.0086 mg/L (25°C) [1)]
Specific gravity: Unknown
n-Octanol/water partition coefficient (LogPow): 7.74 (calculated value) [30)]
Degradability: Not easily degradable [18)]
Accumulativeness: High concentration [18)]
Use: Curing accelerator for flame retardants, adhesives [89)]
Production / import amount: 976 t (production 73 t, import 903 t) in FY1998 [54)]
Released amount (Reported by PRTR): No report

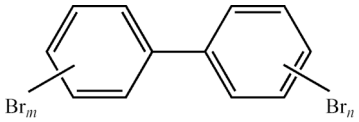
A survey of 1,2,5,6,9,10-hexabromocyclododecane in surface water was conducted in FY2003 for the first time and, under the detection limit of 0.087 μg/L, it was not detected in any of the surveyed 20 areas. Although the trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past, it was confirmed that 1,2,5,6,9,10-hexabromocyclododecane was not detected in surface water under the detection limit adopted in this survey.

A survey of 1,2,5,6,9,10-hexabromocyclododecane in bottom sediment was conducted in FY2003 for the first time and, under the detection limit of 23 ng/g-dry, it was detected in 1 area out of 15 with the range of 85 - 140 ng/g-dry. The trend of its concentration in the environment cannot be grasped as no survey was conducted in the past.

○ Survey Results of 1,2,5,6,9,10-Hexabromocyclododecane

Survey year	*Surface water 20 areas in total*		*Bottom sediment 15 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (Detection frequency (areas))*	*Detection limit (ng/g-dry)*
FY2003	ND (0/20)	0.087	85 - 140 (1/15)	23

[14] Hexabromobiphenyl (CAS RN: 36355-01-8; surveyed media in FY2003: surface water and bottom sediment)



$m+n=6$

Chemical formula / molecular weight: $C_{12}H_4Br_6$ / 627.58
Melting point: 72 - 386°C [31)]
Boiling point: Unknown
Water solubility (Sw): 0.011 - 0.03 (ppm) [31)]
Specific gravity: Unknown
n-Octanol/water partition coefficient (LogPow): Unknown
Degradability: Not easily degradable [97)]
Accumulativeness: High concentration [97)]
Use: Flame retardant [31)]
Production / import amount: Unknown
Released amount (Reported by PRTR): No report

A survey of hexabromobiphenyl in surface water was conducted in FY1989 under the detection limit of 0.00005 μg/L (= 0.05 ng/L) and it was not detected in any of the surveyed 21 areas. In FY2003 it was surveyed under the detection limit of 0.000015 μg/L (= 0.015 ng/L) and it was not detected in any of the surveyed 4 areas. Hexabromobipheny was not detected in surface water in the past surveys and it was also confirmed that it was not detected in this survey.

A survey of hexabromobiphenyl in bottom sediment was conducted in FY1989 under the detection limit of 0.008 ng/g-dry(= 8 pg/g-dry)and it was not detected in any of the surveyed 21 areas. In FY2003 it was surveyed under the detection limit of 0.0087 ng/g-dry(= 8.7 pg/g-dry)and it was not detected in any of the surveyed 2 areas. Hexabromobiphenyl was not detected in bottom sediment in the past surveys and it was also confirmed that it was not detected in this survey.

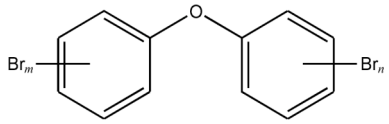
○ Survey Results of Hexabromobiphenyl

Survey year	*Surface water 4 areas in total*		*Bottom sediment 2 areas in total*	
	Detected range (μg/L) (Detection frequency (areas))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (Detection frequency (areas))*	*Detection limit (ng/g-dry)*
FY2003	ND (0/4)	0.000015 (= 0.015 ng/L)	ND (0/2)	0.0087 (= 8.7 pg/g-dry)
FY1989	ND (0/21)	0.00005 (= 0.05 ng/L)	ND (0/21)	0.008 (= 8 pg/g-dry)

[15] Polybromodiphenyl ethers (CAS RN: 36483-60-0; surveyed media in FY2003: bottom sediment and aquatic wildlife)

In FY2003, a survey of hexabromodiphenyl ether and decabromodiphenyl ether was conducted. In addition, a survey of octabromodiphenyl ether in surface water and aquatic wildlife is being conducted in the FY2003 Environmental Survey for Exposure Study.

[15.1] Hexabromodiphenyl ether (CAS RN: 36483-60-0)



$m+n=6$

Chemical formula / molecular weight: $C_{12}H_4Br_6O$ / 643.58
Melting point: Unknown
Boiling point: Unknown
Water solubility (Sw): Unknown
Specific gravity: Unknown
n-Octanol/water partition coefficient (LogPow): 6 [31)]
Degradability: Not easily degradable [18)]
Accumulativeness: Mediate concentration [18)]
Use: Polybromodiphenyl ethers are mainly sold as penta, octa and deca bromide and used as flame retardant. Hexabromodiphenyl ether is a component contained in these commercial products. [1),95)]
Production / import amount: Unknown
Released amount (Reported by PRTR): No report

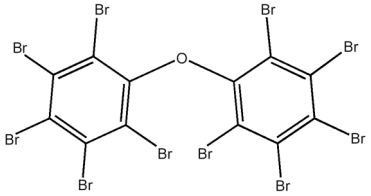
A survey of hexabromodiphenyl ether in bottom sediment was conducted in FY1987 under the detection limit of 5.1 ng/g-dry and it was detected in 2 areas out of 23 with the range of 7 - 77 ng/g-dry. In FY1988, a survey was conducted under the detection limit of 3.5 ng/g-dry and it was detected in 2 areas out of 47 with the range of 4.5 - 18 ng/g-dry. In FY2003, a survey was conducted under the detection limit of 0.5 ng/g-dry and it was not detected in any of the surveyed 3 areas. Although the trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past, it was confirmed that hexabromodiphenyl ether was not detected in bottom sediment in this survey.

A survey of hexabromodiphenyl ether in aquatic wildlife was conducted in FY1987 under the detection limit of 2 ng/g-wet and it was detected in 3 areas out of 25 with the range of 3.8 - 14 ng/g-wet. In FY1988, a survey was conducted under the detection limit of 2 ng/g-wet and it was detected in 3 areas out of 48 with the range of 2 - 6 ng/g-wet. In FY2003, a survey was conducted under the detection limit of 0.5 ng/g-wet and it was not detected in any of the surveyed 3 areas. Although the trend of its concentration change in the environment cannot be grasped as no survey was conducted in the past, it was confirmed that hexabromodiphenyl ether was not detected in aquatic wildlife in this survey.

○ Survey Results of Hexabromobiphenyl ether

Survey year	*Bottom sediment 3 areas in total*		*Aquatic wildlife 3 areas in total*	
	Detected range (ng/g-dry) (Detection frequency (areas))	*Detection limit (ng/g-dry)*	*Detected range (ng/g-wet) (Detection frequency (areas))*	*Detection limit (ng/g-wet)*
FY2003	ND (0/3)	0.5	ND (0/3)	0.5
FY1988	4.5 - 18 (2/47)	3.5	2 - 6 (3/48)	2
FY1987	7 - 77 (2/23)	5.1	3.8 - 14 (3/25)	2

[15.2] Decabromodiphenyl ether (CAS RN: 1163-19-5)



Chemical formula / molecular weight: $C_{12}Br_{10}O$ / 959.2

Melting point: 295°C [2], 304°C [15], Boiling point: 425°C (decomposition) [2), 32)]

Water solubility (Sw): 0.020 - 0.030 mg/L [33)], 0.025 mg/L (25°C) [2)]

Specific gravity: 3.0 [1),32)]

n-Octanol/water partition coefficient (LogPow): 5.24 [1)], 12.11 (calculated value) [2)], 5.236 (calculated value)[15)], ≧5.2 (observed value) [23)]

Degradability: Not easily degradable [18)]

Accumulativeness: Low concentration [18)]

Use: Flame retardant(for styrenic resin: BS/ABS, polybutylene terephthalate resin, polypropylene resin) [56)], raw material for synthesis(flame retardant for polyethylene, ABS resin, polystyrene, polyester resin) [39)]

Production / import amount: 4,320 t (production 1,022 t, import 3,298 t) [38)] in FY1993, 3,773 t in FY2000, 2,323 t in FY2001, 2,986 t in FY2002 [55)]

Released amount (Reported by PRTR, kg/year):

Year	*Other than notified*	*To the atmosphere*	*To public water bodies*	*Total released amount*
FY2001	0	2,702	879	3,581
FY2002	0	1,003	533	1,536

†*Total released amount* = (*Other than notified*) + (*To the atmosphere*) + (*To public water bodies*)

In FY1996, a survey of decabromodiphenyl ether in bottom sediment was conducted in 11 areas under the detection limit of 25 ng/g-dry and it was detected in 6 areas out of 11 with the range of 30 - 580 ng/g-dry. In FY2002, a survey was conducted in 62 areas under the detection limit of 9.7 ng/g-dry and it was detected in 34 areas out of 62 with the range of 10 - 4,400 ng/g-dry. In FY2003, a survey was conducted under the detection limit of 9.7 ng/g-dry and it was detected in 2 areas out of 5 with the range of 37 – 76 ng/g-dry. The trend of its concentration change in the environment cannot be grasped as the number of survey areas is limited.

In FY1987, a survey of decabromodiphenyl ether in aquatic wildlife was conducted in 25 areas under the detection limit of 5 ng/g-wet and it was not detected in any of the surveyed areas. In FY2003, a survey was conducted under the detection limit of 1 ng/g-wet and it was not detected in either of the surveyed 2 areas. Decabromodiphenyl ether in aquatic wildlife was not detected in the past surveys and, although the number of surveyed areas was small, it was confirmed that decabromodiphenyl ether was not detected in this survey.

Further, decabromodiphenyl ether was detected both in surface water and bottom sediment, with especially high concentration in bottom sediment, in line with its low degradable / low accumulative property. However, it has not been detected in aquatic wildlife. This suggests that the molecule of the substance is too large ($C_{12}Br_{10}O$) to accumulate in wildlife

○ Survey Results of Decabromodiphenyl ether

Survey year	*Bottom sediment 5 areas in total*		*Aquatic wildlife 2 areas in total*	
	Detected range (ng/g-dry) (Detection frequency (areas))	*Detection limit (ng/g-dry)*	*Detected range (ng/g-wet) (Detection frequency (areas))*	*Detection limit (ng/g-wet)*
FY2003	37 – 76 (2/5)	9.7	ND (0/2)	1
FY2002	10 - 4400 (34/62)	9.7	*No survey*	
FY1996	30 - 580 (6/11)	25	*No survey*	
FY1988	4 - 600 (15/43)	4	ND (0/46)	5
FY1987	10 - 1400 (6/20)	7	ND (0/25)	5
FY1977	ND (0/7)	25 - 87	*No survey*	

Figure 2-1 Locations of the Initial Environmental Survey for Surface Water and Bottom Sediment (FY2003)

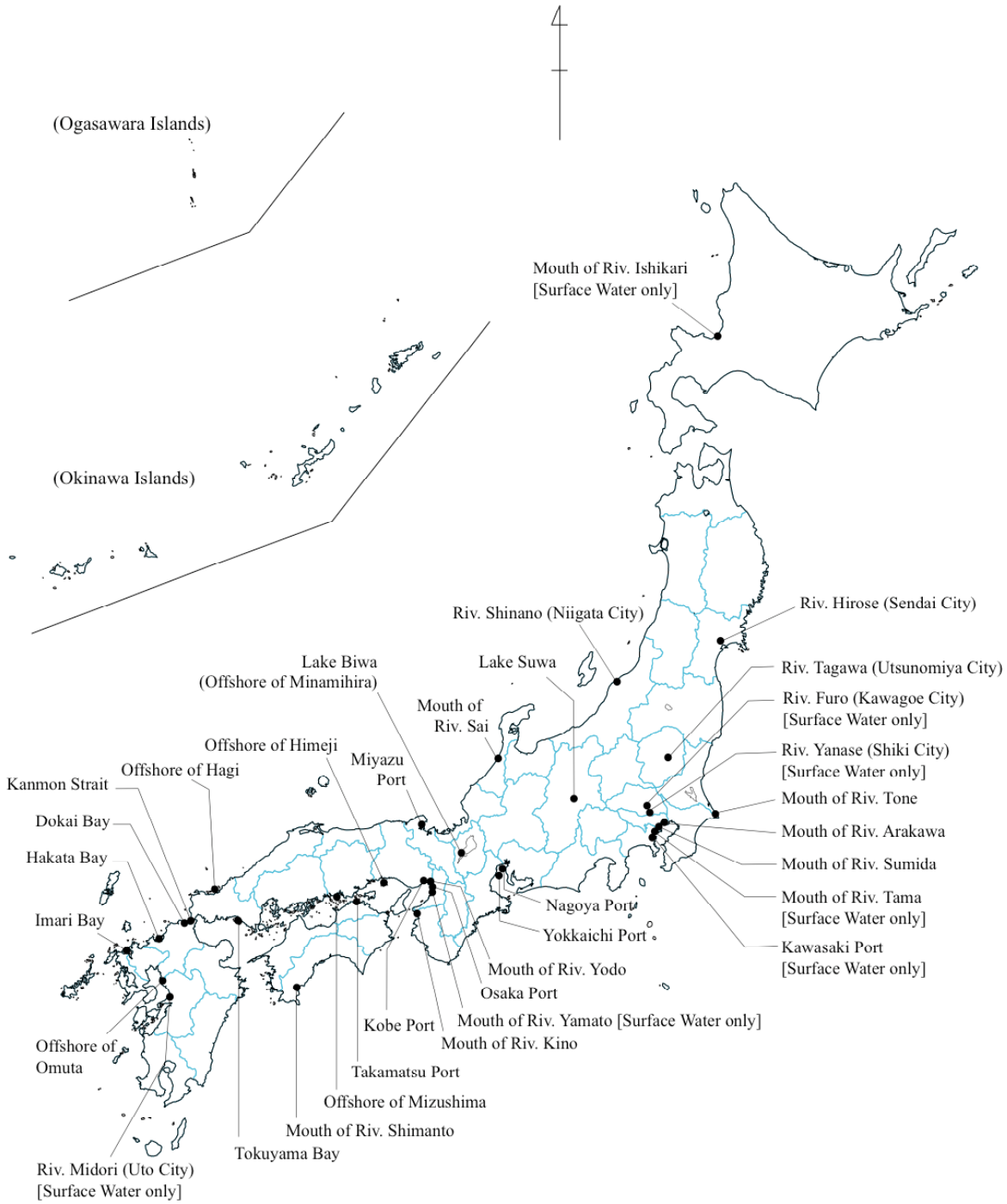


Figure 2-2 Locations of the Initial Environmental Survey for Aquatic Wildlife (FY2003)

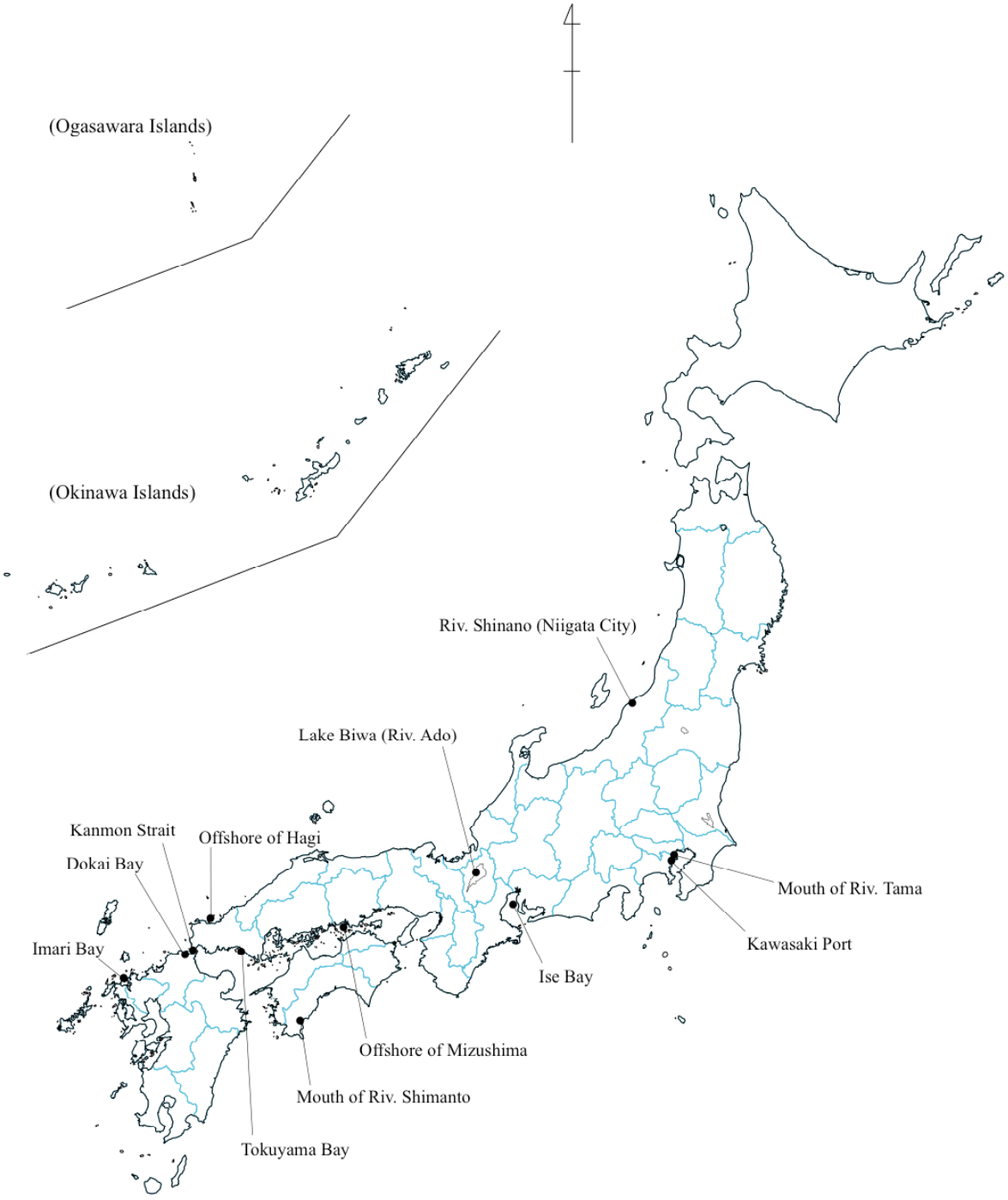


Figure 2-3 Locations of the Initial Environmental Survey for Air (FY2003)

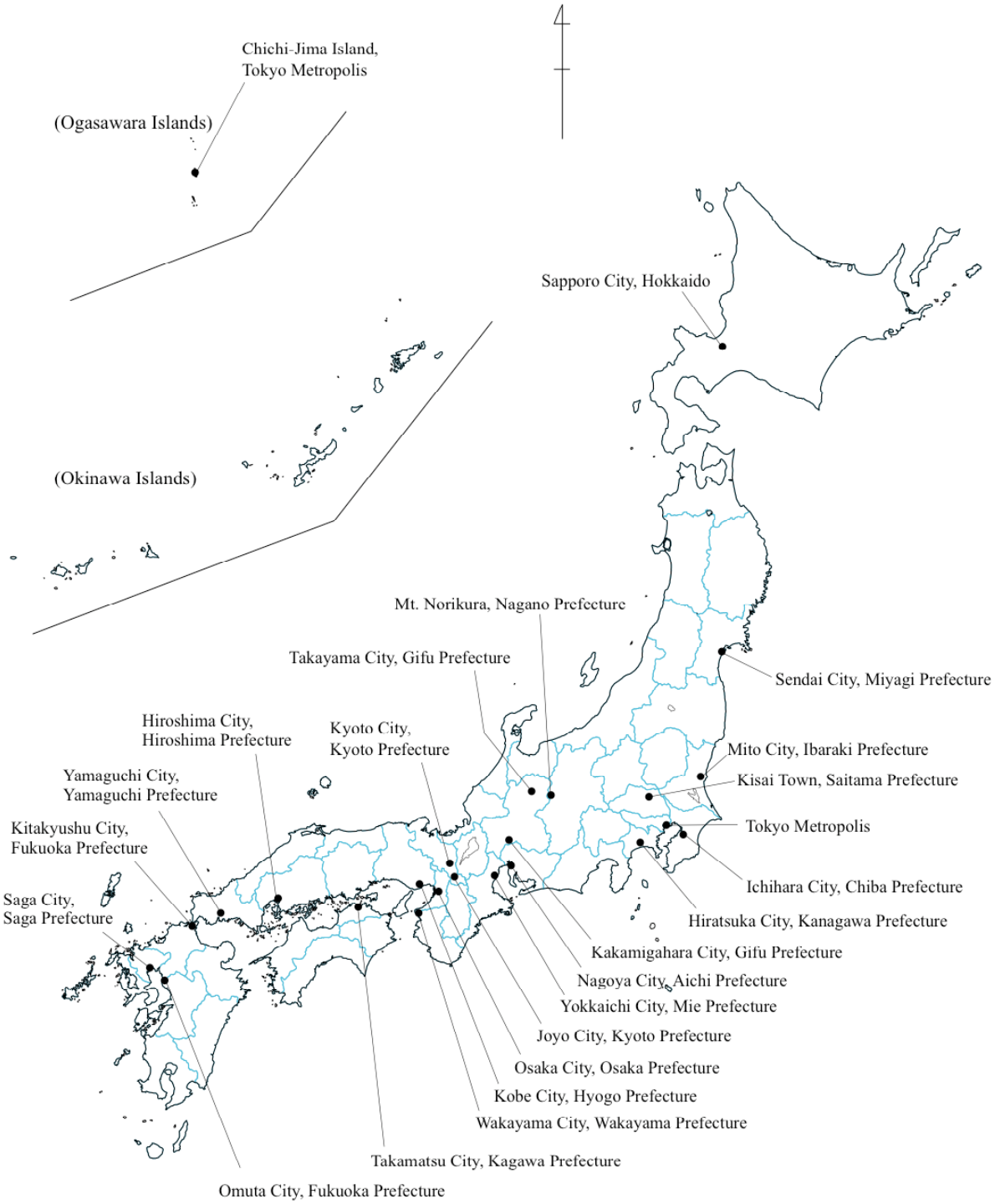


Table 2-2 Detection Results of the FY2003 Initial Environmental Survey

Survey No.	*Substance*	*Surface water 34 areas in total*		*Bottom sediment 27 areas in total*		*Aquatic wildlife 12 areas in total*		*Air 24 areas in total*	
		Detected range (μg/L) (frequency (area))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (frequency (area))*	*Detection limit (ng/g-dry)*	*Detected range (ng/g-wet) (frequency (area))*	*Detection limit (ng/g-wet)*	*Detected range (ng/m^3) (frequency (area))*	*Detection limit (ng/m^3)*
1	HCFCs								
1.1	HCFC-141b							73 - 1,400 (17/17)	4
1.2	HCFC-22							550 - 4,500 (19/19)	6
1.3	HCFC-123							3 - 320 (5/10)	3
1.4	HCFC-142b							54 - 1,100 (20/20)	3
1.5	HCFC-225ca							8.5 - 4,500 (15/16)	4
1.6	HCFC-225cb							17 - 4,400 (13/19)	15
1.7	HFC-134a							100 - 1,800 (20/20)	7
2	LAS (Total of LAS_{10}-LAS_{14})	0.2 - 67 (5/9)	0.2						
2.1	LAS_{10}	0.32 - 28 (3/9)	0.2						
2.2	LAS_{11}	0.32 - 17 (4/9)	0.2						
2.3	LAS_{12}	0.2 - 16 (4/9)	0.2						
2.4	LAS_{13}	0.25 - 6.1 (4/9)	0.2						
2.5	LAS_{14}	--- (0/9)	0.2						
3	Isoprene							88 - 1,300 (5/5)	12

(Note 1) Hatched area denotes that the survey was conducted in other media not targeted in this survey.

(Note 2) Frequency (area) indicates: Number of detected areas / Number of surveyed areas.

(Note 3) [---] in the range column denotes that there was no detected sample.

Table 2-2 Detection Results of the FY2003 Initial Environmental Survey (continued)

Survey No.	*Substance*	*Surface water 34 areas in total*		*Bottom sediment 27 areas in total*		*Aquatic wildlife 12 areas in total*		*Air 24 areas in total*	
		Detected range (μg/L) (frequency (area))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (frequency (area))*	*Detection limit (ng/g-dry)*	*Detected range (ng/g-wet) (frequency (area))*	*Detection limit (ng/g-wet)*	*Detected range (ng/m^3) (frequency (area))*	*Detection limit (ng/m^3)*
4	Chlordecone							--- (0/1)	0.0005 (= 0.5 pg/m^3)
5	Chlorpyrifos					10 (1/9)	3	--- (0/7)	2
6	Chloropicrin							--- (0/8)	220
7	Diethylenetriamine and 1 other substance								
7.1	Diethylenetriamine	--- (0/13)	2						
7.2	Triethylenetetramine	--- (0/13)	8						
8	1,4-Dichloro-2-nitrobenzene and 3 other substances								
8.1	1,4-Dichloro-2-nitrobenzene	--- (0/24)	0.05	--- (0/20)	2.5				
8.2	1,3 -Dichloro-4-nitrobenzene	--- (0/24)	0.06	6.3 (1/21)	1.9				
8.3	1-Chloro-3-nitrobenzene	--- (0/24)	0.05	--- (0/20)	3.2				
8.4	1,4-Dinitrobenzene	--- (0/24)	0.054	--- (0/21)	3.1				
9	3,3'-Dichlorobenzidine	0.014 (1/19)	0.010						
10	Pyridine-triphenylborane	--- (0/5)	0.12						
11	2,4,6-Tri-*tert*-butylphenol							--- (0/9)	0.9
12	Bromomethane							33 - 490 (4/4)	27

(Note 1) Hatched area denotes that the survey was conducted in other media not targeted in this survey.

(Note 2) Frequency (area) indicates: Number of detected areas / Number of surveyed areas.

(Note 3) [---] in the range column denotes that there was no detected sample.

Table 2-2 Detection Results of the FY2003 Initial Environmental Survey (continued)

Survey No.	*Substance*	*Surface water 34 areas in total*		*Bottom sediment 27 areas in total*		*Aquatic wildlife 12 areas in total*		*Air 24 areas in total*	
		Detected range (μg/L) (frequency (area))	*Detection limit (μg/L)*	*Detected range (ng/g-dry) (frequency (area))*	*Detection limit (ng/g-dry)*	*Detected range (ng/g-wet) (frequency (area))*	*Detection limit (ng/g-wet)*	*Detected range (ng/m^3) (frequency (area))*	*Detection limit (ng/m^3)*
13	1,2,5,6,9,10-Hexabromocyclo-dodecane	--- (0/20)	0.087	85-140 (1/15)	23				
14	Hexabromobiphenyl	--- (0/4)	0.000015 (= 0.015 ng/L)	--- (0/2)	0.0087 (= 8.7 pg/g-dry)				
15	Polybromodiphenyl ethers								
15.1	Hexabromodiphenyl ether			--- (0/3)	0.5	--- (0/3)	0.5		
15.2	Decabromodiphenyl ether			37 - 76 (2/5)	9.7	--- (0/2)	1		

(Note 1) Hatched area denotes that the survey was conducted in other media not targeted in this survey.

(Note 2) Frequency (area) indicates: Number of detected areas / Number of surveyed areas.

(Note 3) [---] in the range column denotes that there was no detected sample.

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Chapter 3 Summary of Results of the FY2003 Environmental Survey for Exposure Study

1. Purpose of the Survey

The purpose of this survey is to grasp the status of environmental persistence of chemical substances such as the Designated Chemical Substances specified in the Chemical Substances Control Law and Class 1 Designated Chemical Substances of the PRTR Law, which is necessary for understanding the exposure amount to humans and wildlife used in the environmental risk assessment targeting these chemical substances.

2. Target survey substances, media and survey areas

In FY2003, environmental survey for exposure study was conducted on the following 7 substances (groups) totaling 10 substances-media selected from among the priority substances-media determined by the Expert Group on Substance Selection of the Comprehensive Survey of Chemical Substances on Environmental Safety.

Table 3-1 Target Substances and Media for the FY2003 Environmental Survey for Exposure Study

Survey No.	*Target Substance*	*Number of survey areas classified by media*		
		Surface water	*Bottom sediment*	*Aquatic wildlife*
1	Octabromodiphenyl ether	38		9
2	*o*-Chloroaniline	38		
3	1-Chloro-2,4-dinitrobennzene	38		
4	2,4-Dinitrophenol	38		
5	Phenol	38		
6	Perfluorooctane sulfonic acid (PFOS)		20	9
7	Perfluorooctanoic acid (PFOA)		20	9

Surveyed areas are shown in Figures 3-1 to 3-3. Surveys were conducted for 5 substances (groups) in 38 areas in total for surface water (Figure 3-1), 2 substances (groups) in 20 areas in bottom sediment (Figure 3-2), 3 substances (groups) in 9 areas for aquatic wildlife (Figure 3-3).

3. Sampling and analytical method

Suggested sampling and analytical methods are shown in Appendix C and Appendix D, respectively.

4. Survey results

Among the 7 substances (groups) in the total of 10 substances-media, 7 substances-media were detected. The 3 substances-media exceptions were octabromodiphenyl ether in aquatic wildlife, 2,4-dinitrophenol and phenol in surface water, and PFOS and PFOA both in bottom sediment and aquatic wildlife.

Table 3-2 List of Detection Limits of the Environmental Survey for Exposure Study in FY2003

Survey No.	*Substance*	*Detection limit*		
		Surface water (ng/L)	*Bottom sediment (ng/g-dry)*	*Aquatic wildlife (ng/g-wet)*
1	Octabromodiphenyl ether	3		0.0007
2	*o*-Chloroaniline	25		
3	1-Chloro-2,4-dinitrobennzene	10		
4	2,4-Dinitrophenol	19		
5	Phenol	28		
6	PFOS		0.096	0.033
7	PFOA		0.070	0.059

Note 1: Hatched area denotes that the survey was conducted in other media not targeted in this survey.
Note 2: Measured values of bottom sediment are converted to dry sediment basis and the maximum detection limit was determined as the detection limit for each area, because the detection limit for each area varied considerably depending on the difference of the sediment moisture content.

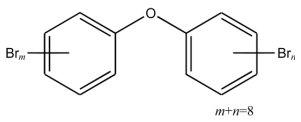
Table 3-3 Summary of Results of the Environmental Survey for Exposure Study in FY2003

Survey No.	*Substance*	*Surface water 38 areas, 114 samples*		*Bottom sediment 20 areas, 60 samples*		*Aquatic wildlife 9 areas, 27 samples*	
		Range (frequency (area))	*Median value (ng/L)*	*Range (frequency (area))*	*Median value (ng/g-dry)*	*Range (frequency (area))*	*Median value (ng/g-dry)*
1	Octabromodiphenyl ether	ND (0/38)	ND			ND - 0.064 (8/9)	0.0065
2	*o*-Chloroaniline	ND (0/38)	ND				
3	1-Chloro-2,4-dinitro-benzene	ND (0/38)	ND				
4	2,4-Dinitrophenol	ND - 540 (5/38)	ND				
5	Phenol	ND - 670 (6/38)	ND				
6	PFOS			ND - 1.5 (10/20)	tr (0.076)	0.16 - 16 (9/9)	1.3
7	PFOA			ND - 0.55 (12/20)	tr (0.066)	ND - 0.10 (4/9)	ND

Note 1: Hatched area denotes that the survey was conducted in other media not targeted in this survey.
Note 2: Frequency (area) indicates: Number of detected areas / Number of surveyed areas.
Note 3: As to bottom sediment, detected values below the detection limit in Table 3-2 were expressed as tr ().

5. Survey results of each substance (group)

[1] Octabromodiphenylether (CAS RN: 32536-52-0; surveyed media in FY2003: surface water and aquatic wildlife)



Chemical formula / molecular weight: $C_{12}H_2Br_8O$ / 801.4
Melting point: 75-220°C (Thermal decomposition temperature) [11)]
Boiling point: Unknown
Water solubility (Sw): <0.001 mg/L (25°C) [11)]
Specific gravity: 2.76 (25°C) [11)]
n-Octanol/water partition coefficient (LogPow): 5.5 [11)], 6.29 [12)]
Degradability: Unknown
Accumulativeness: Unknown

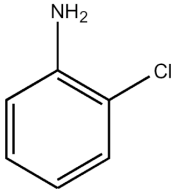
A survey of octabromodiphenylether in surface water was conducted under the detection limit of 3 ng/L and it was not detected in any of the surveyed 38 areas.

A survey of octabromodiphenylether in aquatic wildlife was conducted under the detection limit of 0.0007 ng/g-wet and it was detected in 8 areas out of 9. The maximum detected concentration was 0.064 ng/g-wet.

○ Survey Results of Octabromodiphenylether

Media	*Geometric mean*	*Median value*	*95% value*	*Max. value*	*Detection limit*	*Detection Frequency*	
						Sample	*Area*
Surface water	ND	ND	ND	ND	ng/L 3	0/114	0/38
Aquatic wildlife	ng/g-wet 0.0051	ng/g-wet 0.0065	ng/g-wet 0.058	ng/g-wet 0.064	ng/g-wet 0.0007	23/27	8/9

[2] *o*-Chloroaniline (CAS RN: 95-51-2; surveyed media in FY2003: surface water)



Chemical formula / molecular weight: $C_6H_6C\ell N$ / 127.6
Melting point: -14°C [1)]
Boiling point: 208.84°C (99.61 mol %) [1)]
Water solubility (Sw): 8,165 mg/L (25°C) [1)]
Specific gravity: 1.2114 (d_4^{22}) [1)]

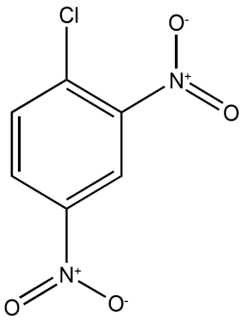
n-Octanol/water partition coefficient (LogPow): 1.90 [1)]
Degradability: Not easily degradable [17)]
Accumulativeness: Low concentration [17)]

o-Chloroaniline in surface water was surveyed in FY2003 under the detection limit of 25 ng/L and it was not detected in any of the surveyed 38 areas.

○ Survey Results of *o*-Chloroaniline

Media	*Geometric mean*	*Median value*	*95% value*	*Max. value*	*Detection limit*	*Detection Frequency*	
						Sample	*Area*
Surface water	ND	ND	ND	ND	25 ng/L	0/114	0/38

[3] 1-Chloro-2,4-dinitrobenzene (CAS RN: 97-00-7; surveyed media in FY2003: surface water)



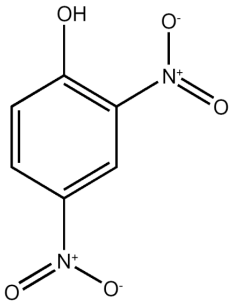
Chemical formula / molecular weight: $C_6H_3C\ell N_2O_4$ / 202.6
Melting point: 54°C [1)]
Boiling point: 315°C [1)]
Water solubility (Sw): 8 mg/L (15°C) [1)]
Specific gravity: 1.7 [1)]
n-Octanol/water partition coefficient (LogPow): 2.17 [1)]
Degradability: Not easily degradable [17)]
Accumulativeness: Low concentration [17)]

1-Chloro-2,4-dinitrobenzene in surface water was surveyed in FY2003 under the detection limit of 10 ng/L and it was not detected in any of the surveyed 38 areas.

○ Survey Results of 1-Chloro-2,4-dinitrobenzene

Media	*Geometric mean*	*Median value*	*95% value*	*Max. value*	*Detection limit*	*Detection Frequency*	
						Sample	*Area*
Surface water	ND	ND	ND	ND	10 ng/L	0/114	0/38

[4] 2,4-Dinitrophenol (CAS RN: 51-28-5; surveyed media in FY2003: surface water)



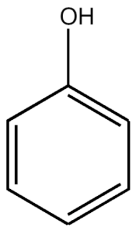
Chemical formula / molecular weight: $C_6H_4N_2O_5$ / 184.1
Melting point: 112 - 114°C [2)]
Boiling point: sublimates [3,4)]
Water solubility (Sw): 2,790 mg/L (20°C) [1)], 6,000 mg/L (25°C) [1)]
Specific gravity: 1.683 (24°C) [3,4)]
n-Octanol/water partition coefficient (LogPow): 1.67 [1)]
Degradability: Not easily degradable [17)]
Accumulativeness: Low concentration [17)]

2,4-Dinitrophenol in surface water was surveyed in FY2003 under the detection limit of 19 ng/L and it was detected in 5 areas out of 38, with the maximum detected concentration being 540 ng/L.

○ Survey Results of 2,4-Dinitrophenol

Media	*Geometric mean*	*Median value*	*95% value*	*Max. value*	*Detection limit*	*Detection Frequency*	
						Sample	*Area*
Surface water	ND	ND	ND	540 ng/L	19 ng/L	11/114	5/38

[5] Phenol (CAS RN: 108-95-2; surveyed media in FY2003: surface water)



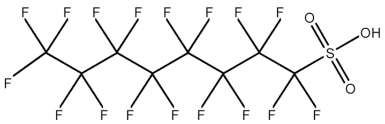
Chemical formula / molecular weight: C_6H_6O / 94.1
Melting point: 40.8°C [2)]
Boiling point: 182°C [2)]
Water solubility (Sw): 6,700 mg/L (16°C) [5)]
Specific gravity: 1.071 (20°C) [2)]
n-Octanol/water partition coefficient (LogPow): 1.46 (measured value) [6)], 1.47 (calculated value) [7)]
Degradability:Easily degradable [17)]
Accumulativeness: Unknown

Phenol in surface water was surveyed in FY2003 under the detection limit of 28 ng/L and it was detected in 6 areas out of 38, with the maximum detected concentration being 670 ng/L.

○ Survey Results of Phenol

Media	*Geometric mean*	*Median value*	*95% value*	*Max. value*	*Detection limit*	*Detection Frequency*	
						Sample	*Area*
Surface water	ND	ND	52 ng/L	670 ng/L	28 ng/L	10/114	6/38

[6] Perfluorooctane sulfonic acid (PFOS) (CAS RN: 1763-23-1; surveyed media in FY2003: bottom sediment and aquatic wildlife)



Chemical formula / molecular weight: $C_8HF_{17}SO_3$ / 500.1
Melting point: >400°C [8], 133°C (0.8 kPa) [1]
Boiling point: >400°C [8]
Water solubility (Sw): 519 mg/L (20±0.5°C) [8], 370 mg/L (purified water) [1], 124 mg/L (sea water) [1]
Specific gravity: Unknown
n-Octanol/water partition coefficient (LogPow): 2.49 (calculated value) [8], 5 (calculated value, unmeasurable because of its surface activity) [1]
Degradability: Not easily degradable [17]
Accumulativeness: Low concentration [17]

Perfluorooctane sulfonic acid (PFOS) in bottom sediment was surveyed in FY2003 for the first time under the detection limit of 0.096 ng/g-dry and it was detected in 10 areas out of 20, with the maximum concentration being 1.5 ng/g-dry.

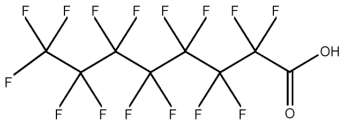
Perfluorooctane sulfonic acid (PFOS) in aquatic wildlife was surveyed in FY2003 for the first time under the detection limit of 0.033 ng/g-wet and it was detected in 9 areas out of 9, with the maximum concentration being 16 ng/g-wet.

○ Survey Results of PFOS

Media	*Geometric mean*	*Median value*	*95% value*	*Max. value*	*Detection limit*	*Detection Frequency*	
						Sample	*Area*
Bottom sediment	ng/g-dry tr(0.085)	ng/g-dry tr(0.076)	ng/g-dry 0.65	ng/g-dry 1.5	ng/g-dry 0.096	25/60	10/20
Aquatic wildlife	ng/g-wet 1.3	ng/g-wet 1.3	ng/g-wet 12	ng/g-wet 16	ng/g-wet 0.033	27/27	9/9

Note: As to bottom sediment, detected values below the detection limit were expressed as tr(). Measured values of bottom sediment are converted to dry sediment basis and the maximum detection limit was determined as the detection limit for each area, because the detection limit for each sample varied considerably depending on the difference of the sediment moisture content

[7] Perfluorooctanoic acid (PFOA) (CAS RN: 335-67-1; surveyed media in FY2003: bottom sediment and aquatic wildlife)



Chemical formula / molecular weight: $C_8HF_{15}O_2$ / 414.1

Melting point: 54°C [9)]

Boiling point: 188°C [9)]

Water solubility (Sw): 171 g/L (22°C) [10)]

Specific gravity: Unknown

n-Octanol/water partition coefficient (LogPow): 4.4 (calculated value) [1)]

Degradability: Not easily degradable [17)]

Accumulativeness: Low concentration [17)]

Perfluorooctanoic acid (PFOA) in bottom sediment was surveyed in FY2003 for the first time under the detection limit of 0.070 ng/g-dry and it was detected in 12 areas out of 20, with the maximum concentration being 0.55 ng/g-dry.

Perfluorooctanoic acid (PFOA) in aquatic wildlife was surveyed in FY2003 for the first time under the detection limit of 0.059 ng/g-wet and it was detected in 4 areas out of 9, with the maximum concentration being 0.10 ng/g-wet.

○ Survey Results of PFOA

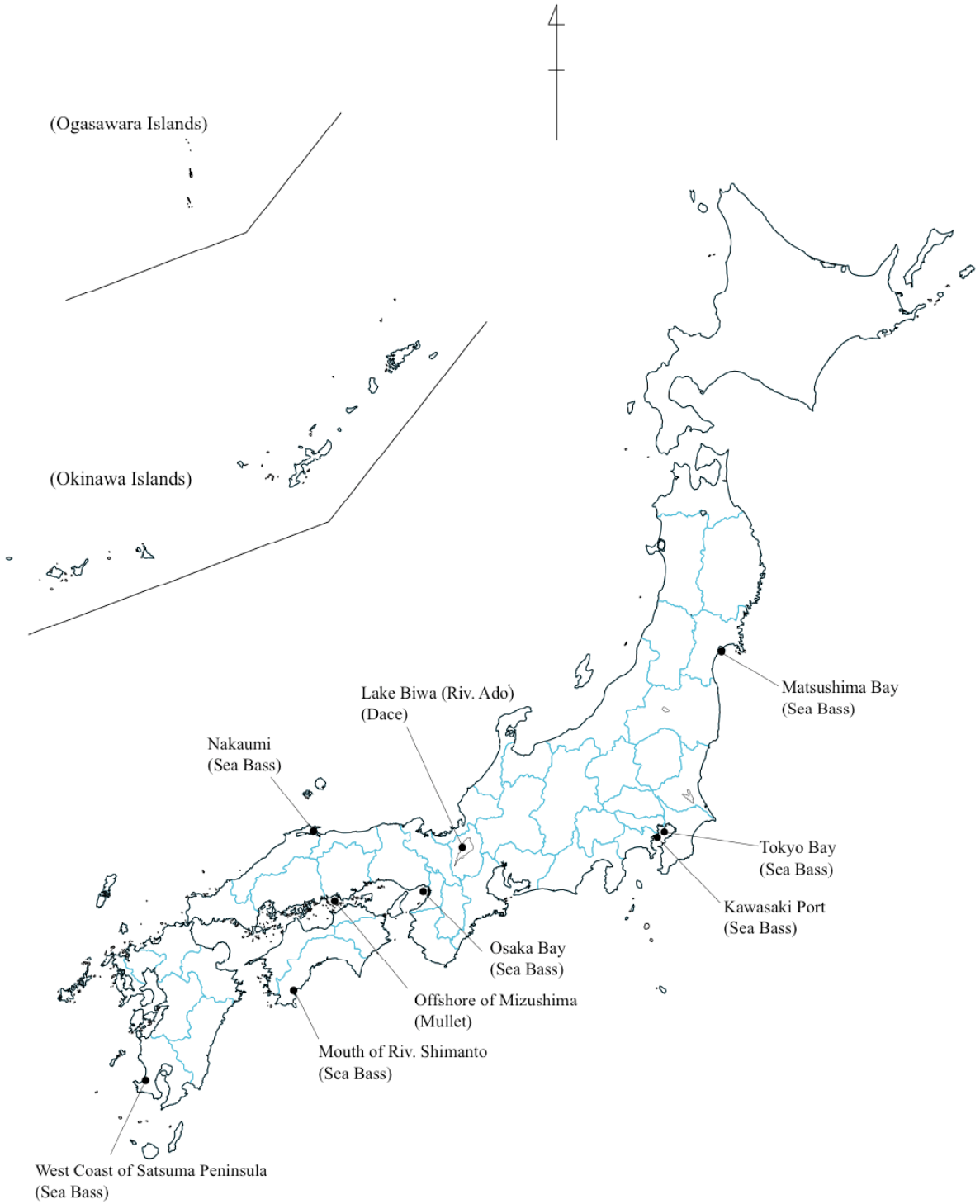
Media	*Geometric mean*	*Median value*	*95% value*	*Max. value*	*Detection limit*	*Detection Frequency*	
						Sample	*Area*
Bottom sediment	ng/g-dry tr (0.059)	ng/g-dry tr (0.066)	ng/g-dry 0.27	ng/g-dry 0.55	ng/g-dry 0.070	29/60	12/20
Aquatic wildlife	ND	ND	ng/g-wet 0.089	ng/g-wet 0.10	ng/g-wet 0.059	6/27	4/9

Note: As to bottom sediment, detected values below the detection limit were expressed as tr(). Measured values of bottom sediment are converted to dry sediment basis and the maximum detection limit was determined as the detection limit for each area, because the detection limit for each sample varied considerably depending on the difference of the sediment moisture content

Figure 3-1 Locations of the Environmental Survey for Exposure Study
(Surface water, FY2003)

Figure 3-2 Locations of the Environmental Survey for Exposure Study
(Bottom sediment, FY2003)

Figure 3-3 Locations of the Environmental Survey for Exposure Study
(Aquatic wildlife, FY2003)



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   · Hazard Assessment and Biomonitoring Data on Perfluorooctane Sulfonate-PFOS (by EPA)

   · Federal Register 40 CFR Part 721 (by USEPA)

   · Information Sheet (by USEPA)

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Chapter 4　Summary of the FY2003 Monitoring Investigation

1. Purpose of the survey

The purpose of this survey is to conduct on an annual basis the monitoring of target substances included in the POPs Treaty and other substances that may be candidates for target substances of the Treaty; highly persistent substances for which environmental standards are not yet established and a grasp of their annual environmental status is required among Class 1 & 2 Specified Chemical Substances and Designated Chemical Substances specified in the Chemical Substances Control Law.

2. Surveyed substances and areas

In the FY2003 Monitoring Investigation following 11 substances (groups) totaling 40 substance-media, which had been discussed and selected from among the priority substances and media at the FY2003 Expert Group on Substance Selection for the Comprehensive Survey of Chemical Substances on Environmental Safety, were surveyed. Among them, PCBs, HCB, aldrin, dieldrin, endrin, DDTs, chlordanes, heptachlor, toxaphene, and mirex are included in the target substances of the POPs Treaty. Monitoring of *trans*-heptachlor epoxide, *cis*-heptachlor epoxide, toxaphene (3 species), mirex, *γ*-HCH, *δ*-HCH (all media of substances mentioned above), DBT, DPT, MPT, tetrabromobisphenol A (bottom sediment and wildlife), *α*-HCH, and *β*-HCH (air) was started in FY2003.

Table 4-1　Target Substances and Media for the Monitoring Investigation

Survey No.	*Target substances*	*Media*			
		Surface water	*Bottom sediment*	*Wildlife*	*Air*
1	PCBs (Total PCB, 1-10 chlorinated homologs and coplanar PCBs (14 species))	✓	✓	✓	✓
2	HCB (Hexachlorobenzene)	✓	✓	✓	✓
3	Drins Aldrin, Dieldrin, Endrin	✓	✓	✓	✓
4	DDTs *p,p′*-DDT, *p,p′*-DDE, *p,p′*-DDD, *o,p′*-DDT, *o,p′*-DDE, *o,p′*-DDD	✓	✓	✓	✓
5	Chlordanes *trans*-Chlordane, *cis*-Chlordane, *trans*-Nonachlor, *cis*-Nonachlor, Oxychlordane	✓	✓	✓	✓
6	Heptachlors Heptachlor, *trans*-Heptachlor epoxide, *cis*-Heptachlor epoxide	✓	✓	✓	✓
7	Toxaphene Parlar 26, Parlar 50, Parlar 62	✓	✓	✓	✓
8	Mirex	✓	✓	✓	✓
9	HCHs (Hexachlorocyclohexane) *α*-HCH, *β*-HCH, *γ*-HCH, *δ*-HCH	✓	✓	✓	✓
10	Organotin compounds TBT, DBT, TPT, DPT, MPT		✓	✓	
11	Tetrabromobisphenol A		✓	✓	

As shown in Figures 4-A to 4-D, 36 areas for surface water, 62 areas for bottom sediment, 21 areas for wildlife (shellfish, fish, birds), and 35 areas for air were surveyed. Surveyed substances in each medium were the same for all areas (surface water: 9 substances (groups), bottom sediment/wildlife: 11 substances (groups), air: 9 substances (groups)). And the species and characteristics of wildlife subject are shown in Table 4-2.

3. Method of assessment

The General Inspection Survey was reexamined in FY2001 and the system of the survey was modified in FY2002. Thus, continuity of the survey has been studied, comparing the target substances, survey areas and quantitation limits before and after the modification in FY2002. Subsequently, change of the persistence of each substance was evaluated based on the results of continuity investigation. In the FY2003 survey, the change of persistence of each substance was also evaluated based on the assessment policy of FY2002.

[The policy of FY2002 assessment]

Monitoring Investigation has been conducted for a long period of time, during which many changes and modifications have been made. Consequently it is difficult to treat the data obtained during the initial years with the survey results in recent years as consecutive values. However, it might be possible to assess the surveyed values with continuity if they are limited to certain periods. The tendency of the survey results during a certain period of time is first assessed for each substance and medium. Next, the tendency of the total period as a whole was assessed.

4. Survey results

Summary of the survey is shown in Table 4-3 and Table 4-4. Furthermore, annual changes of PCBs, HCB, Drins, DDTs, chlordanes, HCHs, and organotin compounds in bottom sediment and wildlife are shown in the following figures.

† Figure 4-1: PCBs † Figure 4-2: HCB

† Figure 4-3: Aldrin † Figure 4-4: Dieldrin † Figure 4-5: Endrin

† Figure 4-6: *p,p*'-DDT † Figure 4-7: *p,p*'-DDE † Figure 4-8: *p,p*'-DDD

† Figure 4-9: *o,p*'-DDT † Figure 4-10: *o,p*'-DDE † Figure 4-11: *o,p*'-DDD

† Figure 4-12: *trans*-Chlordane † Figure 4-13: *cis*-Chlordane † Figure 4-14: *trans*-Nonachlor

† Figure 4-15: *cis*-Nonachlor † Figure 4-16: Oxychlordane

† Figure 4-17: α-HCH † Figure 4-18: β-HCH † Figure 4-19: γ-HCH

† Figure 4-20: δ-HCH

† Figure 4-21: TBT † Figure 4-22: TPT

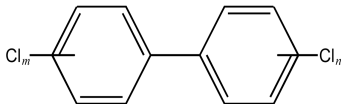
An outline of the FY2003 survey results is as follows.

In this survey, 2 substances of heptachlor (*cis*-heptachlor epoxide, *trans*-heptachlor epoxide), 3 substances of toxaphene (Parlar-26, Parlar-50, Parlar-62), mirex, 2 substances of HCHs (γ-HCH, δ-HCH), 3 substances of organotin compounds (monophenyltin compound, dibutyltin compound, diphenyltin compound) and tetrabromobisphenol A were added as target substances. The FY2003 survey was conducted, as in the FY2002 survey, with highly sensitive analytical methods. Consequently, all POPs, excluding toxaphene in surface water and bottom sediment, were detected in all of the surveyed substances and media.

In addition, a survey of air was conducted both in the warm and cold seasons and it was confirmed that the measured values in the warm season were higher than those in the cold season. Consequently, in comparing the results with those of FY2002, measured values in the cold season were adopted, since the temperature distributions were relatively similar to each other in this season.

An assessment of the survey results for each substance (group) is as follows.

[1] PCBs (CAS RN: 1336-36-3)



PCBs in surface water have been surveyed in the last 4 years and the geometric mean for FY2000, FY2001, FY2002 and FY2003 was 560 pg/L, 440 pg/L, 460 pg/L and 530 pg/L, respectively. The status of persistence of PCBs remains on the same level and they were detected in all samples from all surveyed areas every year; thus they are still evidently persistent in widespread areas.

PCBs	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* *Sample*	*Area*
Surface water (pg/L)	FY2002	460	330	60 - 11,000	0.18 - 0.90 [0.06 - 0.30]	114/114	38/38
	FY2003	530	450	230 - 3,100	0.3 - 6 [0.07 - 2]	36/36	36/36

Note: Values of Quantitation limit [Detection Limit] of PCBs are shown as a range of homologs and coplanar PCBs.

PCBs in bottom sediment have been surveyed in the last 4 years and the geometric mean for FY2000, FY2001, FY2002 and FY2003 was 15,000 pg/g-dry, 15,000 pg/g-dry, 9,200 pg/g-dry and 8,200 pg/g-dry, respectively. Although their concentrations in FY2002 and FY2003 are comparatively low, PCBs were detected in all samples from all surveyed areas every year and the persistence of PCBs in widespread areas is recognized.

PCBs	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* *Sample*	*Area*
Bottom sediment (pg/g-dry)	FY2002	9,200	11,000	39 - 630,000	0.21 - 1.5 [0.07 - 0.5]	189/189	63/63
	FY2003	8,200	9,500	39 - 5,600,000	0.4 - 6 [0.2 - 2]	186/186	62/62

Persistent concentrations of PCBs in shellfish showed a decreasing tendency in early years and the detected values in recent years were mostly below the detection limit (10,000 pg/g-wet). However, in the FY2003 survey under the reporting quantitation limit (hereinafter called QL) 2.1-11 pg/g-wet (reporting

detection limit (hereinafter called DL) 0.69-3.7 pg/g-wet), they were detected in all samples from all surveyed areas. Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of PCBs in widespread areas is recognized.

Although persistent concentrations of PCBs in fish show a decreasing tendency from the initial surveys to recent years, it was detected in all samples from all surveyed areas both in the FY2002 and FY2003 survey and the persistence of PCBs in widespread areas is recognized.

It is difficult to grasp the tendency of persistence of PCBs in birds from the initial years of the survey, mainly because of the change of survey areas, in addition to the fact that only 2 areas were surveyed. Little change is observed in their persistence in recent years and the persistence of PCBs is still recognized.

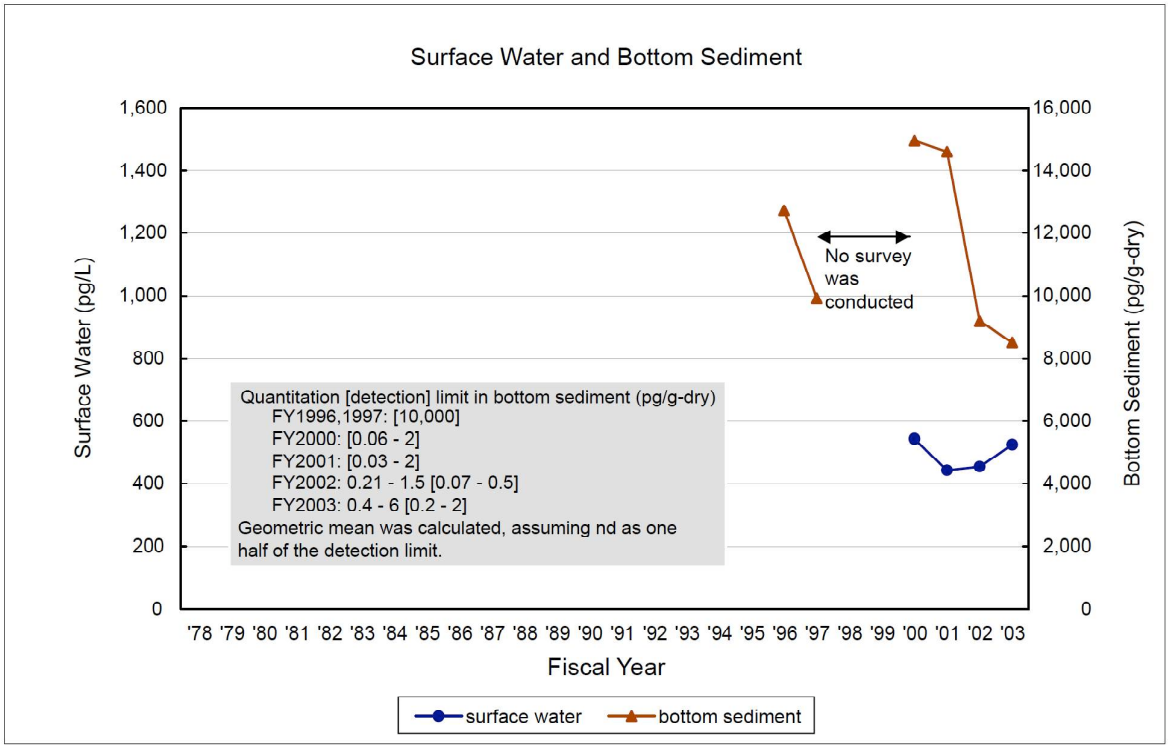
PCBs	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency*	
						Sample	*Area*
Shellfish (pg/g-wet)	FY2002	10,000	28,000	200 - 160,000	1.2 - 3 [0.4 - 1]	38/38	8/8
	FY2003	11,000	9,600	1,000 - 130,000	2.1 - 11 [0.69 - 3.7]	30/30	6/6
Fish (pg/g-wet)	FY2002	14,000	8,100	1,500 - 550,000	1.2 - 3 [0.4 - 1]	70/70	14/14
	FY2003	11,000	9,600	870 - 150,000	2.1 - 11 [0.69 - 3.7]	70/70	14/14
Birds (pg/g-wet)	FY2002	11,000	14,000	4,800 - 22,000	1.2 - 3 [0.4 - 1]	10/10	2/2
	FY2003	18,000	22,000	6,800 - 42,000	2.1 - 11 [0.69 - 3.7]	10/10	2/2

PCBs in air have been surveyed in the last 4 years and the geometric mean decreased gradually from 430 pg/m^3 in FY2000, 280 pg/m^3 in FY2001 to 100 pg/m^3 in FY2002. In FY2003 it was 110 pg/m^3 (cold season), the same level as in FY2002. PCBs have been detected in all areas/samples both in FY2002 and FY2003, indicating that they are still persistent in widespread areas.

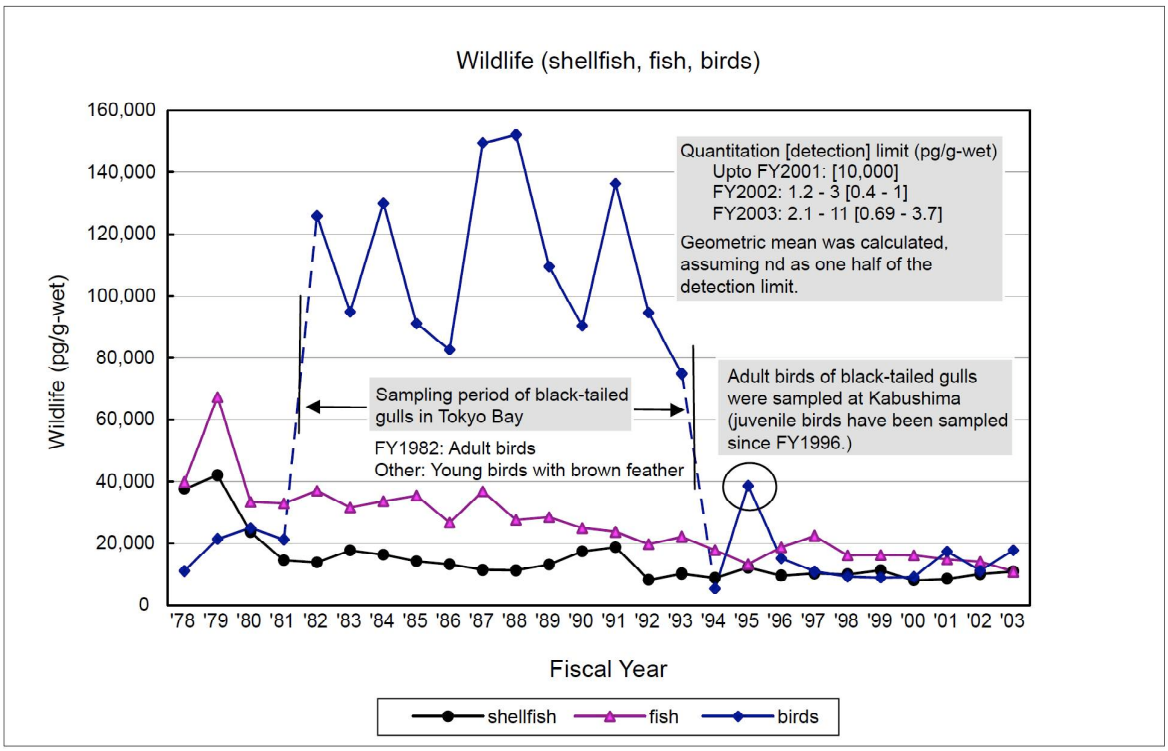
PCBs	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency*	
						Sample	*Area*
Air (pg/m^3)	FY2002	100	100	16 - 880	0.015 - 90 [0.005 - 30]	102/102	34/34
	FY2003 cold season	110	120	17 - 630	0.013 - 3.2 [0.0043 - 1.1]	34/34	34/34

PCBs are substances included in the POPs Treaty, and also from the standpoint of global pollution monitoring, it is necessary to continue the monitoring to trace their fate. As the disposal of PCBs by decomposition has been started, its effects and influences must be taken into account. Furthermore, homologs of PCBs and coplanar PCB are scheduled to be monitored hereafter in addition to the total PCBs.

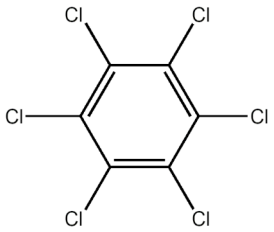
Figure 4-1 Annual Change of PCBs (geometric mean)



Note: No monitoring investigations of PCBs in surface water and bottom sediment were conducted before FY1999 and FY1995, respectively.



[2] HCB (CAS RN: 118-74-1)



HCB in surface water has mostly been below the detection limit (around 10,000 pg/L). However, it was detected in all areas/samples in the FY2003 survey under the QL 5 pg/L (DL 2 pg/L). Although it is difficult to grasp the tendency of the persistence because of the high detection limit in the past years, persistence of HCB in widespread areas is recognized.

HCB	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	36	28	9.8 - 1,400	0.6 [0.2]	114/114	38/38
	FY2003	29	24	11 - 340	5 [2]	36/36	36/36

Persistence of HCB in bottom sediment from the start of the monitoring to recent years shows a decreasing tendency. However, it was detected in all surveyed areas/samples both in FY2002 and FY2003 under the QL 0.9 – 4 pg/g-dry, indicating its persistence in widespread areas as before.

HCB	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	210	200	7.6 - 19,000	0.9 [0.3]	189/189	63/63
	FY2003	140	120	5 - 42,000	4 [2]	186/186	62/62

Concentrations of HCB in shellfish were mostly below the detection limit (1,000 pg/g-wet) until FY2001. However, it was detected in all areas/samples in the FY2003 survey under the QL 23 pg/g-wet (DL 7.5 pg/g-wet). Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of HCB in widespread areas is recognized.

Persistence of HCB in fish from the start of the monitoring shows a decreasing tendency and detected values were mostly below the detection limit (1,000 pg/g-wet) in recent years. In FY2003, it was detected in all surveyed areas/samples under the QL 23 pg/-wet (DL 7.5 pg/g-wet). Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of HCB in widespread areas is recognized.

It is difficult to grasp the tendency of persistence of HCB in birds from the initial years of the survey because of the change of survey areas, in addition to the fact that only 2 areas were surveyed. HCB was detected in birds at higher concentrations compared with that in shellfish and fish, and the concentration gradient of 'black-tailed gull > gray starling', 'birds > fish > shellfish' was observed, indicating its persistence in birds as before.

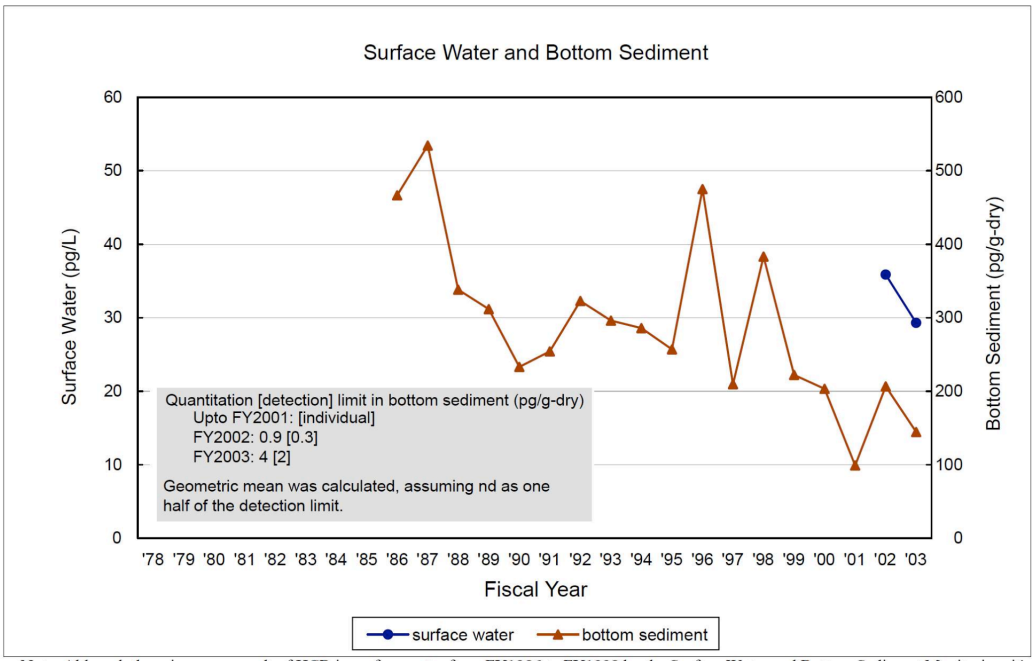
HCB	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	23	22	2.4 - 330	0.18 [0.06]	38/38	8/8
	FY2003	44	27	tr (21) - 660	23 [7.5]	30/30	6/6
Fish (pg/g-wet)	FY2002	140	180	19 - 910	0.18 [0.06]	70/70	14/14
	FY2003	170	170	28 - 1,500	23 [7.5]	70/70	14/14
Birds (pg/g-wet)	FY2002	1,000	1,200	560 - 1,600	0.18 [0.06]	10/10	2/2
	FY2003	1,700	2,000	790 - 4,700	23 [7.5]	10/10	2/2

Although it is difficult to grasp the tendency of its persistence as the monitoring of HCB in air was just initiated in FY2002, the persistence of HCB in widespread areas is recognized.

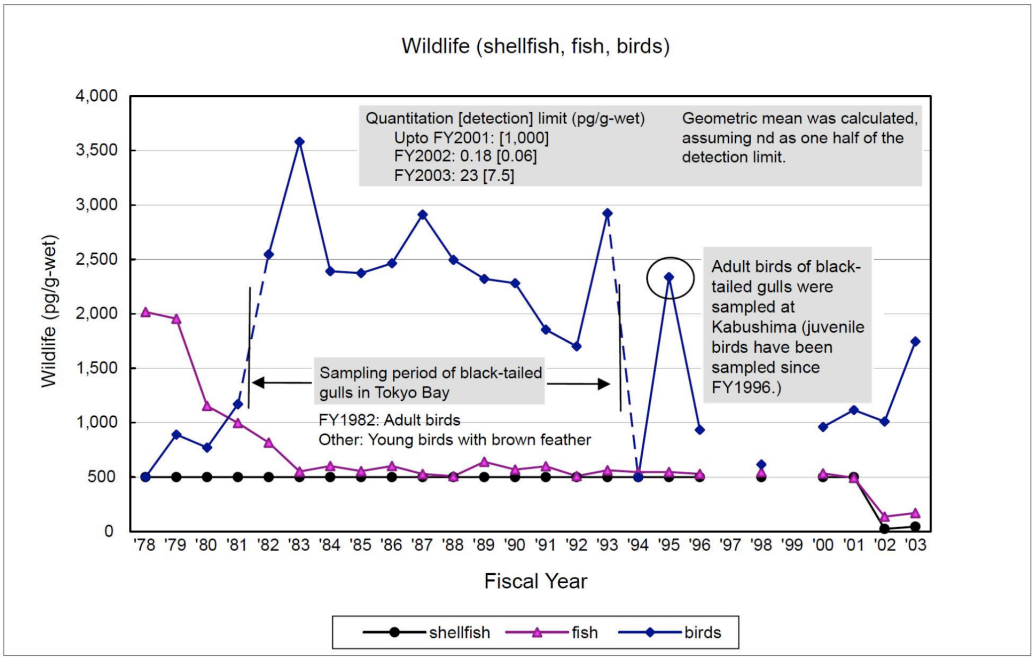
HCB	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Air (pg/m³)	FY2002	99	93	57 - 3,000	0.9	[0.3]	102/102	34/34
	FY2003 cold season	94	90	64 - 320	2.3	[0.78]	34/34	34/34

As HCB is one of the substances included in the POPs Treaty and it is persistent in widespread areas, successive monitoring is necessary for the purpose of tracing its fate, mainly from the standpoint of global pollution monitoring.

Figure 4-2 Annual Change of HCB (geometric mean)

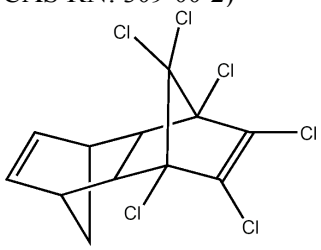


Note: Although there is survey result of HCB in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, it's not figured in above chart because of no-comparability with result since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.



[3] **Drins** (Aldrin, Dieldrin, Endrin)

(Aldrin, CAS RN: 309-00-2)



Although it is difficult to grasp the tendency of the persistence as the monitoring of aldrin in surface water and bottom sediment was started in FY2002, its persistence in widespread areas is recognized.

Aldrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	0.69	0.90	ND - 18	0.6 [0.2]	93/114	37/38
	FY2003	0.9	0.9	ND - 3.8	0.6 [0.2]	34/36	34/36
Bottom sediment (pg/g-dry)	FY2002	12	12	ND - 570	6 [2]	149/189	56/63
	FY2003	17	18	ND - 1,000	2 [0.6]	178/186	60/62

Concentrations of aldrin in shellfish were mostly below the detection limit (1,000 pg/g-wet) until FY1993 and no monitoring has been conducted from FY1994 to FY2001. However, it was detected with the same concentration level in the FY2002 and FY2003 survey under the QL 4.2 pg/g-wet (DL 1.4 pg/g-wet) and QL 2.5 pg/g-wet (DL 0.84 pg/g-wet), respectively. Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of aldrin is recognized.

Concentrations of aldrin in fish were mostly below the detection limit (1,000 pg/g-wet) until FY1993 and no monitoring has been conducted from FY1994 to FY2001. In FY2003, monitoring was conducted under the QL 2.5 pg/g-wet (DL 0.84 pg/g-wet) and, although all of the data were below the QL, aldrin was detected in 16 areas. Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of aldrin is recognized.

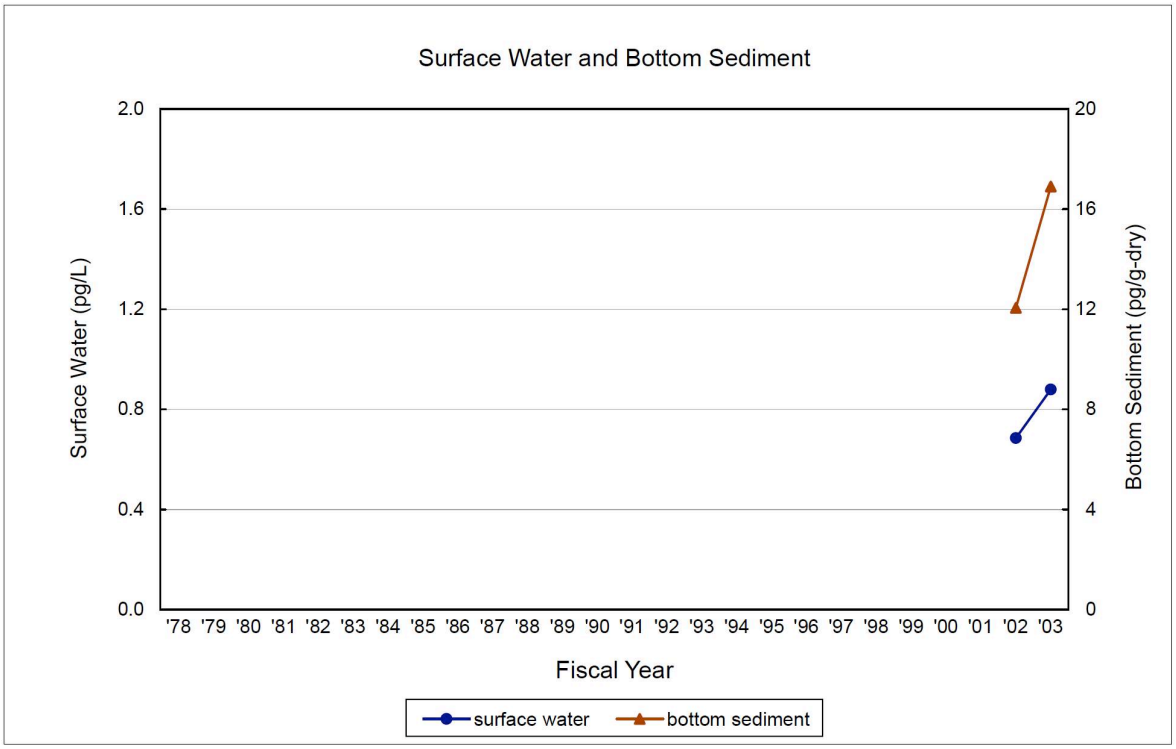
It is difficult to grasp the tendency of persistence, as the concentrations of aldrin in birds were mostly below the detection limit (1,000 pg/g-wet) until FY1993 since its first detection in 1978 and no monitoring has been conducted from FY1994 to FY2001. Aldrin was not detected in FY2002 or FY2003 under the DL 1.4 pg/g-wet and 0.84 pg/g-wet, respectively.

Aldrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	tr (1.7)	ND	ND - tr (34)	4.2 [1.4]	12/38	4/8
	FY2003	tr (1.6)	tr (0.85)	ND - 51	2.5 [0.84]	15/30	3/6
Fish (pg/g-wet)	FY2002	ND	ND	ND - tr (2.0)	4.2 [1.4]	1/70	1/14
	FY2003	ND	ND	ND - tr (1.9)	2.5 [0.84]	16/70	7/14
Birds (pg/g-wet)	FY2002	ND	ND	ND	4.2 [1.4]	0/10	0/2
	FY2003	ND	ND	ND	2.5 [0.84]	0/10	0/2

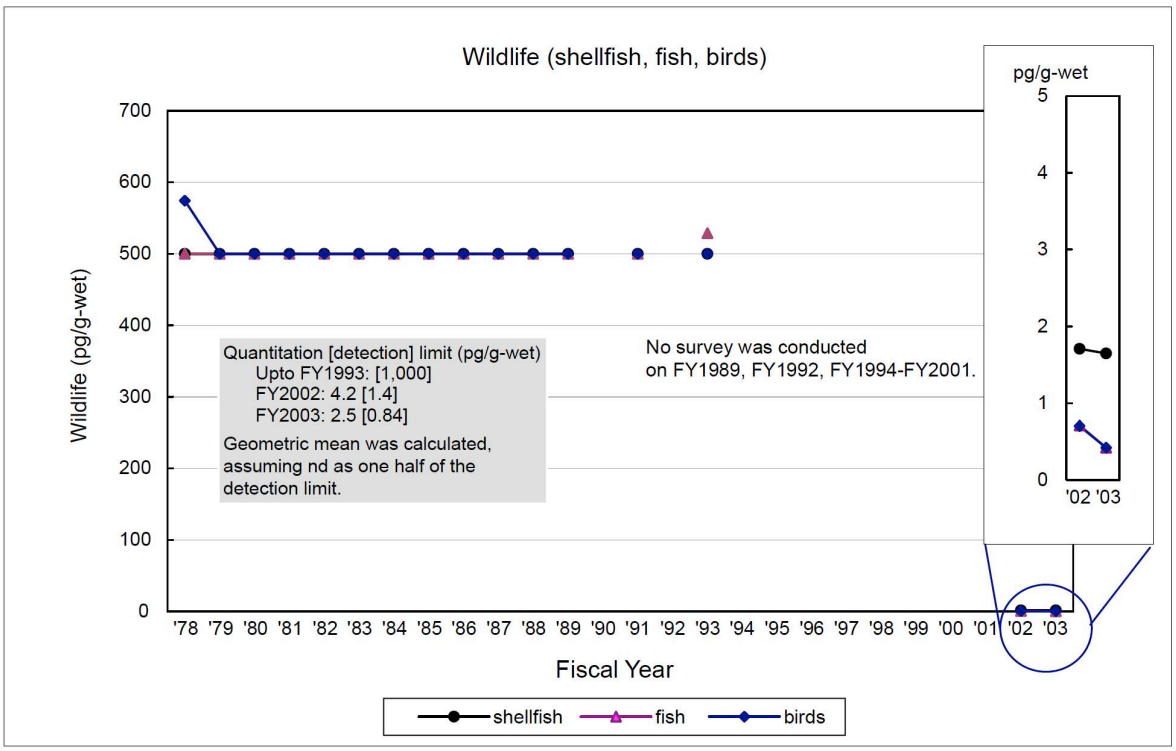
Although it is difficult to grasp the tendency of its persistence as the monitoring of aldrin in air was just initiated in FY2002, persistence of aldrin in widespread areas is recognized.

Aldrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	tr (0.030)	ND	ND - 3.2	0.060 [0.020]	41/102	19/34
	FY2003 cold season	0.55	0.44	0.030 - 6.9	0.023 [0.0077]	34/34	34/34

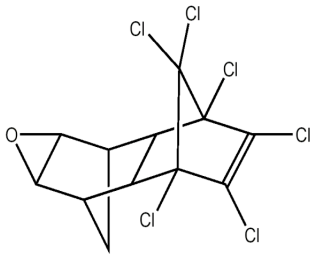
Figure 4-3 Annual Change of Aldrin (geometric mean)



Note: No monitoring investigations of aldrin in surface water and bottom sediment were conducted before FY2001.



(Dieldrin, CAS RN: 60-57-1)



Concentrations of dieldrin in surface water were below the detection limit (around 10,000 pg/L) until FY2001. However, it was detected in all areas in the FY2002 and FY2003 survey under the QL 1.8 pg/L (DL 0.6 pg/L) and QL 0.7 pg/L (DL 0.3 pg/L), respectively. Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of dieldrin in widespread areas is recognized.

Dieldrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	41	41	3.3 - 940	1.8	[0.6]	114/114	38/38
	FY2003	57	57	9.7 - 510	0.7	[0.3]	36/36	36/36

Concentrations of dieldrin in bottom sediment were mostly below the detection limit (around 1,000 pg/g-dry) until FY2001. However, it was detected in all areas in the FY2002 and FY2003 survey under the QL 3 pg/g-dry (DL 1 pg/g-dry) and QL 4 pg/g-dry (DL 2 pg/g-dry), respectively. Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of dieldrin in widespread areas is recognized.

Dieldrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	63	51	4 - 2,300	3	[1]	189/189	63/63
	FY2003	59	56	ND - 9,100	4	[2]	184/186	62/62

Persistence of dieldrin in shellfish and fish shows a decreasing tendency from the start of the monitoring to recent years. However, it was detected in all surveyed areas/samples in the FY2002 and FY2003 survey under the QL 12 pg/g-wet (DL 4 pg/g-wet) and QL 4.8 pg/g-wet (DL 1.6 pg/g-wet), respectively, indicating its persistence in widespread areas.

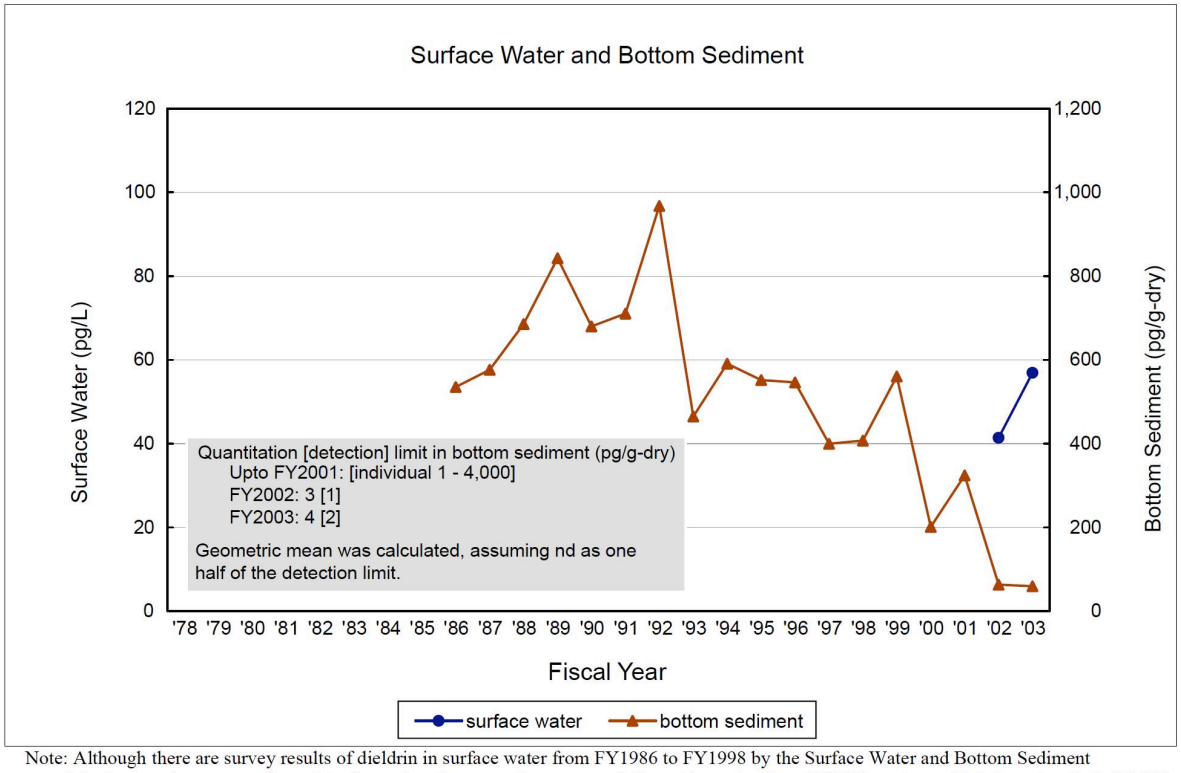
It is difficult to grasp the tendency of persistence of dieldrin in birds since the initiation of the survey because survey areas were changed, in addition to the fact that only 2 areas were surveyed. Little change is observed in the persistence in recent years and the persistence of dieldrin is still recognized.

Dieldrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	490	390	tr (7) - 190,000	12	[4]	38/38	8/8
	FY2003	410	160	46 - 78,000	4.8	[1.6]	30/30	6/6
Fish (pg/g-wet)	FY2002	280	270	46 - 2,400	12	[4]	70/70	14/14
	FY2003	210	200	29 - 1,000	4.8	[1.6]	70/70	14/14
Birds (pg/g-wet)	FY2002	1,200	1,100	820 - 1,700	12	[4]	10/10	2/2
	FY2003	1,300	1,400	790 - 2,200	4.8	[1.6]	10/10	2/2

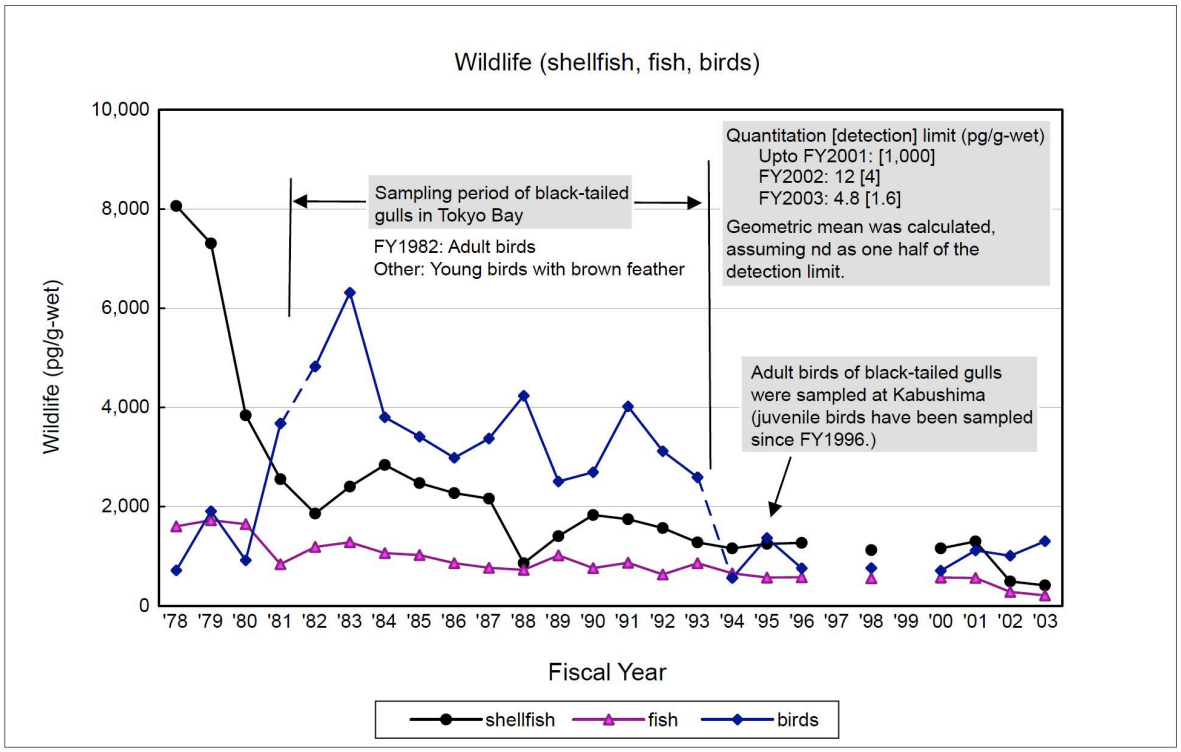
Although it is difficult to grasp the tendency of its persistence as the monitoring of dieldrin in air was just initiated in FY2002, persistence of dieldrin in widespread areas is recognized.

Dieldrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	5.6	5.4	0.73 - 110	0.60	[0.20]	102/102	34/34
	FY2003 cold season	5.7	5.2	tr (0.82) - 110	2.1	[0.70]	34/34	34/34

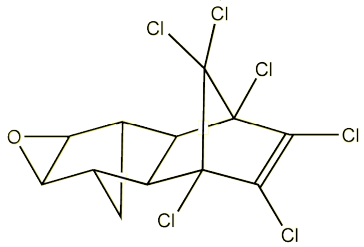
Figure 4-4 Annual Change of Dieldrin (geometric mean)



Note: Although there are survey results of dieldrin in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.



(Endrin, CAS RN: 72-20-8)



It is difficult to grasp the tendency of persistence as the monitoring of endrin in surface water and bottom sediment was started in FY2002, its persistence in widespread areas was recognized.

Endrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Surface water (pg/L)	FY2002	4.7	5.5	ND - 31	6.0	[2.0]	101/114	36/38
	FY2003	5.7	6.0	0.7 - 78	0.7	[0.3]	36/36	36/36
Bottom sediment (pg/g-dry)	FY2002	9	10	ND - 19,000	6	[2]	141/189	54/63
	FY2003	11	11	ND - 29,000	5	[2]	150/186	53/62

Endrin had been detected in shellfish in a specific area under detection limit 1,000 pg/g-wet until FY1993; however, no monitoring has been conducted from FY1994 to FY2001. In FY2002, it was detected in most of the surveyed areas under the QL 18 pg/g-wet (DL 6 pg/g-wet), and in FY2003 it was detected in all areas/samples under the QL 4.8 pg/g-wet (DL 1.6 pg/g-wet), indicating that endrin is widely persistent also in other areas.

Concentrations of endrin in fish were mostly below the detection limit (around 1,000 pg/g-wet) until FY1993 and no monitoring has been conducted from FY1994 to FY2001. In FY2002, it was detected in many areas/samples under the QL 18 pg/g-wet (DL 6 pg/g-wet), and in FY2003 it was detected in all areas/samples under the QL 4.8 pg/g-wet (DL 1.6 pg/g-wet). Although it is difficult to grasp the tendency of the persistence because of the high detection limit in the past years, persistence of endrin in widespread areas is recognized.

Concentrations of endrin in birds were below the detection limit (around 1,000 pg/g-wet) until FY1993 and no monitoring has been conducted from FY1994 to FY2001. In FY2002, it was detected in many areas/samples under the QL 18 pg/g-wet (DL 6 pg/g-wet), and in FY2003 it was detected in all areas/samples under the QL 4.8 pg/g-wet (DL 1.6 pg/g-wet). Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of endrin is recognized.

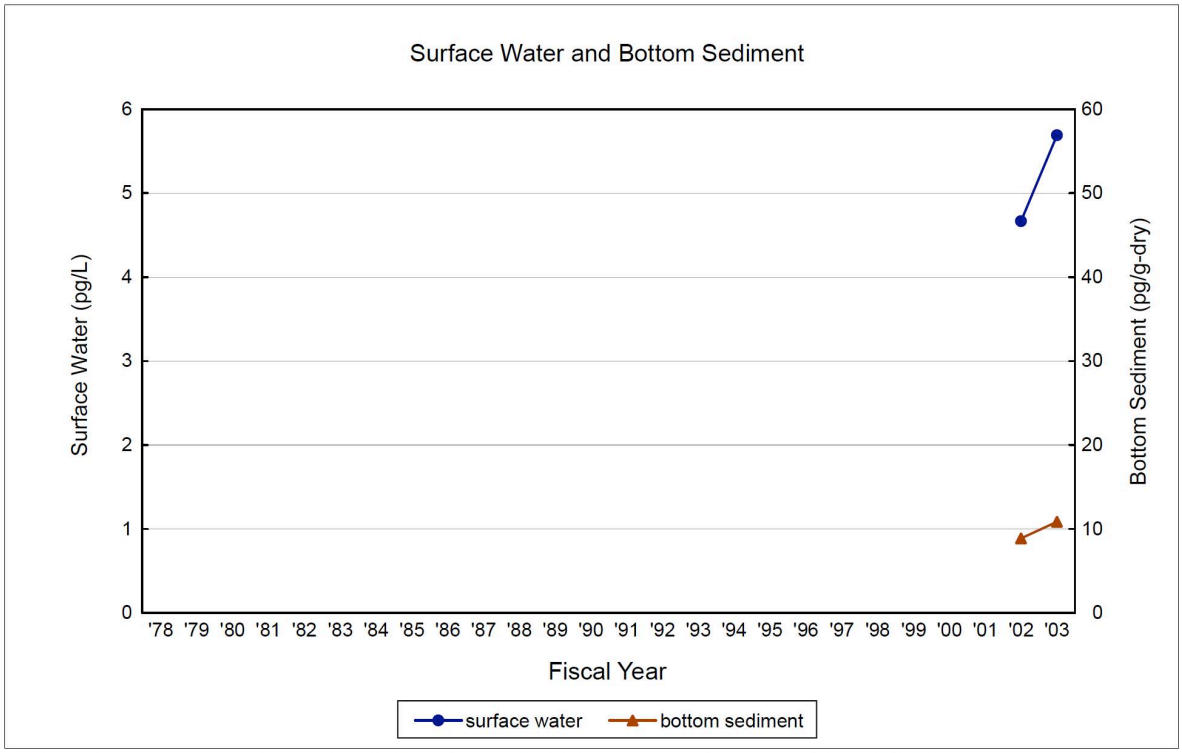
Endrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Shellfish (pg/g-wet)	FY2002	44	27	ND - 12,000	18	[6]	35/38	7/8
	FY2003	36	21	6.3 - 5,000	4.8	[1.6]	30/30	6/6
Fish (pg/g-wet)	FY2002	19	24	ND - 180	18	[6]	54/70	13/14
	FY2003	14	10	ND - 180	4.8	[1.6]	67/70	14/14
Birds (pg/g-wet)	FY2002	22	52	ND - 99	18	[6]	7/10	2/2
	FY2003	21	30	5.4 - 96	4.8	[1.6]	10/10	2/2

Although it is difficult to grasp the tendency of its persistence as the monitoring of endrin in air was just initiated in FY2002, persistence of endrin in widespread areas is recognized.

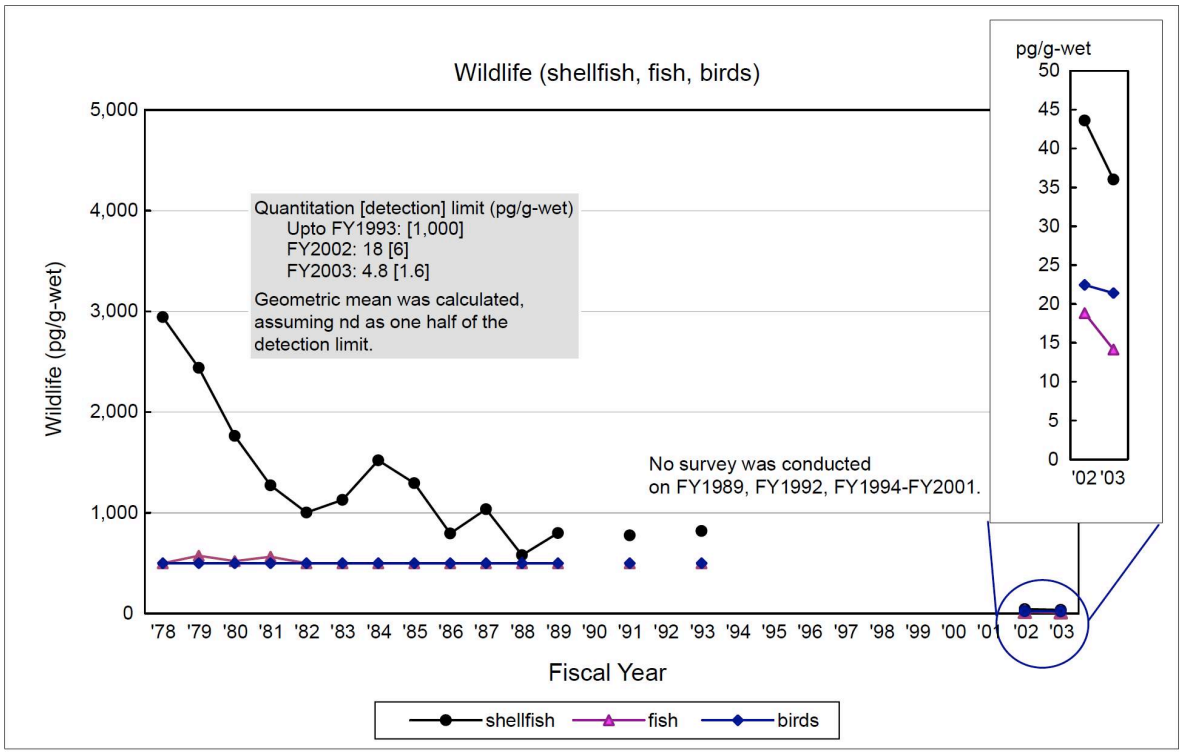
Endrin	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Air (pg/m^3)	FY2002	0.22	0.28	ND - 2.5	0.090	[0.030]	90/102	32/34
	FY2003 cold season	0.23	0.20	0.042 - 2.1	0.042	[0.014]	34/34	34/34

Aldrin, dieldrin and endrin are target substances included in the POPs Treaty, and also from the standpoint of global pollution monitoring, it is necessary to continue the monitoring to trace their fate.

Figure 4-5 Annual Change of Endrin (geometric mean)

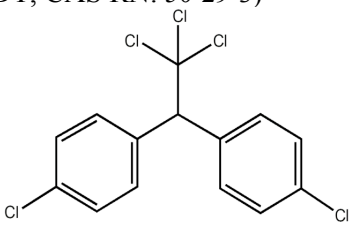


Note: No monitoring investigations of endrin in surface water and bottom sediment were conducted before FY2001.



[4] DDTs

(*p,p'*-DDT, CAS RN: 50-29-3)



Concentrations of *p,p'*-DDT in surface water were below the detection limit (10,000 pg/L) until FY2001. It was detected in all areas/samples in the FY2003 survey under the QL 3 pg/L (DL 0.9 pg/L). Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of *p,p'*-DDT in widespread areas is recognized.

p,p'-DDT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	12	11	tr (0.25) - 440	0.6	[0.2]	114/114	38/38
	FY2003	14	12	tr (2.8) - 740	3	[0.9]	36/36	36/36

No considerable change had been observed in the persistence of *p,p'*-DDT in bottom sediment until FY1996; however, a decreasing tendency has been observed since FY1997. In the FY2003 survey, it was detected in all surveyed areas/samples under the QL 2 pg/g-dry (DL 0.4 pg/g-dry), indicating its persistence in widespread areas as before.

p,p'-DDT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	270	240	tr (5) - 97,000	6	[2]	189/189	63/63
	FY2003	240	220	3 - 55,000	2	[0.4]	186/186	62/62

Persistence of *p,p'*-DDT in shellfish showed a decreasing tendency in early years and concentrations in recent years were mostly below the detection limit (1,000 pg/g-wet). In the FY2003 survey, it was detected in all surveyed areas/samples under the QL 11 pg/g-wet (DL 3.5 pg/g-wet). Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, persistence of *p,p'*-DDT in widespread areas is recognized.

Persistence of *p,p'*-DDT in fish shows a decreasing tendency from the start of the monitoring to recent years. However, in the FY2003 survey, it was detected in all surveyed areas/samples under the QL 11 pg/g-wet (DL 3.5 pg/g-wet), indicating its persistence in widespread areas.

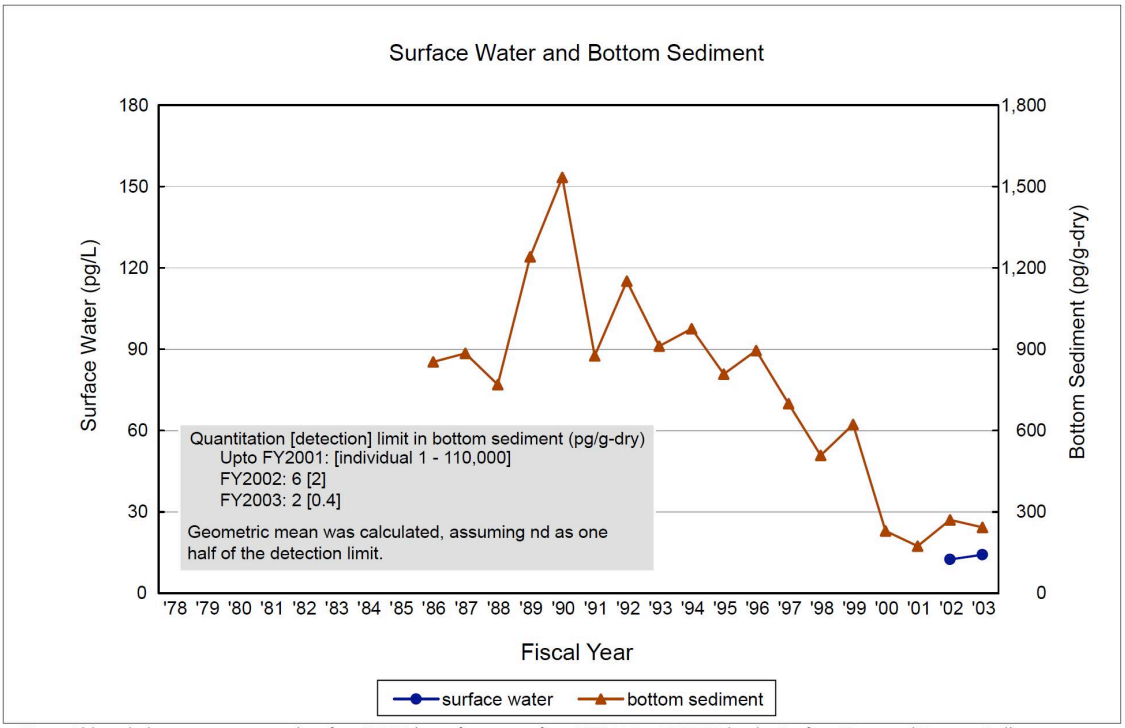
It is difficult to grasp the tendency of persistence of *p,p'*-DDT in birds from the start of the survey because survey areas were changed, in addition to the fact that only 2 areas were surveyed. Little change is observed in the persistence in recent years and the persistence of *p,p'*-DDT is still recognized.

p,p'-DDT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	200	200	38 - 1,200	4.2	[1.4]	38/38	8/8
	FY2003	290	290	49 - 1,800	11	[3.5]	30/30	6/6
Fish (pg/g-wet)	FY2002	330	450	6.8 - 24,000	4.2	[1.4]	70/70	14/14
	FY2003	210	400	tr (3.7) - 1,900	11	[3.5]	70/70	14/14
Birds (pg/g-wet)	FY2002	380	510	76 - 1,300	4.2	[1.4]	10/10	2/2
	FY2003	540	620	180 - 1,400	11	[3.5]	10/10	2/2

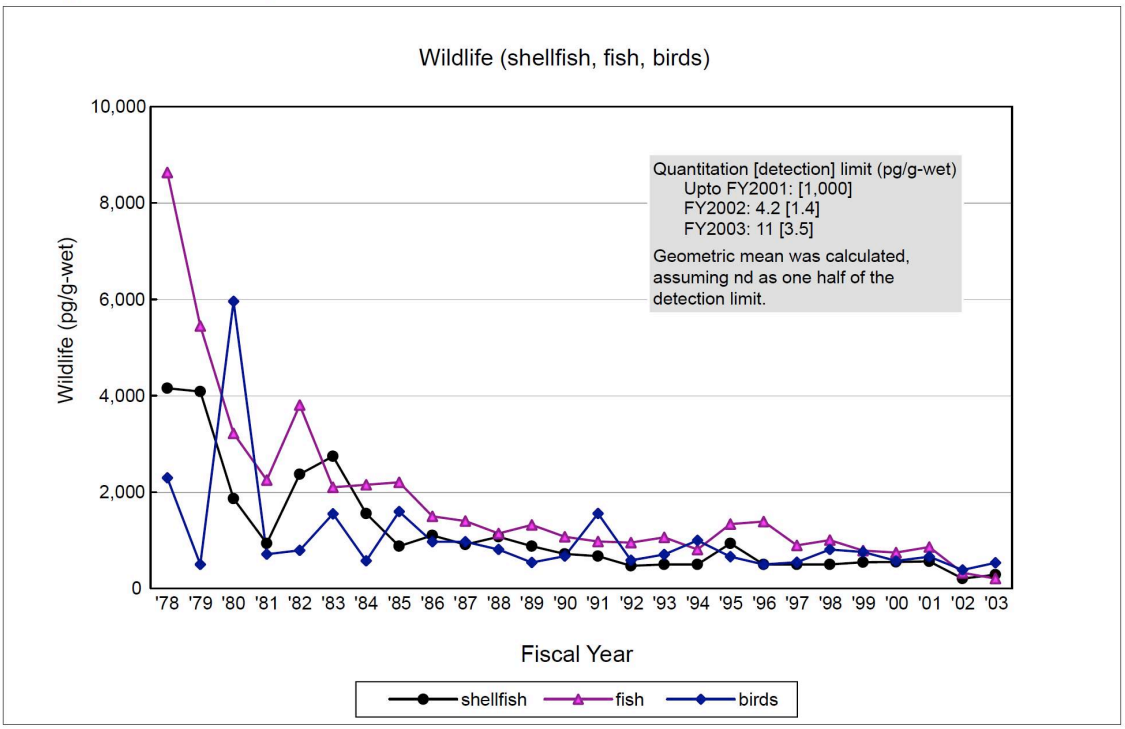
Although it is difficult to grasp the tendency of its persistence as the monitoring of *p,p'*-DDT in air was just initiated in FY2002, persistence of *p,p'*-DDT in widespread areas is recognized.

p,p'-DDT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Air (pg/m³)	FY2002	1.9	1.8	0.25 - 22	0.24 [0.08]	102/102	34/34
	FY2003 cold season	1.7	1.6	0.31 - 11	0.14 [0.046]	34/34	34/34

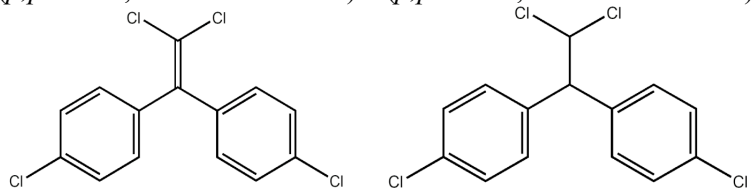
Figure 4-6 Annual Change of *p,p'*-DDT (geometric mean)



Note: Although there are survey results of *p,p'*-DDT in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.



(*p,p'*-DDE, CAS RN: 72-55-9) (*p,p'*-DDD, CAS RN: 72-54-8)



p,p'-DDE and *p,p'*-DDD in surface water had been surveyed under detection limit around 10,000 pg/L and *p,p'*-DDE was detected in FY1987 only in one area. In FY2003, they were detected in all areas/samples under the QL 4 pg/L (DL 2 pg/L) for *p,p'*-DDE and QL 2 pg/L (DL 0.5 pg/L) for *p,p'*-DDD. Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, their persistence in widespread areas is recognized.

p,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	24	26	1.3 - 760	0.6 [0.2]	114/114	38/38
	FY2003	26	22	5 - 380	4 [2]	36/36	36/36

p,p'-DDD	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	15	18	0.57 - 190	0.24 [0.08]	114/114	38/38
	FY2003	19	18	4 - 410	2 [0.5]	36/36	36/36

In the early years of the monitoring, little change was observed in their persistence in bottom sediment and a decreasing tendency was observed in recent years. In FY2003, they were detected in all areas/samples under the QL 0.9 pg/g-dry (DL 0.3 pg/g-dry) for both substances, indicating that both substances are still persistent in widespread areas.

p,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	660	630	8.4 - 23,000	2.7 [0.9]	189/189	63/63
	FY2003	710	780	9.5 - 80,000	0.9 [0.3]	186/186	62/62

p,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	540	690	tr (2.2) - 51,000	2.4 [0.8]	189/189	63/63
	FY2003	590	580	3.7 - 32,000	0.9 [0.3]	186/186	62/62

Persistence of *p,p'*-DDE in shellfish showed a decreasing tendency in initial years; however, no tendency is observed in recent years. And, no change is observed in the persistence of *p,p'*-DDD from the initial years to recent years. However, in the FY2003 survey, they were detected in all surveyed areas/samples under the QL 5.7 pg/g-wet (DL 1.9 pg/g-wet) for *p,p'*-DDE and QL 9.9 pg/g-wet (DL 3.3 pg/g-wet) for *p,p'*-DDD, indicating that they are still persistent in widespread areas.

Persistence of both substances in fish shows a slightly decreasing tendency from the initial year of the monitoring to recent years. However, in the FY2003 survey, they were detected in all surveyed areas/samples under the QL 5.7 pg/g-wet (DL 1.9 pg/g-wet) for *p,p'*-DDE and QL 9.9 pg/g-wet (DL 3.3 pg/g-wet) for *p,p'*-DDD, indicating that they are still persistent in widespread areas.

It is difficult to grasp the tendency of persistence of both substances in birds from the initial year of the survey because survey areas were changed, in addition to the fact that only 2 areas were surveyed. Although little change is observed in the persistence in recent years, their persistence is still recognized. Further, concentrations of *p,p'*-DDE in birds tend to be higher than that in other media, in addition to the fact that it has been detected at higher concentration than in other DDTs, the same as in the past.

p,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	1,100	1,700	140 - 6,000	2.4 [0.8]	38/38	8/8
	FY2003	1,100	1,000	190 - 6,500	5.7 [1.9]	30/30	6/6
Fish (pg/g-wet)	FY2002	2,500	2,200	510 - 98,000	2.4 [0.8]	70/70	14/14
	FY2003	2,000	2,200	180 - 12,000	5.7 [1.9]	70/70	14/14
Birds (pg/g-wet)	FY2002	36,000	60,000	8,100 - 170,000	2.4 [0.8]	10/10	2/2
	FY2003	63,000	76,000	18,000 - 240,000	5.7 [1.9]	10/10	2/2

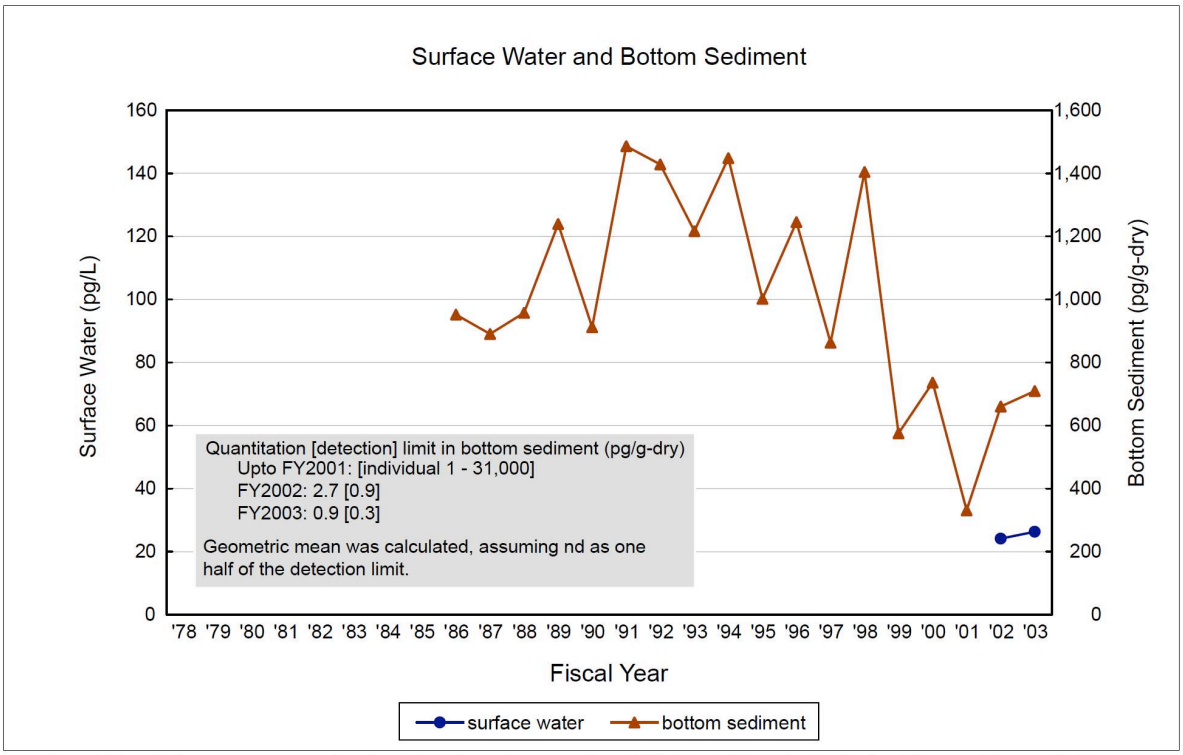
p,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	340	710	11 - 3,200	5.4 [1.8]	38/38	8/8
	FY2003	380	640	tr (7.5) - 2,600	9.9 [3.3]	30/30	6/6
Fish (pg/g-wet)	FY2002	610	680	80 - 14,000	5.4 [1.8]	70/70	14/14
	FY2003	500	520	43 - 3,700	9.9 [3.3]	70/70	14/14
Birds (pg/g-wet)	FY2002	560	740	140 - 3,900	5.4 [1.8]	10/10	2/2
	FY2003	590	860	110 - 3,900	9.9 [3.3]	10/10	2/2

Although it is difficult to grasp the tendency of their persistence as the monitoring of *p,p'*-DDE and *p,p'*-DDD in air was just initiated in FY2002, persistence of them in widespread areas is recognized.

p,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	2.8	2.7	0.56 - 28	0.09 [0.03]	102/102	34/34
	FY2003 cold season	2.8	2.4	1.1 - 22	0.40 [0.13]	34/34	34/34

p,p'-DDD	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	0.12	0.13	ND - 0.76	0.018 [0.006]	101/102	34/34
	FY2003 cold season	0.13	0.14	tr (0.037) - 0.52	0.054 [0.018]	34/34	34/34

Figure 4-7 Annual Change of *p,p'*-DDE (geometric mean)



Note: Although there are survey results of *p,p'*-DDE in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.

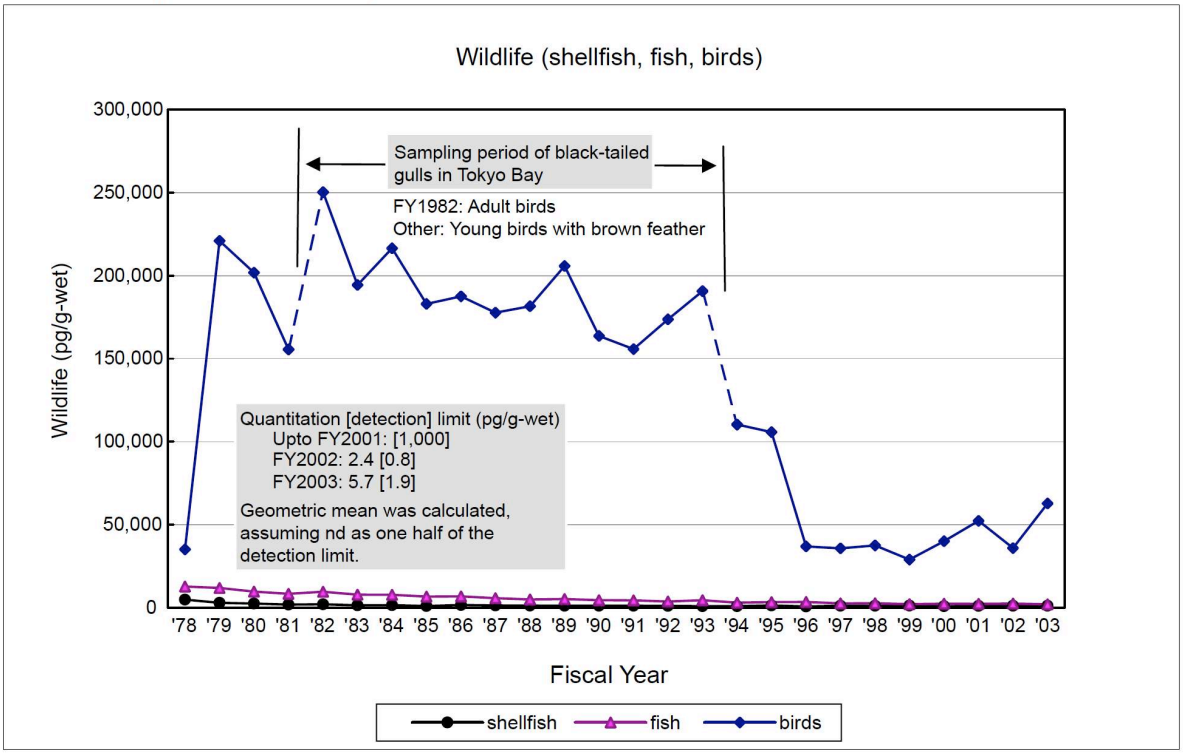
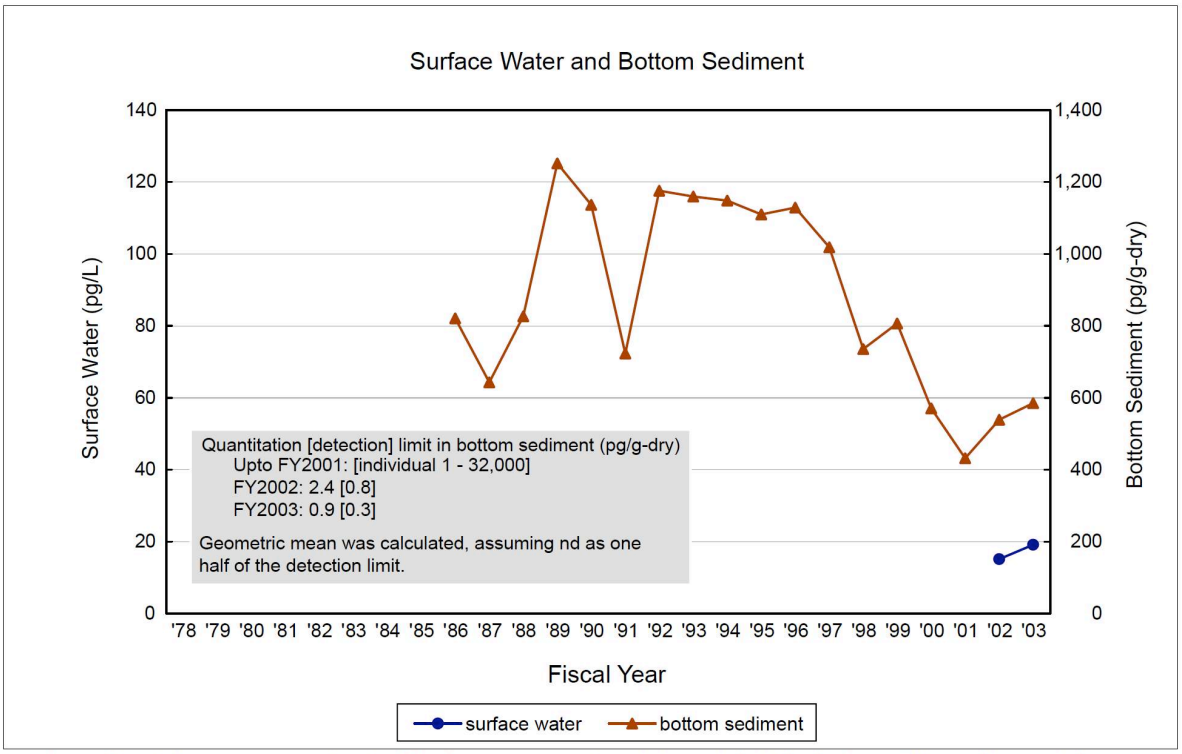
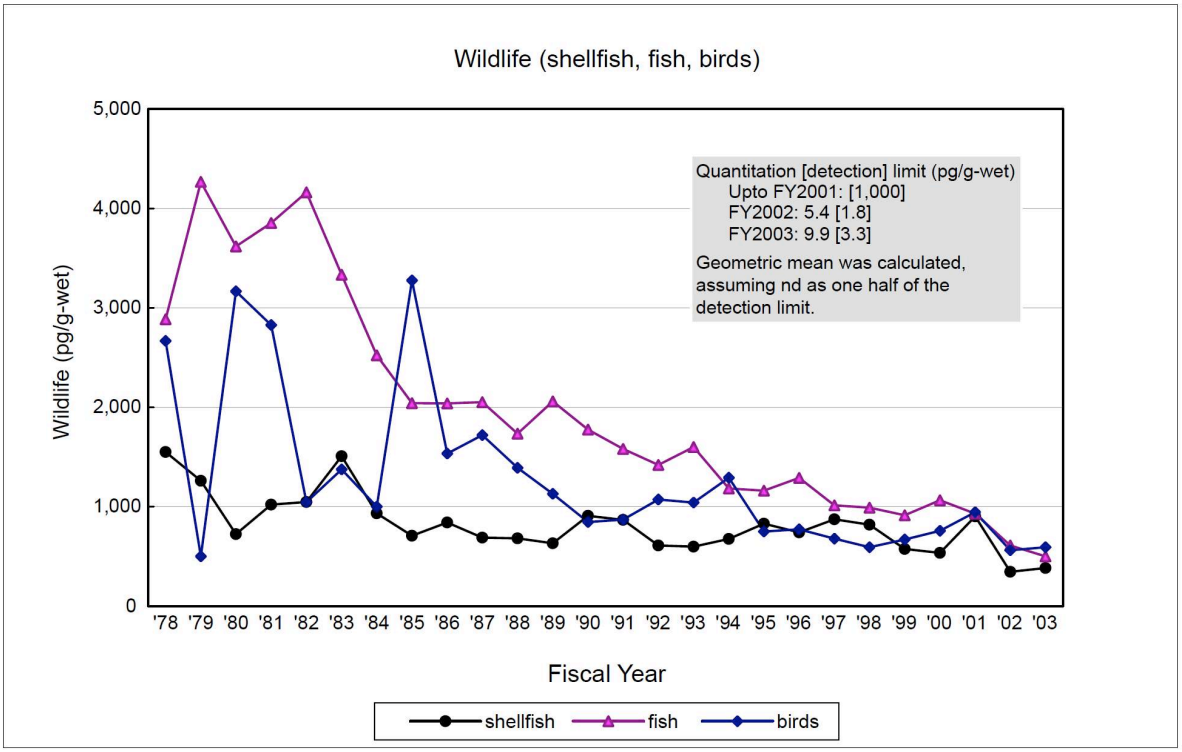


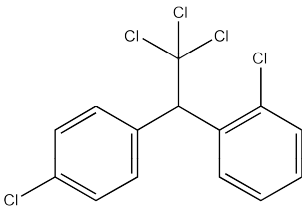
Figure 4-8 Annual Change of *p,p'*-DDD (geometric mean)

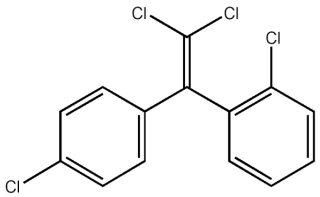


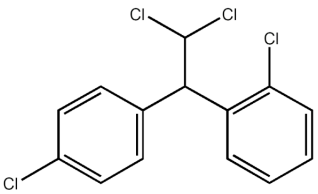
Note: Although there are survey results of *p,p'*-DDD in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.



(*o,p*'-DDT, CAS RN: 789-02-6) (*o p'*- DDE, CAS RN: 3424-82-6) (*o,p'*-DDD, CAS RN: 53-19-0)







Although it is difficult to grasp the tendency of their persistence as the monitoring of *o,p*'-DDT, *o,p*'-DDE and *o,p'*-DDD in surface water and bottom sediment was just initiated in FY2002, persistence of them in widespread areas is recognized.

o,p'-DDT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Surface water (pg/L)	FY2002	5.1	4.6	0.19 - 77	1.2	[0.4]	114/114	38/38
	FY2003	6	5	tr (1.5) - 100	3	[0.7]	36/36	36/36
Bottom sediment (pg/g-dry)	FY2002	58	47	ND - 27,000	6	[2]	183/189	62/63
	FY2003	43	43	ND - 3,200	0.8	[0.3]	185/186	62/62

o,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Surface water (pg/L)	FY2002	2.3	2.1	ND - 680	0.9	[0.3]	113/114	38/38
	FY2003	2.2	2.0	tr (0.42) - 170	0.8	[0.3]	36/36	36/36
Bottom sediment (pg/g-dry)	FY2002	46	37	ND - 16,000	3	[1]	188/189	63/63
	FY2003	43	39	tr (0.5) - 24,000	0.6	[0.2]	186/186	62/62

o,p'-DDD	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Surface water (pg/L)	FY2002	5.5	6.0	ND - 110	0.6	[0.2]	113/114	38/38
	FY2003	7.1	5.0	1.1 - 160	0.8	[0.3]	36/36	36/36
Bottom sediment (pg/g-dry)	FY2002	140	150	ND - 14,000	6	[2]	184/189	62/63
	FY2003	140	130	tr (1.0) - 8,800	2	[0.5]	186/186	62/62

No change had been observed in their persistence in shellfish and fish from the initial years to recent years, and detected values were mostly below the detection limit (1,000 pg/g-wet). In FY2003, they were detected in all surveyed areas/samples under the QL 2.9 pg/g-wet (DL 0.97 pg/g-wet) for *o,p*'-DDT, QL 3.6 pg/g-wet (DL 1.2 pg/g-wet) for *o,p*'- DDE, QL 6 pg/g-wet (DL 2.0 pg/g-wet) for *o,p'*-DDD. Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, their persistence in widespread areas is recognized.

It is difficult to grasp the tendency of persistence of these substances in birds from the start of the survey because survey areas were changed, in addition to the fact that only 2 areas were surveyed. Little change is observed in the persistence in recent years and their persistence is still recognized.

o,p'-DDT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Shellfish (pg/g-wet)	FY2002	100	83	22 - 480	12	[4]	38/38	8/8
	FY2003	130	120	35 - 480	2.9	[0.97]	30/30	6/6
Fish (pg/g-wet)	FY2002	110	130	tr (6) - 2,300	12	[4]	70/70	14/14
	FY2003	80	120	2.9 - 520	2.9	[0.97]	70/70	14/14
Birds (pg/g-wet)	FY2002	tr (10)	tr (10)	ND - 58	12	[4]	8/10	2/2
	FY2003	18	16	8.3 - 66	2.9	[0.97]	10/10	2/2

o,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	88	66	13 - 1,100	3.6 [1.2]	38/38	8/8
	FY2003	84	100	17 - 460	3.6 [1.2]	30/30	6/6
Fish (pg/g-wet)	FY2002	77	50	3.6 - 13,000	3.6 [1.2]	70/70	14/14
	FY2003	48	54	ND - 2,500	3.6 [1.2]	67/70	14/14
Birds (pg/g-wet)	FY2002	28	26	20 - 49	3.6 [1.2]	10/10	2/2
	FY2003	tr (2.0)	tr (2.0)	ND - 4.2	3.6 [1.2]	9/10	2/2

o,p'-DDD	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	130	190	tr (9) - 2,900	12 [4]	38/38	8/8
	FY2003	200	220	6.5 - 1,900	6.0 [2.0]	30/30	6/6
Fish (pg/g-wet)	FY2002	83	90	ND - 1,100	12 [4]	70/70	14/14
	FY2003	73	96	ND - 920	6.0 [2.0]	66/70	14/14
Birds (pg/g-wet)	FY2002	15	15	tr (8) - 23	12 [4]	10/10	2/2
	FY2003	14	14	tr (5.0) - 36	6.0 [2.0]	10/10	2/2

Although it is difficult to grasp the tendency of its persistence as the monitoring of *o,p'*-DDT, *o,p'*-DDE and *o,p'*-DDD in air was just initiated in FY2002, persistence of them in widespread areas is recognized.

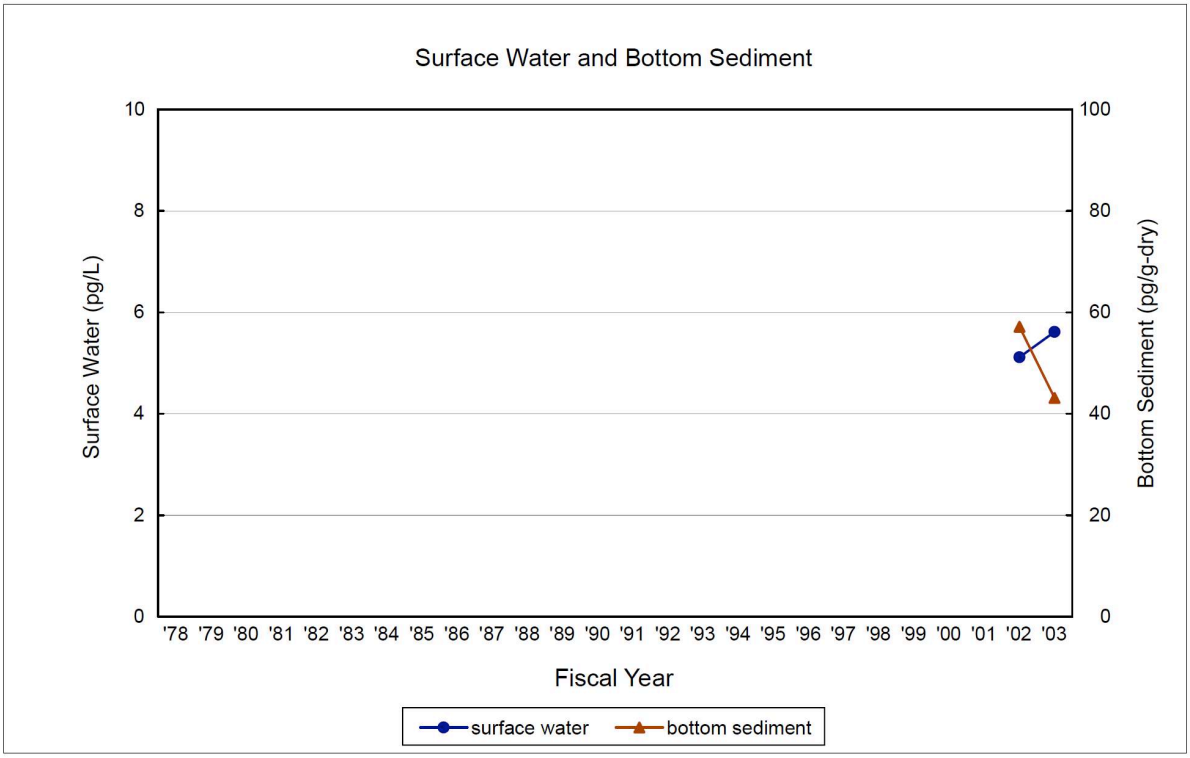
o,p'-DDT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	2.2	2.0	0.41 - 40	0.15 [0.05]	102/102	34/34
	FY2003 cold season	1.6	1.4	0.43 - 6.4	0.12 [0.040]	34/34	34/34

o,p'-DDE	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	0.60	0.56	0.11 - 8.5	0.03 [0.01]	102/102	34/34
	FY2003 cold season	0.50	0.47	0.18 - 1.7	0.020 [0.0068]	34/34	34/34

o,p'-DDD	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	0.14	0.18	ND - 0.85	0.021 [0.006]	97/102	33/34
	FY2003 cold season	0.15	0.14	0.062 - 0.42	0.042 [0.014]	34/34	34/34

DDTs are target substances included in the POPs Treaty, and also from the standpoint of global pollution monitoring, it is necessary to continue the monitoring to trace their fate.

Figure 4-9 Annual Change of *o,p'*-DDT (geometric mean)



Note: No monitoring investigations of *o,p'*-DDT in surface water and bottom sediment were conducted before FY2001.

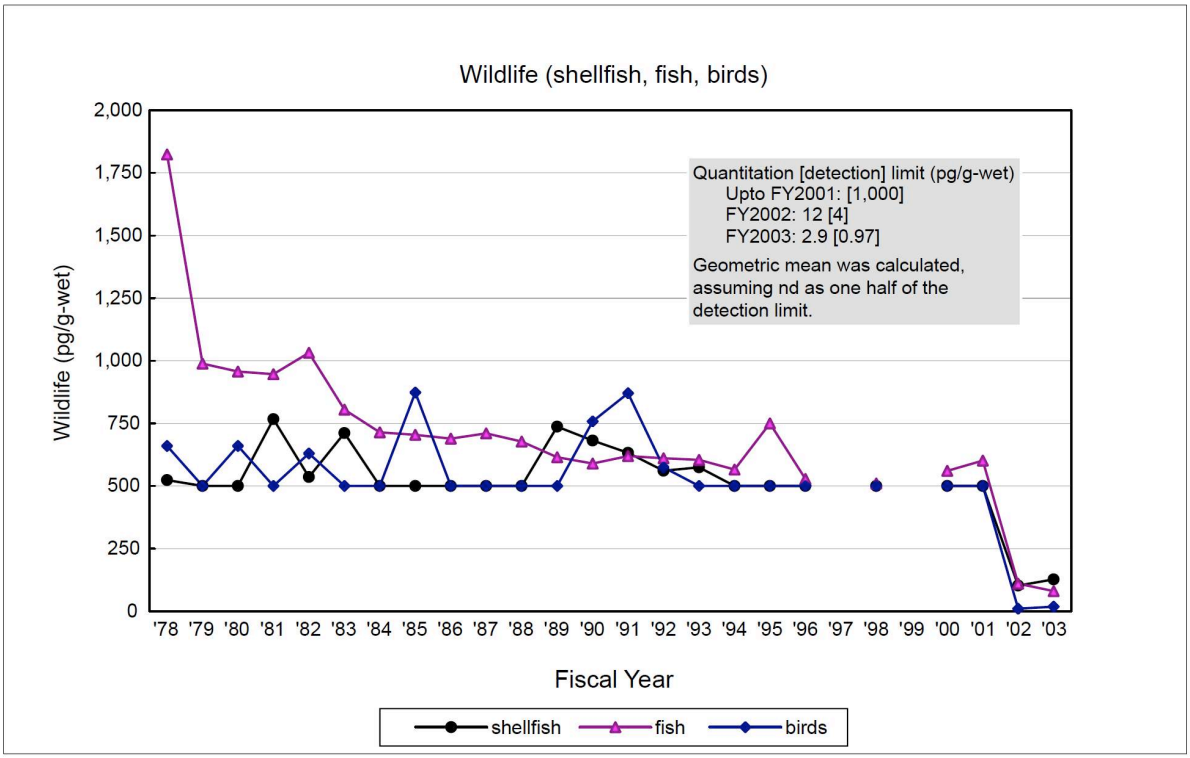
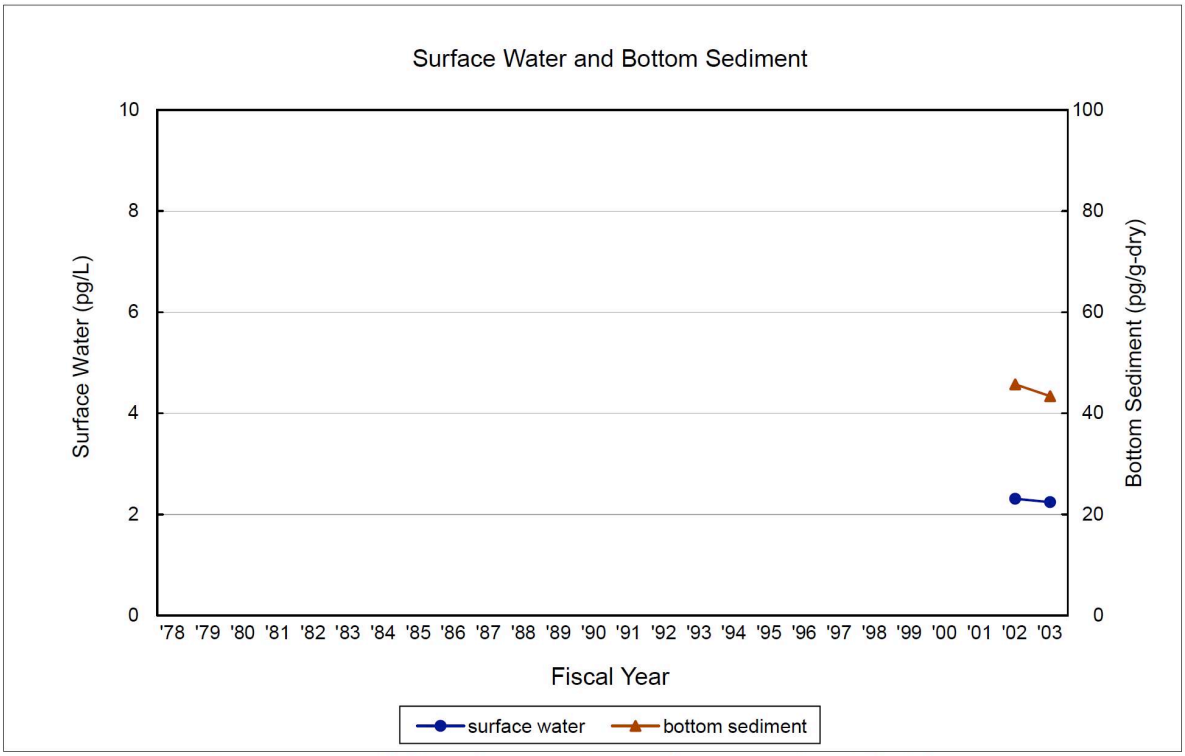


Figure 4-10 Annual Change of *o,p'*-DDE (geometric mean)



Note: No monitoring investigations of *o,p'*-DDE in surface water and bottom sediment were conducted before FY2001.

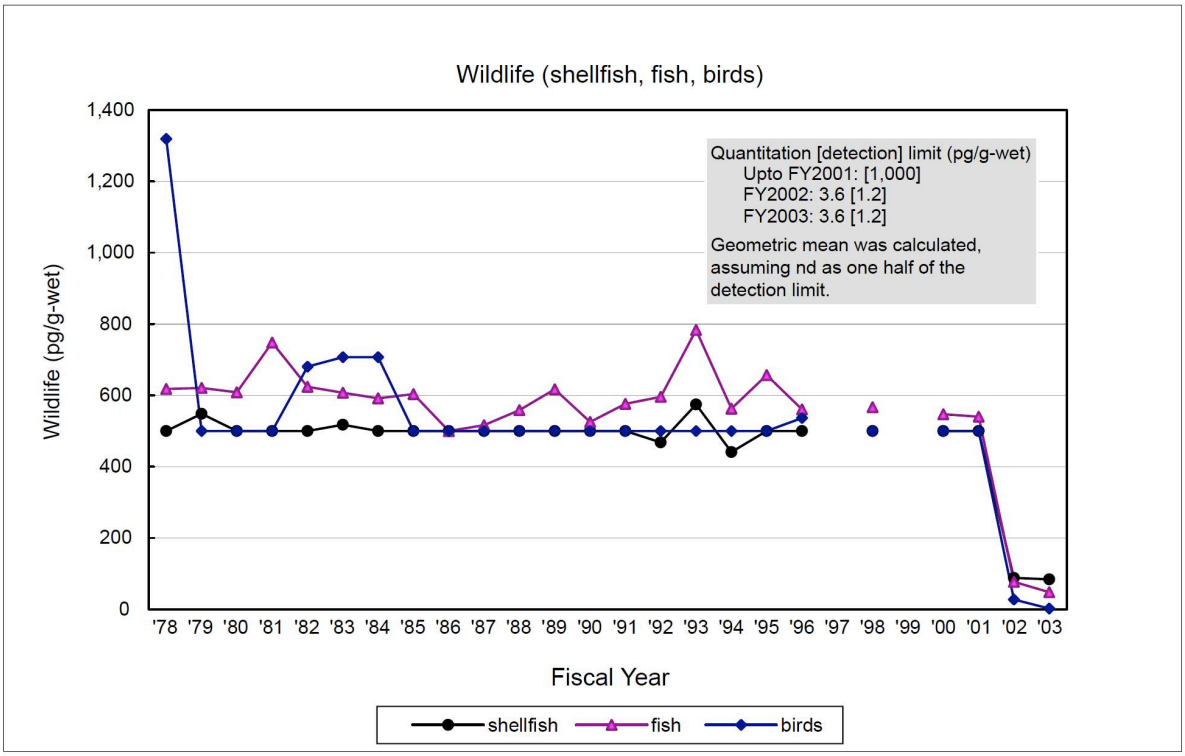
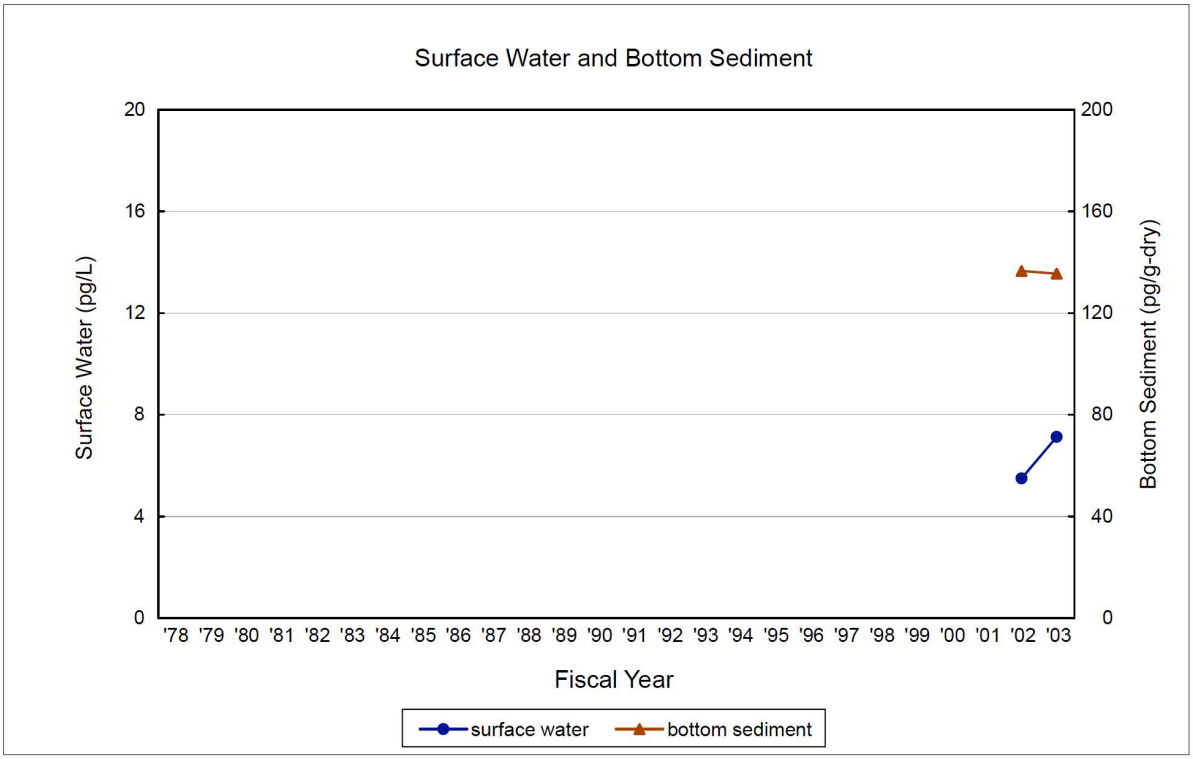
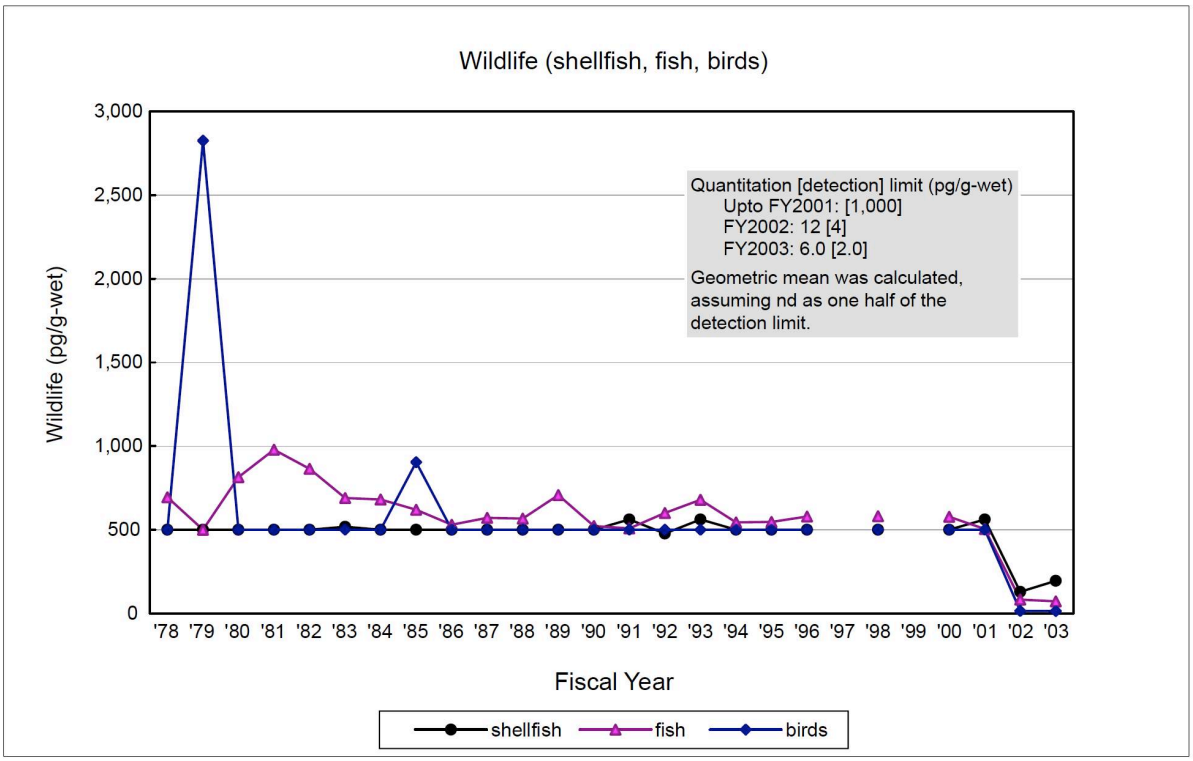


Figure 4-11 Annual Change of *o,p'*-DDD (geometric mean)

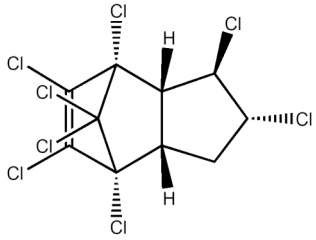


Note: No monitoring investigations of *o,p'*-DDD in surface water and bottom sediment were conducted before FY2001.



[5] Chlordanes

(*trans*-Chlordane, CAS RN: 5103-74-2)



Concentrations of *trans*-chlordane in surface water had been below the detection limit (10,000 pg/L), with the exception of its detection in 1987 and 1993 in one sample each. In FY2002, *trans*-chlordane was detected in all surveyed areas/samples under the QL 1.5 pg/L (DL 0.5 pg/L). In FY2003 it was also detected in all surveyed areas/samples under the QL 5 pg/L (DL 2 pg/L). Geometric means of *trans*-chlordane in FY2002 and FY2003 were 32 pg/L and 34 pg/L, respectively. Although it is difficult to grasp the tendency of persistence because of the high detection limit in the past years, its persistence in widespread areas is still recognized.

trans-Chlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency*	
						Sample	*Area*
Surface water (pg/L)	FY2002	32	24	3.1 - 780	1.5 [0.5]	114/114	38/38
	FY2003	34	30	6 - 410	5 [2]	36/36	36/36

Persistence of *trans*-chlordane in bottom sediment shows a decreasing tendency from the start of the monitoring to recent years and most of the detected values were around the detection limit (1,000 pg/g-dry). However, in the FY2002 survey, it was detected in all surveyed areas/samples under the QL 1.8 pg/g-dry (DL 0.6 pg/g-dry). In FY2003 it was also detected in all surveyed areas/samples under the QL 4 pg/g-dry (DL 2 pg/g-dry). Geometric means of *trans*-chlordane in FY2002 and FY2003 were 130 pg/g-dry and 120 pg/g-dry, respectively, indicating its widespread persistence as before.

trans-Chlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency*	
						Sample	*Area*
Bottom sediment (pg/g-dry)	FY2002	130	110	2.1 - 16,000	1.8 [0.6]	189/189	63/63
	FY2003	120	100	tr (2.4) - 13,000	4 [2]	186/186	62/62

Persistence of *trans*-chlordane in shellfish and fish shows a slightly decreasing tendency from the start of the monitoring to recent years and most of the detected values were below the detection limit (1,000 pg/g-wet). However, in the FY2002 survey, it was detected in all surveyed areas/samples under the QL 2.4 pg/g-wet (DL 0.8 pg/g-wet). In FY2003 it was also detected in all surveyed areas/samples under the QL 7.2 pg/g-wet (DL 2.4 pg/g-wet). Geometric means of *trans*-chlordane in shellfish and fish were 420, 180 pg/g-wet in FY2002 and 550, 150 pg/g-wet in FY2003, respectively, indicating that it is still persistent in widespread areas.

It is difficult to grasp the tendency of persistence of *trans*-chlordane in birds from the start of the survey because survey areas were changed, in addition to the fact that only 2 areas were surveyed. Concentrations of *trans*-chlordane in birds had been below the detection limit (1,000 pg/g-wet) from

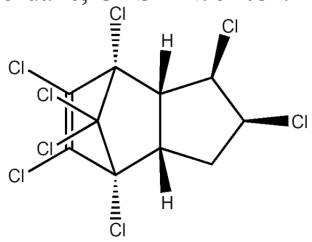
FY1987 to FY2001. In the FY2002 survey, it was detected in all surveyed areas/samples under the QL 2.4 pg/g-wet (DL 0.8 pg/g-wet). In FY2003 it was also detected in all surveyed areas/samples under the QL 7.2 pg/ g-wet (DL 2.4 pg/ g-wet). Geometric mean of *trans*-chlordane in birds was 14 pg/g-wet in FY2002 and 11 pg/g-wet in FY2002, indicating its persistence as before.

trans-Chlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	420	840	33 - 2,300	2.4	[0.8]	38/38	8/8
	FY2003	550	840	69 - 2,800	7.2	[2.4]	30/30	6/6
Fish (pg/g-wet)	FY2002	180	160	20 - 2,700	2.4	[0.8]	70/70	14/14
	FY2003	150	120	9.6 - 1,800	7.2	[2.4]	70/70	14/14
Birds (pg/g-wet)	FY2002	14	14	8.9 - 26	2.4	[0.8]	10/10	2/2
	FY2003	11	12	tr (5.9) - 27	7.2	[2.4]	10/10	2/2

Although it is difficult to grasp the tendency of its persistence as the monitoring of *trans*-chlordane in air was just initiated in FY2002, it was detected in all surveyed areas/samples. Geometric mean of *trans*-chlordane in birds was 36 pg/m^3 in FY2002 and 37 pg/m^3 in FY2002, indicating its widespread persistence.

trans-Chlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	36	48	0.62 - 820	0.60	[0.20]	102/102	34/34
	FY2003 cold season	37	44	2.5 - 290	0.86	[0.29]	34/34	34/34

(*cis*-Chlordane, CAS RN: 5103-71-9)



Concentrations of *cis*-chlordane in surface water had mostly been below the detection limit (10,000 pg/L) until FY2001. However, it was detected in all areas/samples in the FY2002 survey under the QL 0.9 pg/L (DL 0.3 pg/L). In FY2003 it was also detected in all surveyed areas/samples under the QL 3 pg/L (DL 0.9 pg/L). Geometric mean of *trans*-chlordane was 41 pg/L in FY2002 and 69 pg/L in FY2003. Although it is difficult to grasp the tendency of its persistence because of the high detection limit in the past years, its persistence in widespread areas is recognized.

cis-Chlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	41	32	2.5 - 880	0.9	[0.3]	114/114	38/38
	FY2003	69	51	12 - 920	3	[0.9]	36/36	36/36

Persistence of *cis*-chlordane in bottom sediment shows a decreasing tendency from the start of the monitoring to recent years and most of the detected values were around the detection limit (1,000 pg/g-dry). However, in the FY2002 survey, it was detected in all surveyed areas/samples under the QL 0.9 pg/g-dry

(DL 0.3 pg/g-dry). In FY2003 it was also detected in all surveyed areas/samples under the QL 4 pg/g-dry (DL 2 pg/g-dry). Geometric mean of *cis*-chlordane was 120 pg/g-dry in FY2002 and 170 pg/g-dry in FY2003. Although the concentrations remain at lower level compared with the detection limit before FY2001, its persistence in widespread areas is recognized as before.

cis-Chlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	120	98	1.8 - 18,000	0.9 [0.3]	189/189	63/63
	FY2003	170	140	tr (3.6) - 19,000	4 [2]	186/186	62/62

Persistence of *cis*-chlordane in shellfish and shellfish shows a slightly decreasing tendency from the start of the monitoring to recent years and most of the detected values were below the detection limit (1,000 pg/g-wet). However, in the FY2002 survey, it was detected in all surveyed areas/samples under the QL of 2.4 pg/g-wet (DL 0.8 pg/g-wet). In FY2003 it was also detected in all surveyed areas/samples under the QL 3.9 pg/g-wet (DL 1.3 pg/g-wet). Geometric means of *cis*-chlordane in shellfish and fish were 810, 580 pg/g-wet in FY2002 and 1,100, 490 pg/g-wet in FY2003, respectively, indicating its widespread persistence as before.

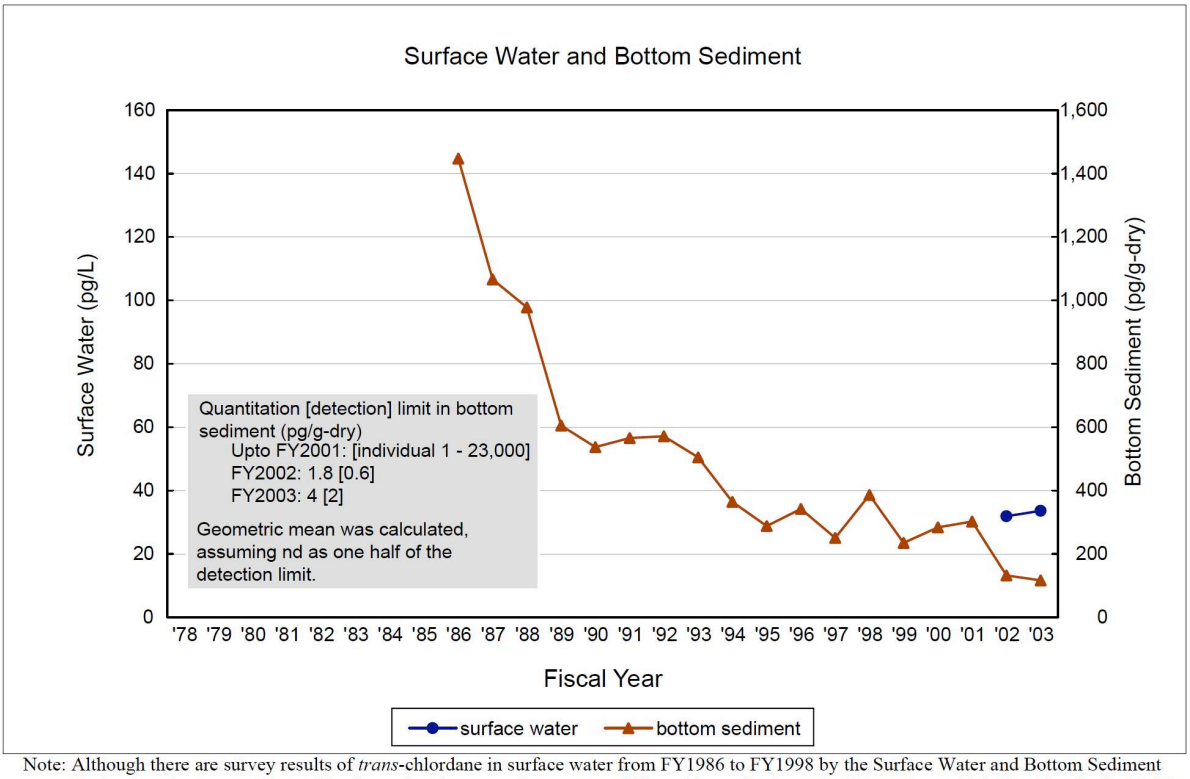
It is difficult to grasp the tendency of persistence of *cis*-chlordane in birds since the initial years of the survey because survey areas were changed, in addition to the fact that only 2 areas were surveyed. Concentrations of *cis*-chlordane in birds had been below the detection limit (1,000 pg/g-wet) from FY1994 to FY2001. In the FY2002 survey, it was detected in all surveyed areas/samples under the QL 2.4 pg/g-wet (DL 0.8 pg/g-wet). In FY2003 it was also detected in all surveyed areas/samples under the QL 3.9 pg/g-wet (DL 1.3 pg/g-wet). Although the geometric mean of *cis*-chlordane in birds, which was 67 pg/g-wet in FY2002 and 47 pg/g-wet in FY2003, shows a decreasing tendency, its persistence is still recognized.

cis-Chlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (pg/g-wet)	FY2002	810	1,200	24 - 26,000	2.4 [0.8]	38/38	8/8
	FY2003	1,100	1,400	110 - 14,000	3.9 [1.3]	30/30	6/6
Fish (pg/g-wet)	FY2002	580	550	57 - 6,900	2.4 [0.8]	70/70	14/14
	FY2003	490	400	43 - 4,400	3.9 [1.3]	70/70	14/14
Birds (pg/g-wet)	FY2002	67	180	10 - 450	2.4 [0.8]	10/10	2/2
	FY2003	47	120	6.8 - 370	3.9 [1.3]	10/10	2/2

Although it is difficult to grasp the tendency of its persistence as the monitoring of *trans*-chlordane in air was just initiated in FY2002, it was detected in all surveyed areas/samples both in FY2002 and FY2003. Geometric mean of *cis*-chlordane in air was 31 pg/m^3 in FY2002 and 30 pg/m^3 in FY2003, indicating its widespread persistence.

cis-Chlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Air (pg/m^3)	FY2002	31	40	0.86 - 670	0.60 [0.20]	102/102	34/34
	FY2003 cold season	30	38	2.5 - 220	0.51 [0.17]	34/34	34/34

Figure 4-12 Annual Change of *trans*-Chlordane (geometric mean)



Note: Although there are survey results of *trans*-chlordane in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.

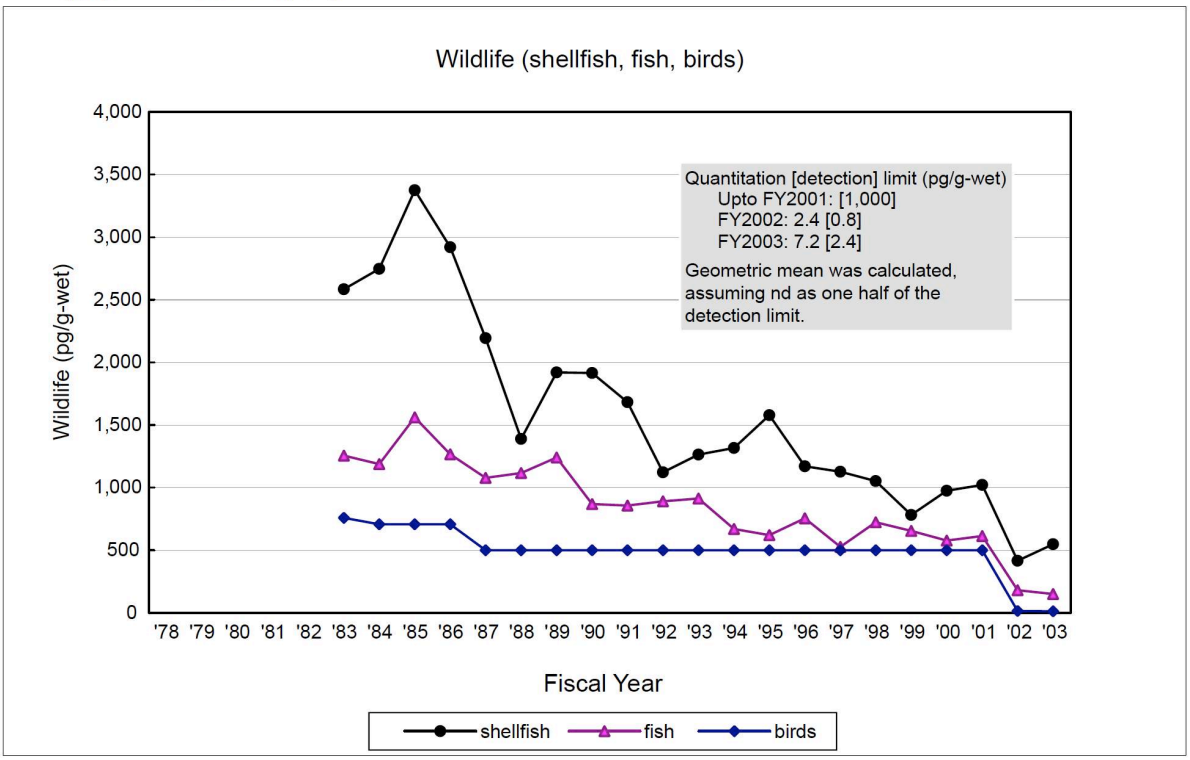
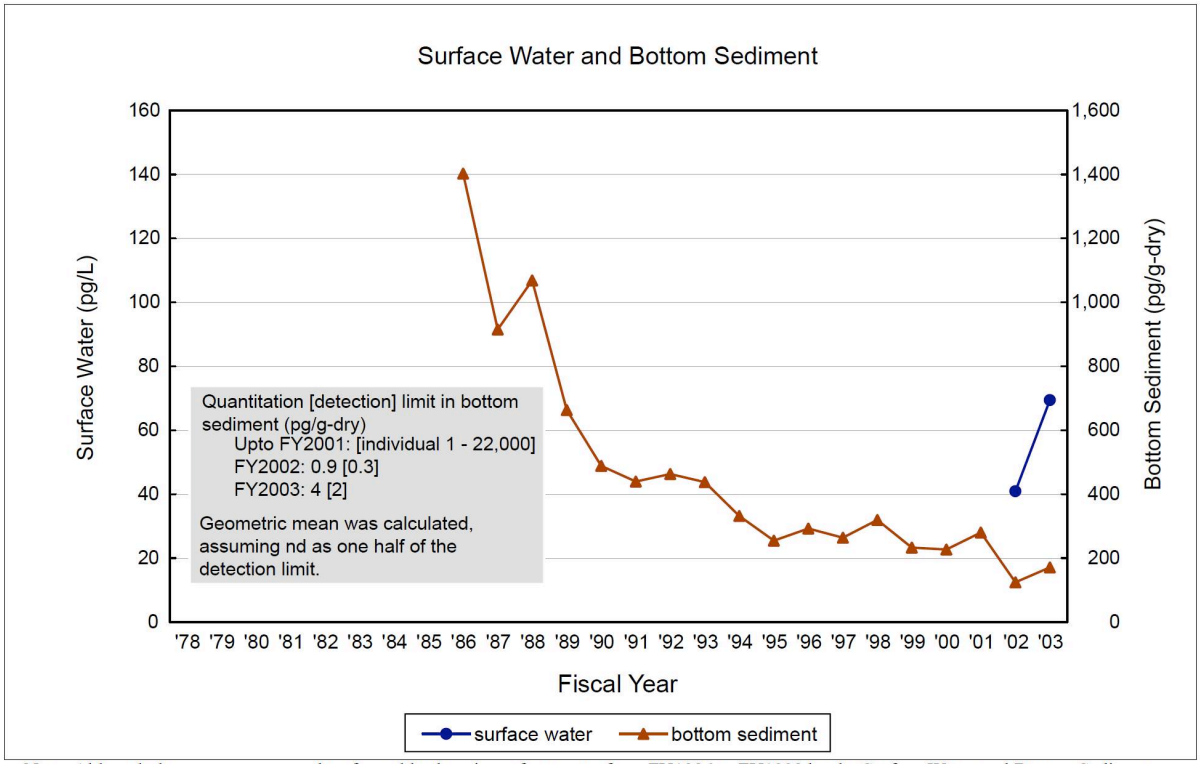
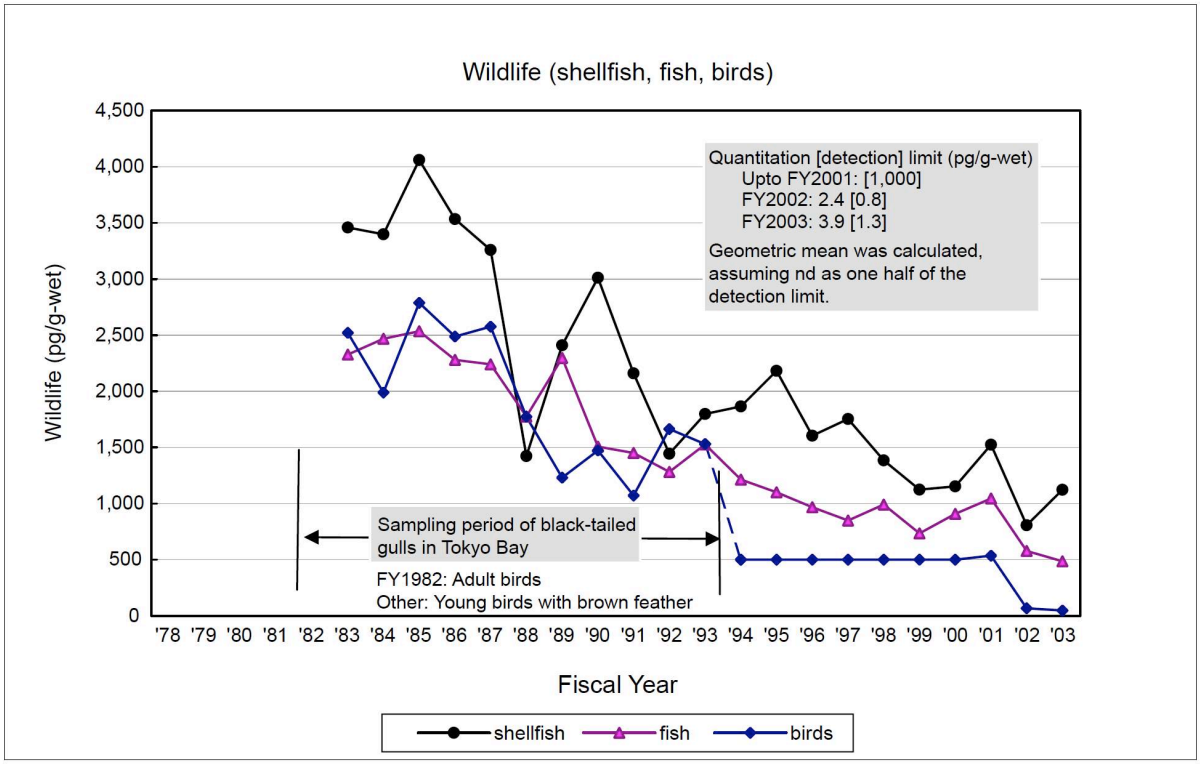


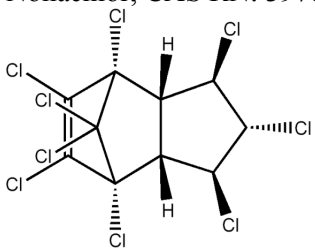
Figure 4-13 Annual Change of *cis*-Chlordane (geometric mean)



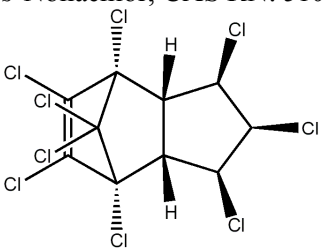
Note: Although there are survey results of *cis*-chlordane in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.



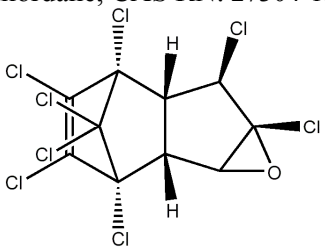
(*trans*-Nonachlor, CAS RN: 39765-80-5)



(*cis*-Nonachlor, CAS RN: 5103-73-1)



(Oxychlordane, CAS RN: 27304-13-8)



Concentrations of *trans*-nonachlor and *cis*-nonachlor in surface water had been mostly below the detection limit (10,000 pg/L) until FY2001. Concentrations of oxychlordane had been below the detection limit (10,000 pg/L) until FY1987 and no survey has been conducted from FY1988 to FY2001. In the FY2002 survey, conducted under the QL 1.2 pg/L (DL 0.4 pg/L) for *trans*-nonachlor, QL 1.8 pg/L (DL 0.6 pg/L) for *cis*-nonachlor and QL 1.2 pg/L (DL 0.4pg/L) for oxychlordane, *trans*-nonachlor and *cis*-nonachlor were detected in all areas/samples and oxychlordane was detected in many areas/samples. In the FY2003 survey, conducted under the QL 2 pg/L (DL 0.5 pg/L) for *trans*-nonachlor, QL 0.3 pg/L (DL 0.1 pg/L) for *cis*-nonachlor and QL 2 pg/L (DL 0.5 pg/L) for oxychlordane, they were detected in all areas/samples. Geometric means of them in FY2002 and FY2003 were 29 and 26 pg/L for *trans*-nonachlor, 7.6 and 8.0 pg/L for *cis*-nonachlor, and 2.4 and 3 pg/L for oxychlordane, respectively, indicating their persistence in widespread areas as before.

trans-Nonachlor	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	29	24	1.8 - 780	1.2 [0.4]	114/114	38/38
	FY2003	26	20	4 - 450	2 [0.5]	36/36	36/36

cis-Nonachlor	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	7.6	6.7	0.23 - 250	1.8 [0.6]	114/114	38/38
	FY2003	8.0	7.0	1.3 - 130	0.3 [0.1]	36/36	36/36

Oxychlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Surface water (pg/L)	FY2002	2.4	3.5	ND - 41	1.2 [0.4]	96/114	35/38
	FY2003	3	2	tr (0.6) - 39	2 [0.5]	36/36	36/36

Concentrations of *trans*-nonachlor and *cis*-nonachlor in bottom sediment showed a decreasing tendency in initial survey years and in recent years, they were around the detection limit (1,000 pg/g-dry). Concentrations of oxychlordane had been below the detection limit (1,000 pg/g-dry) until FY1987 and no survey has been conducted from FY1988 to FY2001. In FY2002, survey was conducted under the QL 1.5 pg/g-dry (DL 0.5 pg/g-dry) for *trans*-nonachlor, QL 2.1 pg/g-dry (DL 0.7 pg/g-dry) for *cis*-nonachlor and

QL 1.5 pg/g-dry (DL 0.5 pg/g-dry) for oxychlordane, and *trans*-nonachlor and *cis*-nonachlor were detected in all areas/samples and oxychlordane was detected in many areas/samples. In FY2003, survey was conducted under the QL 2 pg/g-dry (DL 0.6 pg/g-dry) for *trans*-nonachlor, 3 pg/g-dry (DL 0.9 pg/g-dry) for *cis*-nonachlor and 1 pg/g-dry (DL 0.4 pg/g-dry) for oxychlordane, and they were detected in many areas/samples. Geometric means of them in FY2002 and FY2003 were 120 and 100 pg/g-dry for *trans*-nonachlor, 66 and 59 pg/g-dry for *cis*-nonachlor, and 2.2 and 2 pg/ g-dry for oxychlordane, indicating their widespread persistence as before.

trans-Nonachlor	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	120	83	3.1 - 13,000	1.5 [0.5]	189/189	63/63
	FY2003	100	78	2 - 11,000	2 [0.6]	186/186	62/62

cis-Nonachlor	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	66	65	ND - 7,800	2.1 [0.7]	188/189	63/63
	FY2003	59	50	ND - 6,500	3 [0.9]	184/186	62/62

Oxychlordane	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (pg/g-dry)	FY2002	2.2	1.7	ND - 120	1.5 [0.5]	153/189	59/63
	FY2003	2	2	ND - 85	1 [0.4]	158/186	57/62

Persistence of these three substances in shellfish and fish showed a slightly decreasing tendency from the start of the monitoring, and the concentrations of oxychlordane were mostly below the detection limit (1,000 pg/g-wet). In FY2002, survey was conducted under the QL 2.4 pg/g-wet (DL 0.8 pg/g-wet) for *trans*-nonachlor, QL 1.2 pg/g-wet (DL 0.4 pg/g-wet) for *cis*-nonachlor and QL 3.6 pg/g-wet (DL 1.2 pg/g-wet) for oxychlordane, and *trans*-nonachlor and *cis*-nonachlor were detected in all areas/samples and oxychlordane was also detected in many areas/samples. In FY2003, survey was conducted under the QL 3.6 pg/g-wet (DL 1.2 pg/g-wet) for *trans*-nonachlor, 4.8 pg/g-wet (DL 1.6 pg/g-wet) for *cis*-nonachlor and 8.4 pg/g-wet (DL 2.8 pg/g-wet) for oxychlordane, they were detected in all areas/samples. Geometric means of them in shellfish in FY2002 and FY2003 were 510 and 780 pg/g-wet for *trans*-nonachlor, 190 and 290 pg/g-wet for *cis*-nonachlor, and 76 and 90 pg/g-wet for oxychlordane, and that in fish in FY2002 and FY2003 are 970 and 880 pg/g-wet for *trans*-nonachlor, 420 and 350 pg/g-wet for *cis*-nonachlor and 160 and 140 pg/g-wet for oxychlordane, respectively, indicating their persistence in widespread areas as before.

It is difficult to grasp the tendency of persistence of these three substances in birds from the start of the monitoring, because survey areas were changed, in addition to the fact that only 2 areas were surveyed. In recent years, concentrations of these three substances in birds had mostly been below the detection limit (1,000 pg/g-wet). In FY2002, survey was conducted under the QL 2.4 pg/g-wet (DL 0.8 pg/g-wet) for *trans*-nonachlor, 1.2 pg/g-wet (DL 0.4 pg/g-wet) for *cis*-nonachlor, and 3.6 pg/g-wet (DL 1.2 pg/g-wet) for oxychlordane, and *trans*-nonachlor and *cis*-nonachlor were detected in all areas/samples and oxychlordane was detected in most of the samples from all areas. In FY2003, survey was conducted under the QL 3.6 pg/g-wet (DL 1.2 pg/g-wet) for *trans*-nonachlor, 4.8 pg/g-wet (DL 1.6 pg/g-wet) for *cis*-nonachlor, and 8.4 pg/g-wet (DL 2.8 pg/g-wet) for oxychlordane, and they were detected in all areas/samples. Geometric means of them in FY2002 and FY2003 were 880 and 1,100 pg/g-wet for *trans*-nonachlor, 200 and 200 pg/g-wet for *cis*-nonachlor, and 640 and 750 pg/g-wet for oxychlordane, indicating their persistence in widespread areas as before.

trans-Nonachlor	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Detection frequency Area
Shellfish (pg/g-wet)	FY2002	510	1,100	21 - 1,800	2.4	[0.8]	38/38	8/8
	FY2003	780	700	140 - 3,800	3.6	[1.2]	30/30	6/6
Fish (pg/g-wet)	FY2002	970	900	98 - 8,300	2.4	[0.8]	70/70	14/14
	FY2003	880	840	85 - 5,800	3.6	[1.2]	70/70	14/14
Birds (pg/g-wet)	FY2002	880	980	350 - 1,900	2.4	[0.8]	10/10	2/2
	FY2003	1,100	1,400	350 - 3,700	3.6	[1.2]	10/10	2/2

cis-Nonachlor	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Detection frequency Area
Shellfish (pg/g-wet)	FY2002	190	300	8.6 - 870	1.2	[0.4]	38/38	8/8
	FY2003	290	260	48 - 1,800	4.8	[1.6]	30/30	6/6
Fish (pg/g-wet)	FY2002	420	420	46 - 5,100	1.2	[0.4]	70/70	14/14
	FY2003	350	360	19 - 2,600	4.8	[1.6]	70/70	14/14
Birds (pg/g-wet)	FY2002	200	240	68 - 450	1.2	[0.4]	10/10	2/2
	FY2003	200	260	68 - 660	4.8	[1.6]	10/10	2/2

Oxychlordane	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Detection frequency Area
Shellfish (pg/g-wet)	FY2002	76	83	ND - 5,600	3.6	[1.2]	37/38	8/8
	FY2003	90	62	11 - 1,900	8.4	[2.8]	30/30	6/6
Fish (pg/g-wet)	FY2002	160	140	16 - 3,900	3.6	[1.2]	70/70	14/14
	FY2003	140	160	30 - 820	8.4	[2.8]	70/70	14/14
Birds (pg/g-wet)	FY2002	640	630	470 - 890	3.6	[1.2]	10/10	2/2
	FY2003	750	700	610 - 1,300	8.4	[2.8]	10/10	2/2

Although it is difficult to grasp the tendency of their persistence as the monitoring of the 3 substances in air was just initiated in FY2002, they were detected in all surveyed areas/samples both in FY2002 and FY2003. Geometric means of them in FY2002 and FY2003 were 24 and 24 pg/m^3 for *trans*-nonachlor, 3.1 and 2.7 pg/m^3 for *cis*-nonachlor, and 0.96 and 0.87 pg/m^3 for oxychlordane, indicating their persistence in widespread areas.

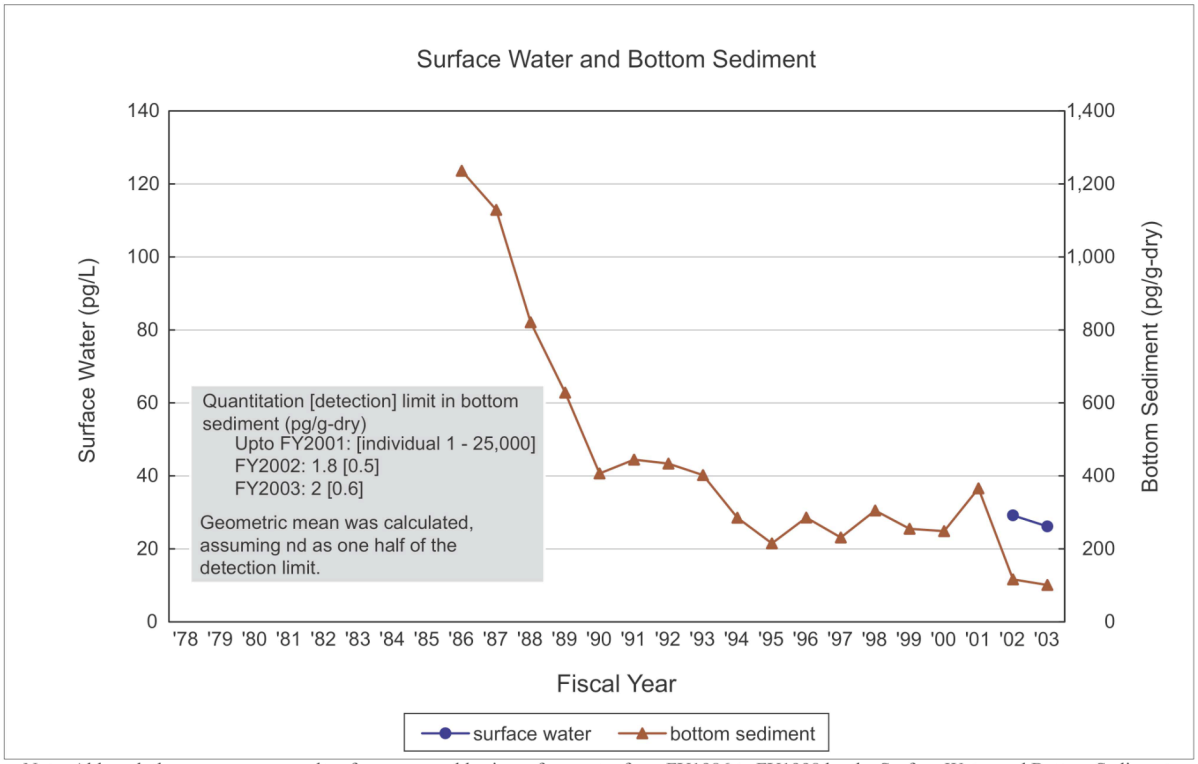
trans-Nonachlor	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Detection frequency Area
Air (pg/m^3)	FY2002	24	30	0.64 - 550	0.30	[0.10]	102/102	34/34
	FY2003 cold season	24	28	2.1 - 180	0.35	[0.12]	34/34	34/34

cis-Nonachlor	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Detection frequency Area
Air (pg/m^3)	FY2002	3.1	4.0	0.071 - 62	0.030	[0.010]	102/102	34/34
	FY2003 cold season	2.7	3.5	0.18 - 23	0.026	[0.0088]	34/34	34/34

Oxychlordane	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Detection frequency Area
Air (pg/m^3)	FY2002	0.96	0.98	ND - 8.3	0.024	[0.008]	101/102	34/34
	FY2003 cold season	0.87	0.88	0.41 - 3.2	0.045	[0.015]	34/34	34/34

Chlordanes are target substances included in the POPs Treaty, and also from the standpoint of global pollution monitoring, it is necessary to continue the monitoring to trace their fate.

Figure 4-14 Annual Change of *trans*-Nonachlor (geometric mean)



Note: Although there are survey results of *trans*-nonachlor in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.

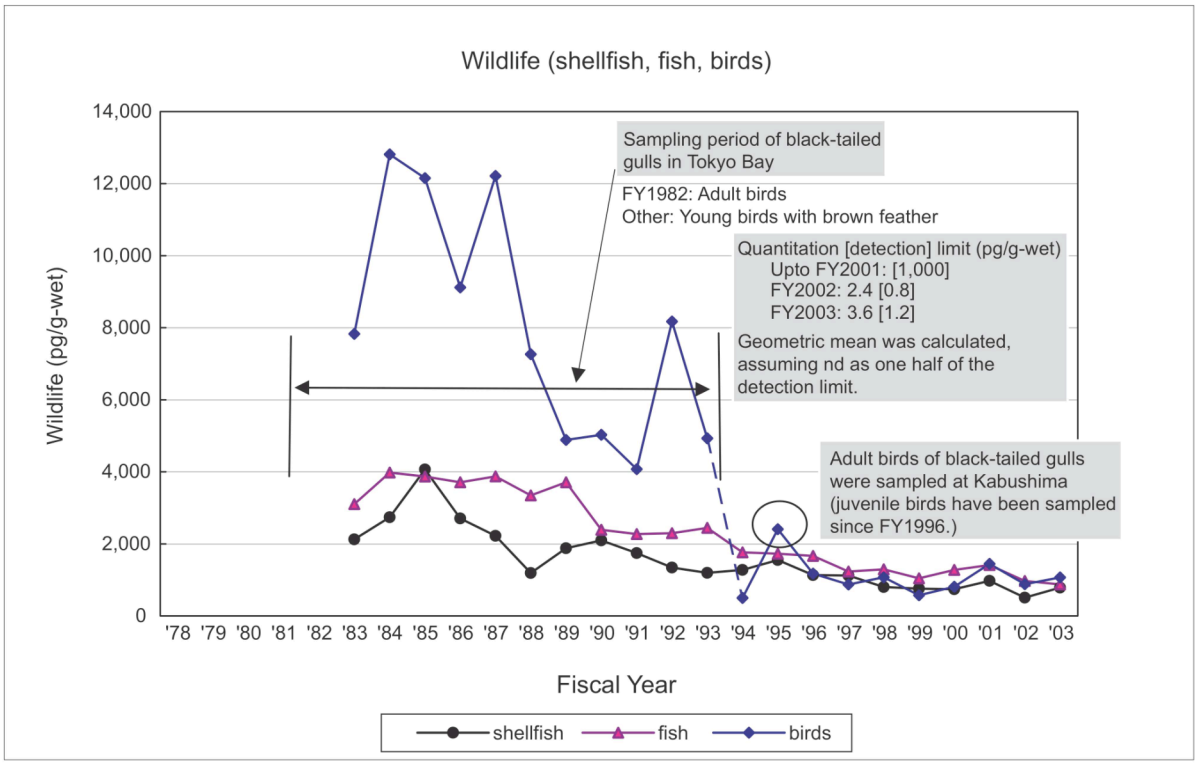
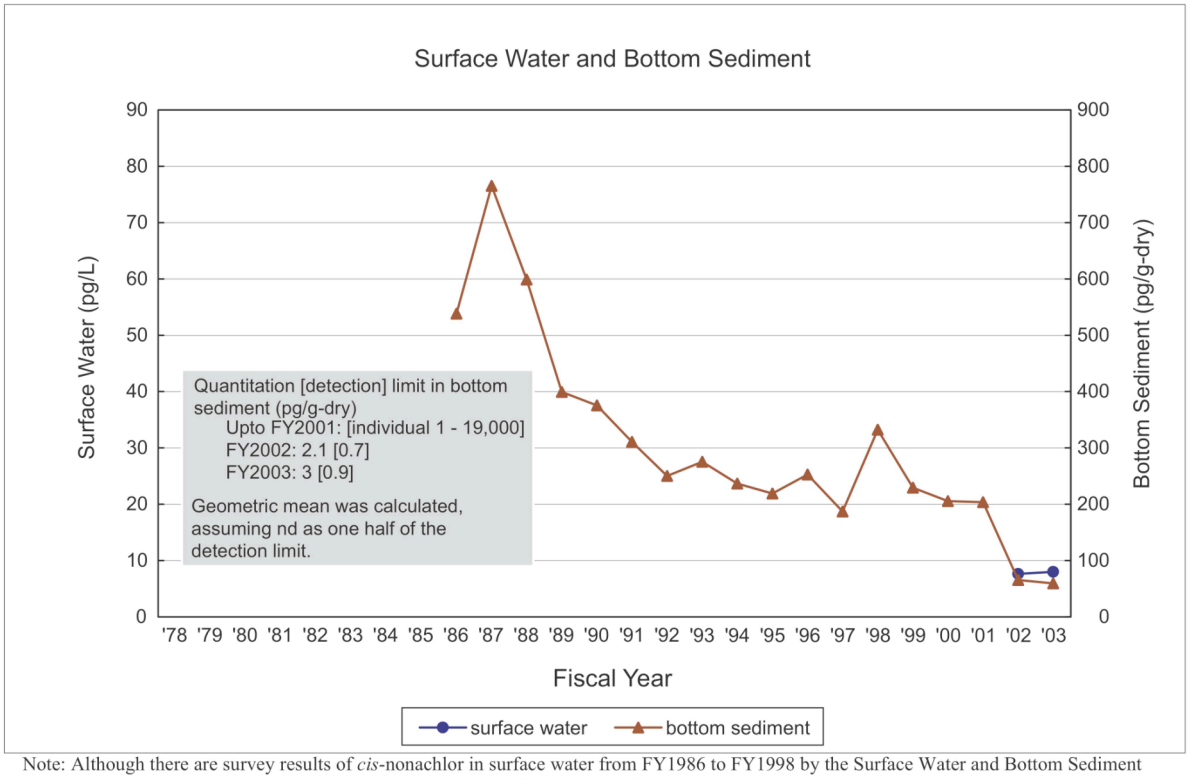


Figure 4-15 Annual Change of *cis*-Nonachlor (geometric mean)



Note: Although there are survey results of *cis*-nonachlor in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.

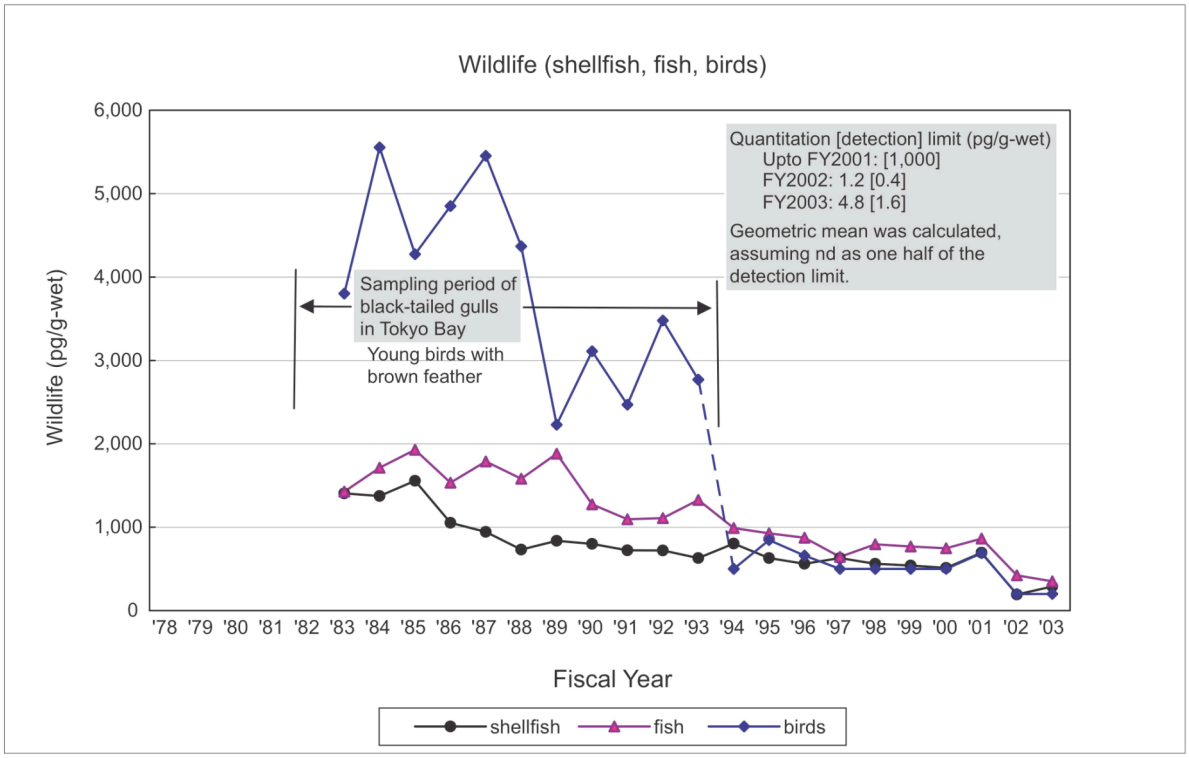
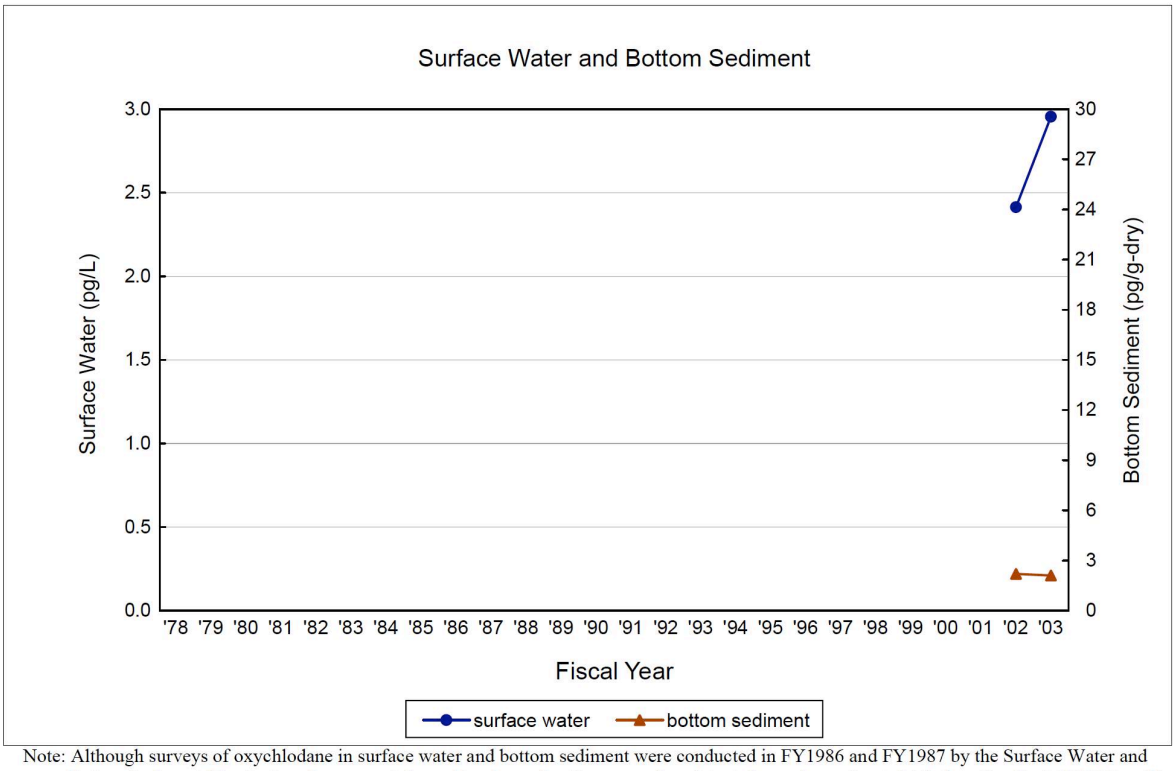
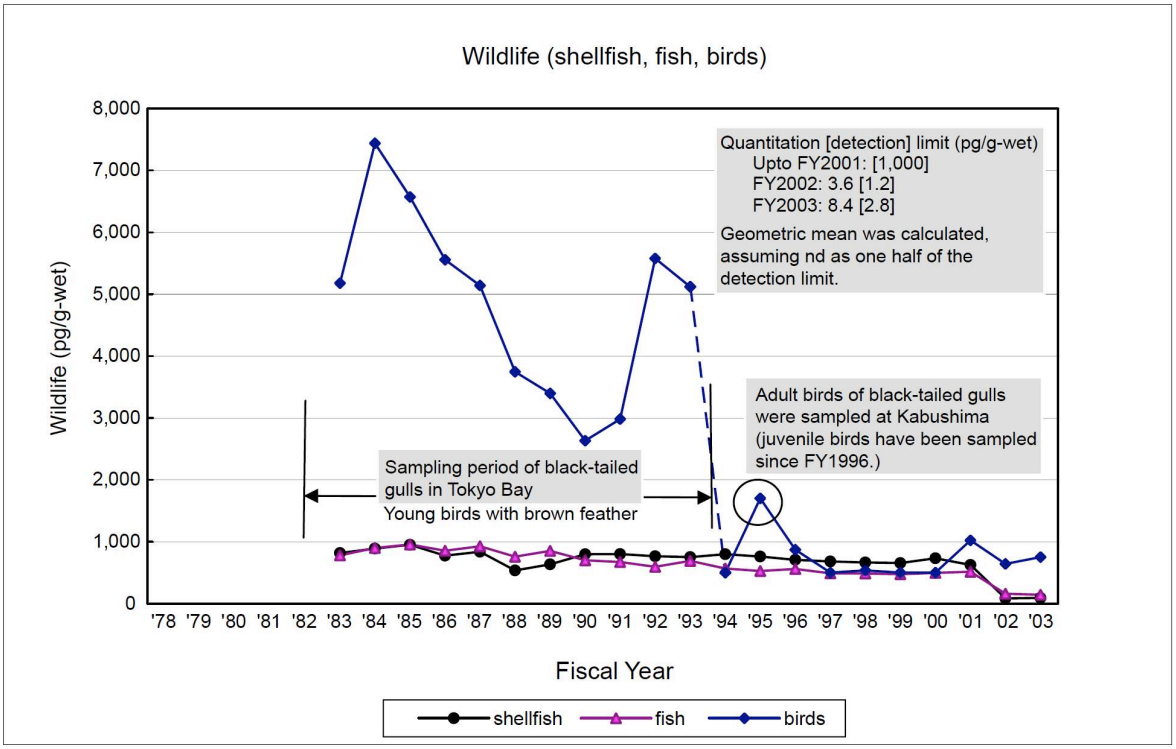


Figure 4-16 Annual Change of Oxychlordane (geometric mean)

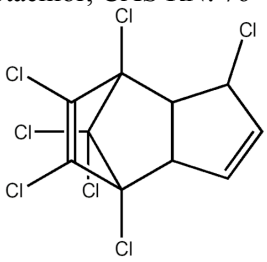


Note: Although surveys of oxychlodane in surface water and bottom sediment were conducted in FY1986 and FY1987 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-detected samples owing to high detection limit (10,000 pg/L).

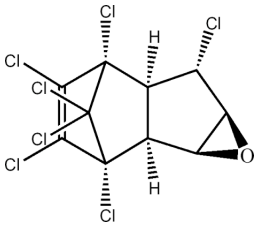


[6] **Heptachlors** (CAS RN: 76-44-8)

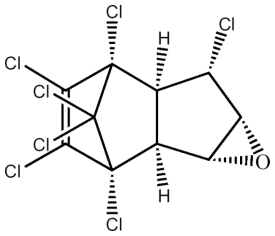
(Heptachlor, CAS RN: 76-44-8)



(Heptachlor epoxide, CAS RN: 1024-57-3)



trans-Heptachlor epoxide



cis-Heptachlor epoxide

Although it is difficult to grasp the tendency of persistence of heptachlor as the monitoring of it in all media was just initiated in FY2002, it was detected at the same level both in FY2002 and FY2003, indicating its persistence in widespread areas.

Heptachlor	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Surface water (pg/L)	FY2002	tr (1.1)	1.0	ND - 25	1.5	[0.5]	97/114	38/38
	FY2003	tr (1.8)	tr (1.6)	tr (1.0) - 7	2	[0.5]	36/36	36/36
Bottom sediment (pg/g-dry)	FY2002	3.5	3.2	ND - 120	1.8	[0.6]	167/189	60/63
	FY2003	tr (2.4)	tr (2.2)	ND - 160	3	[1]	138/186	53/62
Shellfish (pg/g-wet)	FY2002	3.6	4.6	ND - 15	4.2	[1.4]	28/38	6/8
	FY2003	tr (2.8)	tr (2.4)	ND - 14	6.6	[2.2]	16/30	4/6
Fish (pg/g-wet)	FY2002	4.0	4.8	ND - 20	4.2	[1.4]	57/70	12/14
	FY2003	ND	ND	ND - 11	6.6	[2.2]	29/70	8/14
Birds (pg/g-wet)	FY2002	tr (2.1)	tr (2.8)	ND - 5.2	4.2	[1.4]	7/10	2/2
	FY2003	ND	ND	ND	6.6	[2.2]	0/10	0/2
Air (pg/m^3)	FY2002	11	14	0.20 - 220	0.12	[0.04]	102/102	34/34
	FY2003 cold season	10	16	0.39 - 65	0.25	[0.085]	34/34	34/34

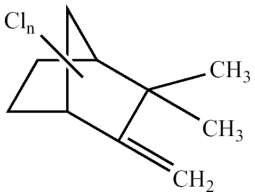
Although it is difficult to grasp the tendency of persistence of *trans*- and *cis*-heptachlor epoxide as the monitoring of them in all media was just started in FY2003, its persistence in widespread areas is recognized.

trans-Heptachlor epoxide	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*		*Detection frequency* *Sample*	*Area*
Surface water (pg/L)	FY2003	ND	ND	ND - 2	2	[0.4]	4/36	4/36
Bottom sediment (pg/g-dry)	FY2003	ND	ND	ND	9	[3]	0/186	0/62
Shellfish (pg/g-wet)	FY2003	ND	ND	ND - 48	13	[4.4]	5/30	1/6
Fish (pg/g-wet)	FY2003	ND	ND	ND	13	[4.4]	0/70	0/14
Birds (pg/g-wet)	FY2003	ND	ND	ND	13	[4.4]	0/10	0/2
Air (pg/m^3)	FY2003 cold season	ND	ND	ND - tr (0.094)	0.099	[0.033]	3/34	3/34

cis-Heptachlor epoxide	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency*	
						Sample	*Area*
Surface water (pg/L)	FY2003	9.8	11	1.2 - 170	0.7 [0.2]	36/36	36/36
Bottom sediment (pg/g-dry)	FY2003	4	3	ND - 160	3 [1]	153/186	55/62
Shellfish (pg/g-wet)	FY2003	42	29	9.7 - 880	6.9 [2.3]	30/30	6/6
Fish (pg/g-wet)	FY2003	42	43	7.0 - 320	6.9 [2.3]	70/70	14/14
Birds (pg/g-wet)	FY2003	520	510	370 - 770	6.9 [2.3]	10/10	2/2
Air (pg/m^3)	FY2003 cold season	1.3	1.3	0.49 - 6.6	0.015 [0.0048]	34/34	34/34

Heptachlors are target substances included in the POPs Treaty, and also from the standpoint of global pollution monitoring, it is necessary to continue the monitoring to trace their fate.

[7] Toxaphene (CAS RN: 8001-35-2)



2-endo,3-exo,5-endo,6-exo,8,8,10,10-Octachlorobornane (Parlar-26)

2-endo,3-exo-5-endo,6-exo,8,8,9,10,10-Nonachlorobornane (Parlar-50)

2,2,5,5,8,9,9,10,10-Nonachlorobornane (Parlar-62)

Although it is difficult to grasp the tendency of persistence of toxaphene as the monitoring of it in all media was just started in FY2003, its persistence in widespread areas is recognized in wildlife and air.

All three substances of toxaphene (Parlar-26, Parlar-50, Parlar-62) were not detected in birds (gray starling) in the suburbs of Morioka City, but all of them were detected in all samples (black-tailed gull) at Kabushima at high concentration. This phenomenon is attributed to the kinds of bait and their sphere of action, since toxaphene is neither manufactured nor imported in Japan.

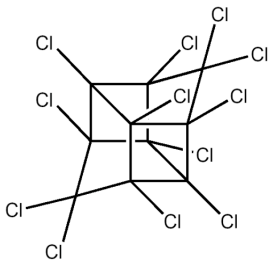
Toxaphene is a target substance included in the POPs Treaty, and also from the standpoint of global pollution monitoring, it is necessary to continue the monitoring to trace their fate.

Toxaphene Parlar-26	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency*	
						Sample	*Area*
Surface water (pg/L)	FY2003	ND	ND	ND	40 [20]	0/36	0/36
Bottom sediment (pg/g-dry)	FY2003	ND	ND	ND	90 [30]	0/186	0/62
Shellfish (pg/g-wet)	FY2003	ND	ND	ND - tr (39)	45 [15]	11/30	3/6
Fish (pg/g-wet)	FY2003	tr (29)	tr (24)	ND - 810	45 [15]	44/70	11/14
Birds (pg/g-wet)	FY2003	110	650	ND - 2,500	45 [15]	5/10	1/2
Air (pg/m^3)	FY2003 cold season	tr (0.17)	tr (0.17)	tr (0.091) - 0.27	0.20 [0.066]	34/34	34/34

Toxaphene Parlar-50	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Area
Surface water (pg/L)	FY2003	ND	ND	ND	70	[30]	0/36	0/36
Bottom sediment (pg/g-dry)	FY2003	ND	ND	ND	200	[50]	0/186	0/62
Shellfish (pg/g-wet)	FY2003	tr (13)	tr (12)	ND - 58	33	[11]	17/30	4/6
Fish (pg/g-wet)	FY2003	34	34	ND - 1,100	33	[11]	55/70	14/14
Birds (pg/g-wet)	FY2003	110	850	ND - 3,000	33	[11]	5/10	1/2
Air (pg/m^3)	FY2003 cold season	ND	ND	ND	0.81	[0.27]	0/34	0/34

Toxaphene Parlar-62	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Area
Surface water (pg/L)	FY2003	ND	ND	ND	300	[90]	0/36	0/36
Bottom sediment (pg/g-dry)	FY2003	ND	ND	ND	4,000	[2,000]	0/186	0/62
Shellfish (pg/g-wet)	FY2003	ND	ND	ND	120	[40]	0/30	0/6
Fish (pg/g-wet)	FY2003	ND	ND	ND - 580	120	[40]	9/70	3/14
Birds (pg/g-wet)	FY2003	tr (96)	200	ND - 530	120	[40]	5/10	1/2
Air (pg/m^3)	FY2003 cold season	ND	ND	ND	1.6	[0.52]	0/34	0/34

[8] Mirex (CAS RN: 2385-85-5)



It is difficult to grasp the tendency of detection status of mirex as the monitoring of it in all media was just started in FY2003.

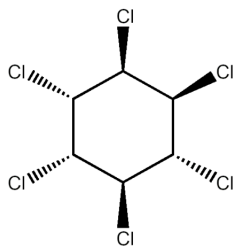
Its persistence in widespread areas is recognized, nevertheless it is neither manufactured nor imported in Japan.

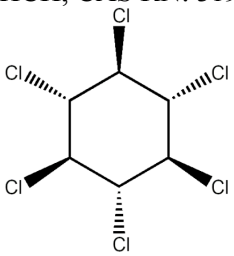
Mirex is a target substance included in the POPs Treaty, and also from the standpoint of global pollution monitoring, it is necessary to continue the monitoring to trace its fate.

Mirex	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Area
Surface water (pg/L)	FY2003	tr (0.13)	tr (0.12)	ND - 0.8	0.3	[0.09]	25/36	25/36
Bottom sediment (pg/g-dry)	FY2003	tr (1.8)	tr (1.6)	ND - 1,500	2	[0.4]	137/186	51/62
Shellfish (pg/g-wet)	FY2003	4.8	4.2	tr (1.6) - 19	2.4	[0.81]	30/30	6/6
Fish (pg/g-wet)	FY2003	7.9	9.0	tr (1.7) - 25	2.4	[0.81]	70/70	14/14
Birds (pg/g-wet)	FY2003	110	150	31 - 450	2.4	[0.81]	10/10	2/2
Air (pg/m^3)	FY2003 cold season	0.044	0.043	0.024 - 0.099	0.0084	[0.0028]	34/34	34/34

[9] HCHs (CAS RN: 608-73-1)

(α-HCH, CAS RN: 319-84-6)　(β-HCH, CAS RN: 319-85-7)





Persistence of both α-HCH and β-HCH in surface water showed a decreasing tendency, and all of the detected values had been below the detection limit (10,000 pg/L) from FY1994 to FY2001. In FY2002 and FY2003, HCHs were detected in all surveyed areas under the QL 0.9 - 3 pg/L (DL 0.3 - 0.9 pg/L). Detected values in the FY2003 survey remain at the same concentration level as in the previous year, indicating their persistence in widespread areas. Concentrations of γ-HCH and δ-HCH were below the detection limit (both 100,000 pg/L) in the General Inspection Survey of Chemical Substances conducted in FY1974. However, in FY2003 they were detected in all areas under the QL 7 pg/L (DL 2 pg/L) for γ-HCH and QL 2 pg/L (DL 0.5 pg/L) for δ-HCH, indicating their persistence in widespread areas.

α-HCH	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency Sample*	*Area*
Surface water (pg/L)	FY2002	84	76	1.9 - 6,500	0.9 [0.3]	114/114	38/38
	FY2003	120	120	13 - 970	3 [0.9]	36/36	36/36

β-HCH	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency Sample*	*Area*
Surface water (pg/L)	FY2002	210	180	24 - 1,600	0.9 [0.3]	114/114	38/38
	FY2003	250	240	14 - 1,700	3 [0.7]	36/36	36/36

γ-HCH	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency Sample*	*Area*
Surface water (pg/L)	FY1974	ND	ND	ND	[100,000]	0/60	
	FY2003	92	90	32 - 370	7 [2]	36/36	36/36

δ-HCH	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency Sample*	*Area*
Surface water (pg/L)	FY1974	ND	ND	ND	[100,000]	0/60	
	FY2003	14	14	tr (1.1) - 200	2 [0.5]	36/36	36/36

Detected values of both α-HCH and β-HCH in bottom sediment fluctuated so sharply in the past that it is difficult to grasp the tendency of their persistence. Detected values in the FY2003 survey remain at the same concentration level as in the previous year, indicating their persistence in widespread areas as before. The concentration levels of γ-HCH and δ-HCH were around the detection limit (both 10,000 pg/g-dry) in the General Inspection Survey of Chemical Substances conducted in FY1974. In the FY2003 survey, they were detected in many areas under the QL 2 pg/g-dry (DL 0.4 pg/g-dry) for γ-HCH and QL 2 pg/g-dry (DL 0.7 pg/g-dry) for δ-HCH, indicating their persistence in widespread areas.

α-HCH	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]	Detection frequency Sample	Area
Bottom sediment (pg/g-dry)	FY2002	130	170	2.0 - 8,200	1.2 [0.4]	189/189	63/63
	FY2003	140	170	2 - 9,500	2 [0.5]	186/186	62/62

β-HCH	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]	Detection frequency Sample	Area
Bottom sediment (pg/g-dry)	FY2002	200	230	3.9 - 11,000	0.9 [0.3]	189/189	63/63
	FY2003	220	220	5 - 39,000	2 [0.7]	186/186	62/62

γ-HCH	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]	Detection frequency Sample	Area
Bottom sediment (pg/g-dry)	FY1974	ND	ND	ND - 10,000	[10,000]	9/60	
	FY2003	45	47	tr (1.4) - 4,000	2 [0.4]	186/186	62/62

δ-HCH	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]	Detection frequency Sample	Area
Bottom sediment (pg/g-dry)	FY1974	ND	ND	ND - 10,000	[10,000]	4/60	
	FY2003	37	46	ND - 5,400	2 [0.7]	180/186	61/62

Persistence of HCHs in shellfish and fish showed a decreasing tendency from the mid-80s to mid-90s and in recent years detected values were mostly below the detection limit (1,000 pg/g-wet). Especially, as the concentrations of γ-HCH and δ-HCH had been consecutively below the detection limit in all samples, survey of them was discontinued in FY1996 for γ-HCH and in FY1992 for δ-HCH. In FY2002, both α-HCH and β-HCH were detected in all surveyed areas/samples under the QL 4.2 pg/g-wet (DL 1.4 pg/g-wet) for α-HCH and QL 12 pg/g-wet (DL 4 pg/g-wet) for β-HCH. In FY2003, they were also detected in all surveyed areas/samples under the QL 1.8 pg/g-wet (DL 0.61 pg/g-wet) for α-HCH and QL 9.9 pg/g-wet (DL 3.3 pg/g-wet) for β-HCH. Detected values in the FY2003 survey remain at the same concentration level as in the previous year, indicating their persistence in widespread areas as before. γ-HCH and δ-HCH were detected in all areas under the QL 3.3 pg/g-wet (DL 1.1 pg/g-wet) for γ-HCH and QL 3.9 pg/g-wet (DL 1.3 pg/g-wet) for δ-HCH, indicating their persistence in widespread areas.

It is difficult to grasp the tendency of persistence of HCHs in birds from the initial years of the monitoring, because survey areas were changed, in addition to the fact that only 2 areas were surveyed. Concentration gradient of 'gray starling> black-tailed gull', 'birds > shellfish, fish' is observed for β-HCH. Similar tendency is also observed in another investigation on wildlife conducted by MOE. Concentrations of α-HCH and β-HCH in FY2003 remain at the same level as in previous year, indicating their persistence. Survey of γ-HCH and δ-HCH was discontinued in FY1996 for γ-HCH and in FY1992 for δ-HCH, as in the case of shellfish/fish. In the FY2003 survey, γ-HCH and δ-HCH were detected in all areas/samples under the QL 3.3 pg/g-wet (DL 1.1 pg/g-wet) for γ-HCH and QL 3.9 pg/g-wet (DL 1.3 pg/g-wet) for δ-HCH, indicating their persistence in widespread areas as before.

α-HCH	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Area
Shellfish (pg/g-wet)	FY2002	65	64	12 - 1,100	4.2	[1.4]	38/40	8/8
	FY2003	45	30	9.9 - 610	1.8	[0.61]	30/30	6/6
Fish (pg/g-wet)	FY2002	51	56	tr (1.9) - 6,500	4.2	[1.4]	70/70	14/14
	FY2003	41	58	2.6 - 590	1.8	[0.61]	70/70	14/14
Birds (pg/g-wet)	FY2002	160	130	93 - 360	4.2	[1.4]	10/10	2/2
	FY2003	70	74	30 - 230	1.8	[0.61]	10/10	2/2

β-HCH	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Area
Shellfish (pg/g-wet)	FY2002	89	62	32 - 1,700	12	[4]	70/70	14/14
	FY2003	77	50	23 - 1,100	9.9	[3.3]	30/30	6/6
Fish (pg/g-wet)	FY2002	99	120	tr (5) - 1,800	12	[4]	70/70	14/14
	FY2003	78	96	tr (3.5) - 1,100	9.9	[3.3]	70/70	14/14
Birds (pg/g-wet)	FY2002	3,000	3,000	1,600 - 7,300	12	[4]	10/10	2/2
	FY2003	3,400	3,900	1,800 - 5,900	9.9	[3.3]	10/10	2/2

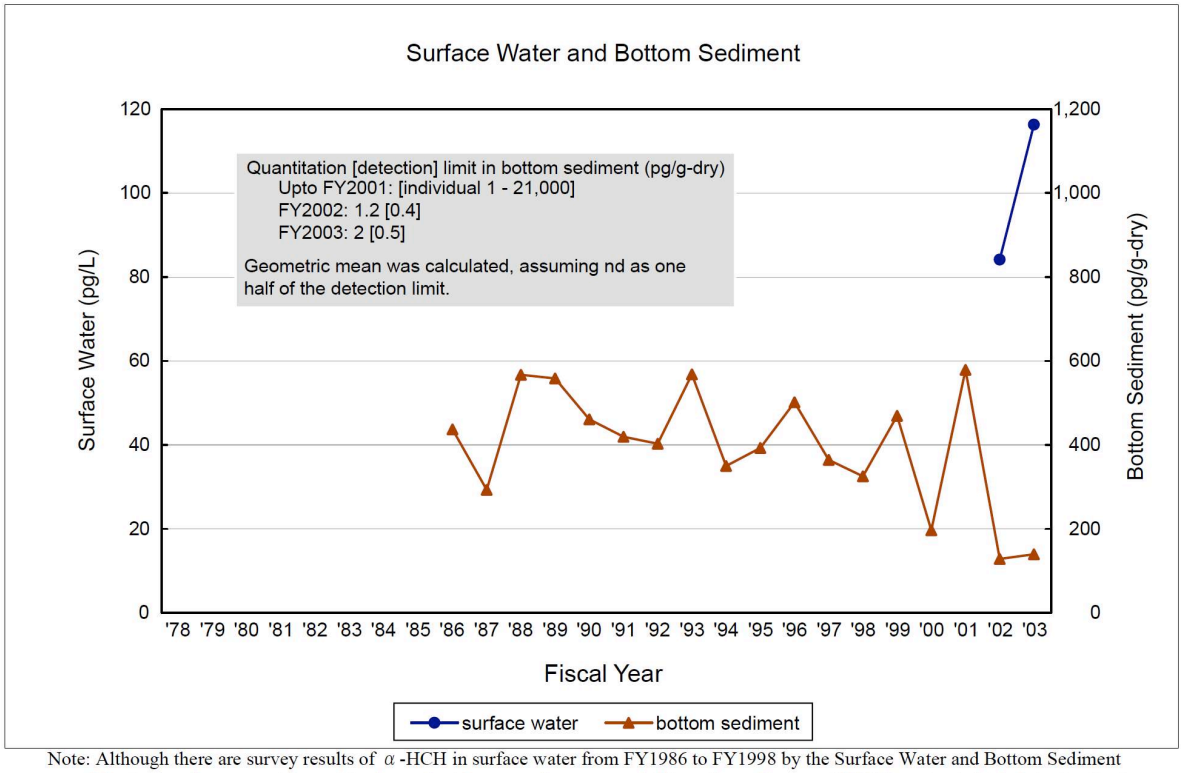
γ-HCH	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Area
Shellfish (pg/g-wet)	FY1996	ND	ND	ND	[1,000]		0/30	0/6
	FY2003	19	18	5.2 - 130	3.3	[1.1]	30/30	6/6
Fish (pg/g-wet)	FY1996	ND	ND	ND	[1,000]		0/70	0/14
	FY2003	16	22	tr (1.7) - 130	3.3	[1.1]	70/70	14/14
Birds (pg/g-wet)	FY1996	ND	ND	ND	[1,000]		0/10	0/2
	FY2003	14	19	3.7 - 40	3.3	[1.1]	10/10	2/2

δ-HCH	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]		Detection frequency Sample	Area
Shellfish (pg/g-wet)	FY1992	ND	ND	ND	[1,000]		0/30	0/6
	FY2003	7.2	tr (2.6)	ND - 1,300	3.9	[1.3]	29/30	6/6
Fish (pg/g-wet)	FY1992	ND	ND	ND	[1,000]		0/70	0/14
	FY2003	tr (3.5)	4.0	ND - 16	3.9	[1.3]	59/70	13/14
Birds (pg/g-wet)	FY1992	ND	ND	ND	[1,000]		0/10	0/2
	FY2003	18	18	12 - 31	3.9	[1.3]	10/10	2/2

Although it is difficult to grasp the tendency of their persistence in air as the monitoring of HCHs were just started in FY2003, any HCHs, α-HCH, β-HCH, γ-HCH and δ-HCH, were detected in all areas/samples, indicating their persistence in widespread areas.

Isomers of HCHs except γ-isomers are recognized as having high persistence and may possibly be included in the candidate substances for the POPs Treaty. Furthermore, it is necessary to continue the monitoring for the purpose of tracing their fate from the standpoint of global pollution monitoring.

Figure 4-17 Annual Change of α-HCH (geometric mean)



Note: Although there are survey results of α-HCH in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.

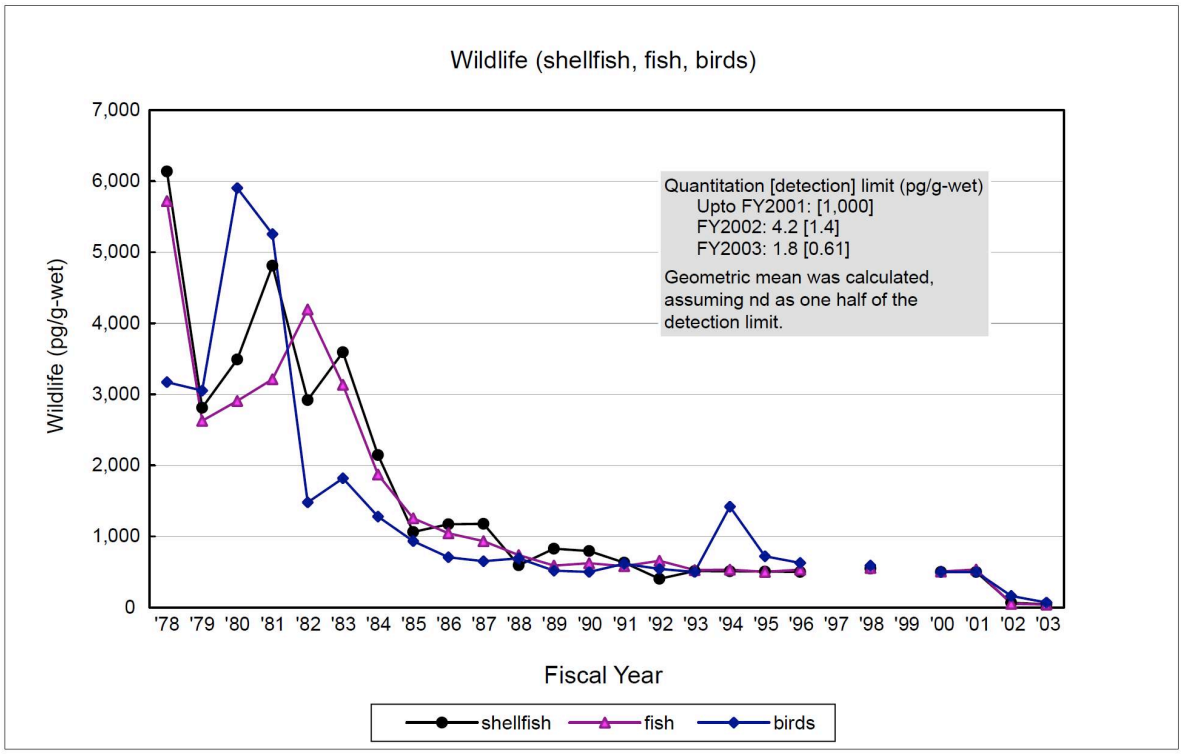
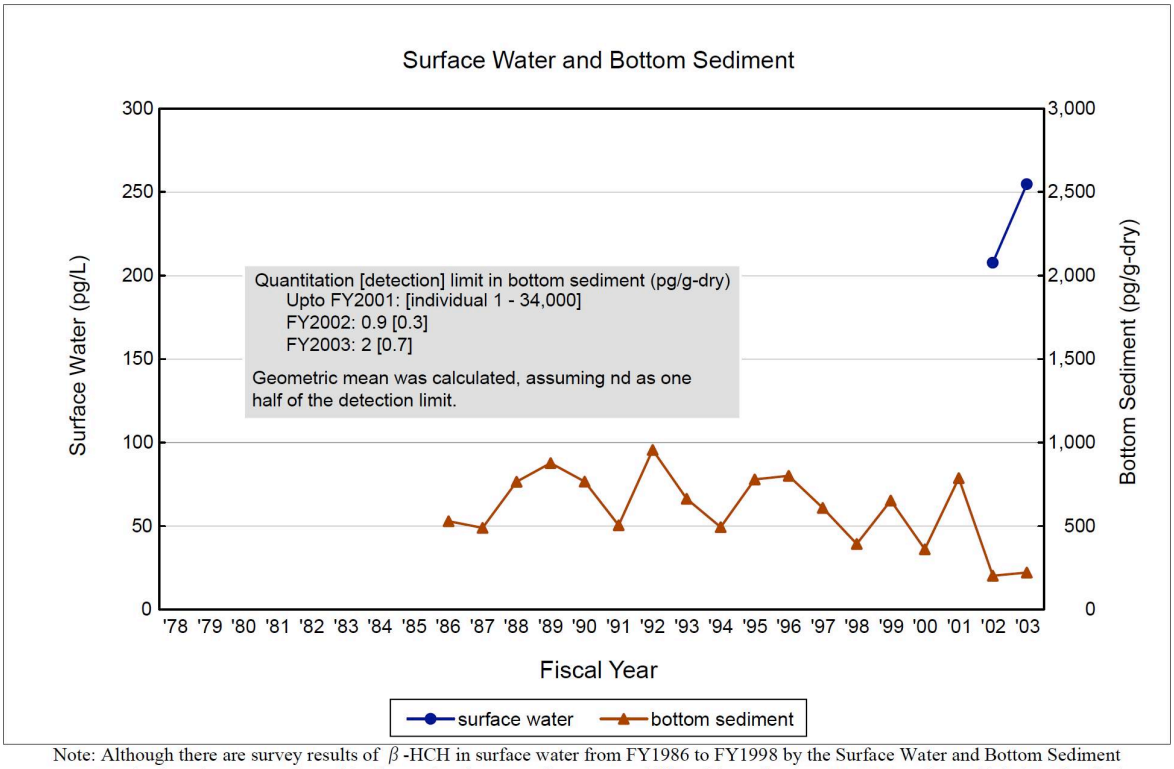


Figure 4-18 Annual Change of β-HCH (geometric mean)



Note: Although there are survey results of β-HCH in surface water from FY1986 to FY1998 by the Surface Water and Bottom Sediment Monitoring, they are not figured in above chart because of no-comparability with results since FY2002, owing to high detection limit (10,000 pg/L) and low detection frequency.

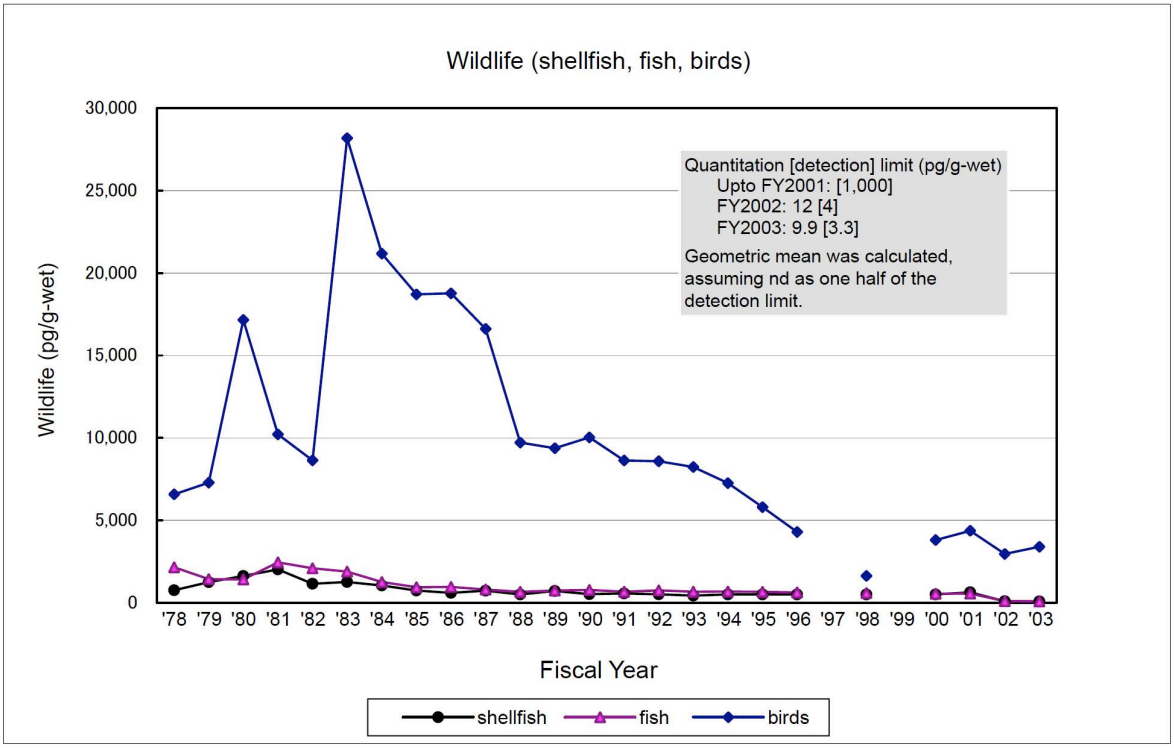
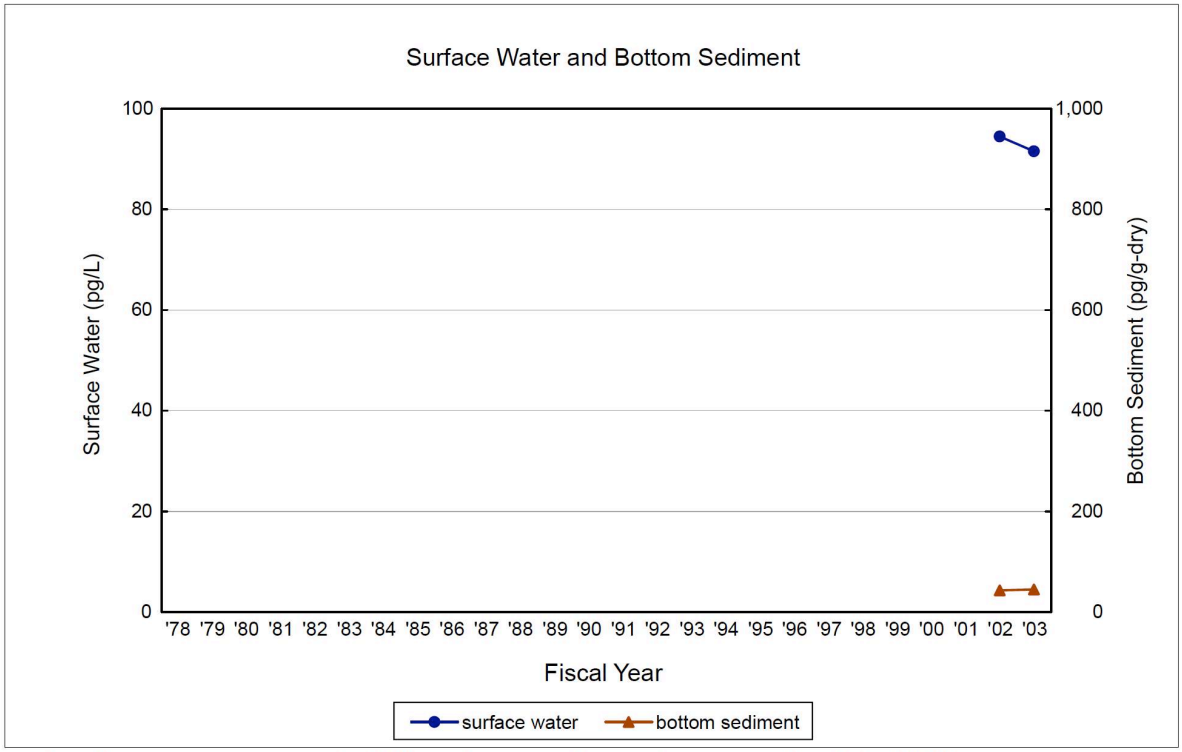


Figure 4-19 Annual Change of γ-HCH (geometric mean)



Note: No monitoring investigations of γ-HCH in surface water and bottom sediment were conducted before FY2001.

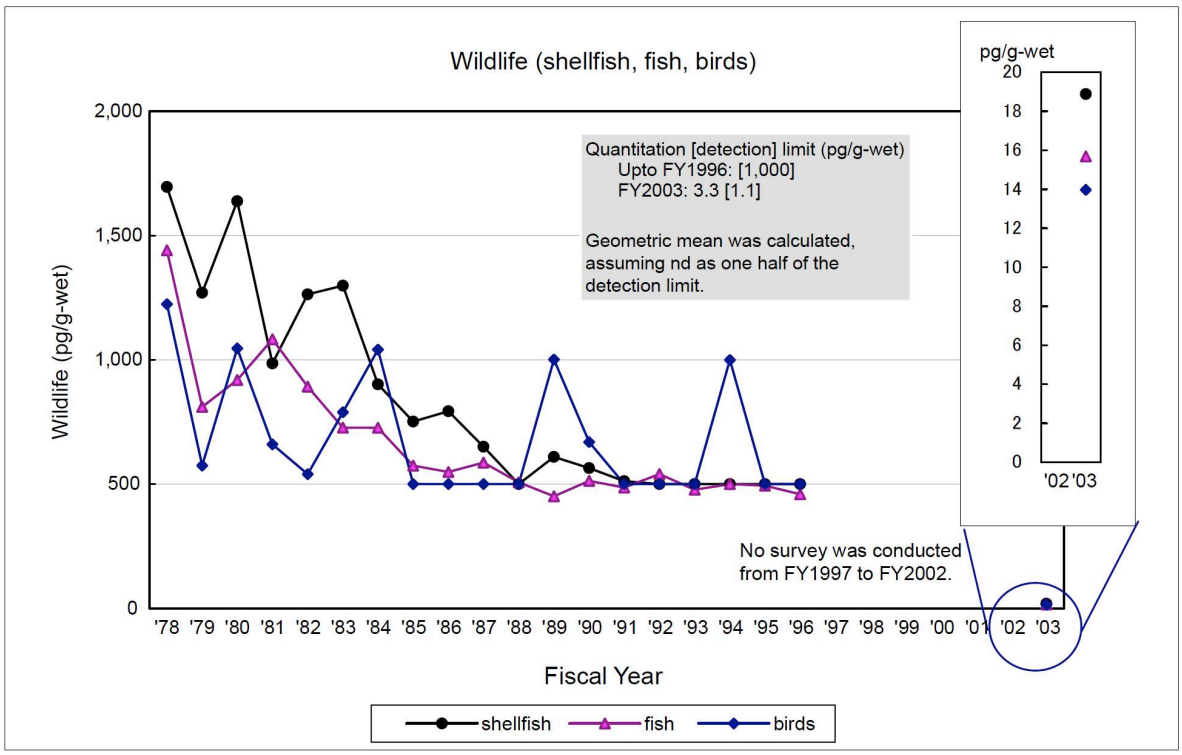
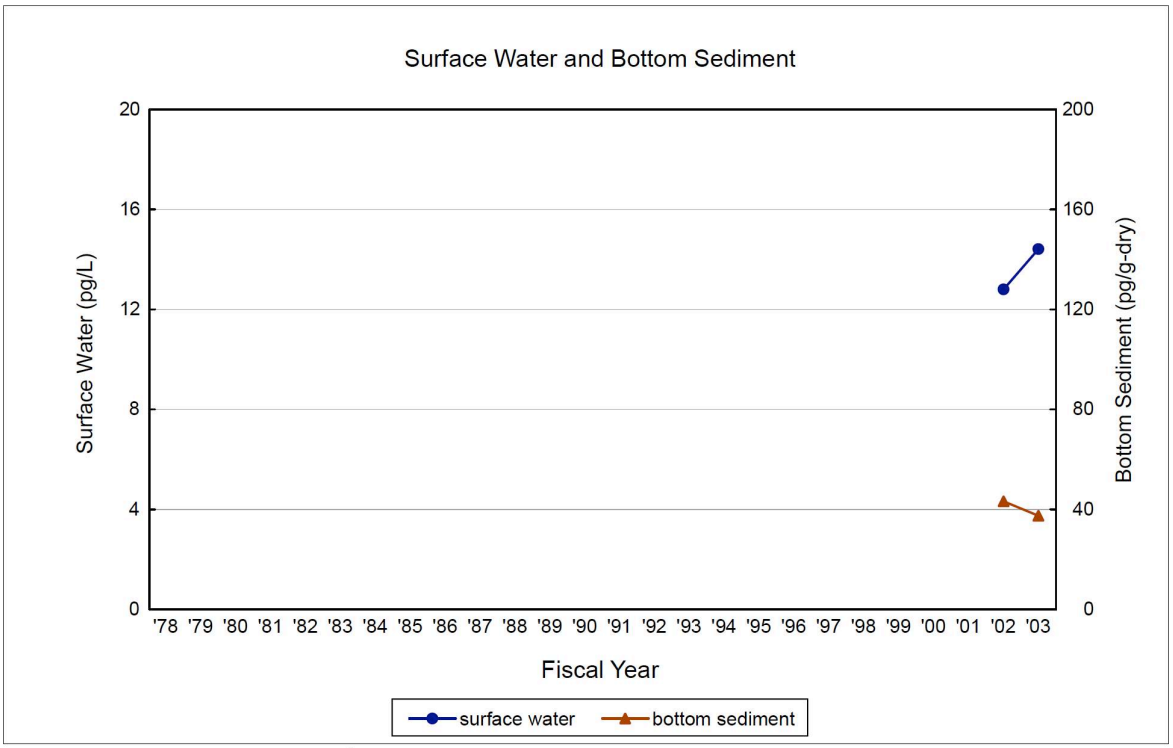
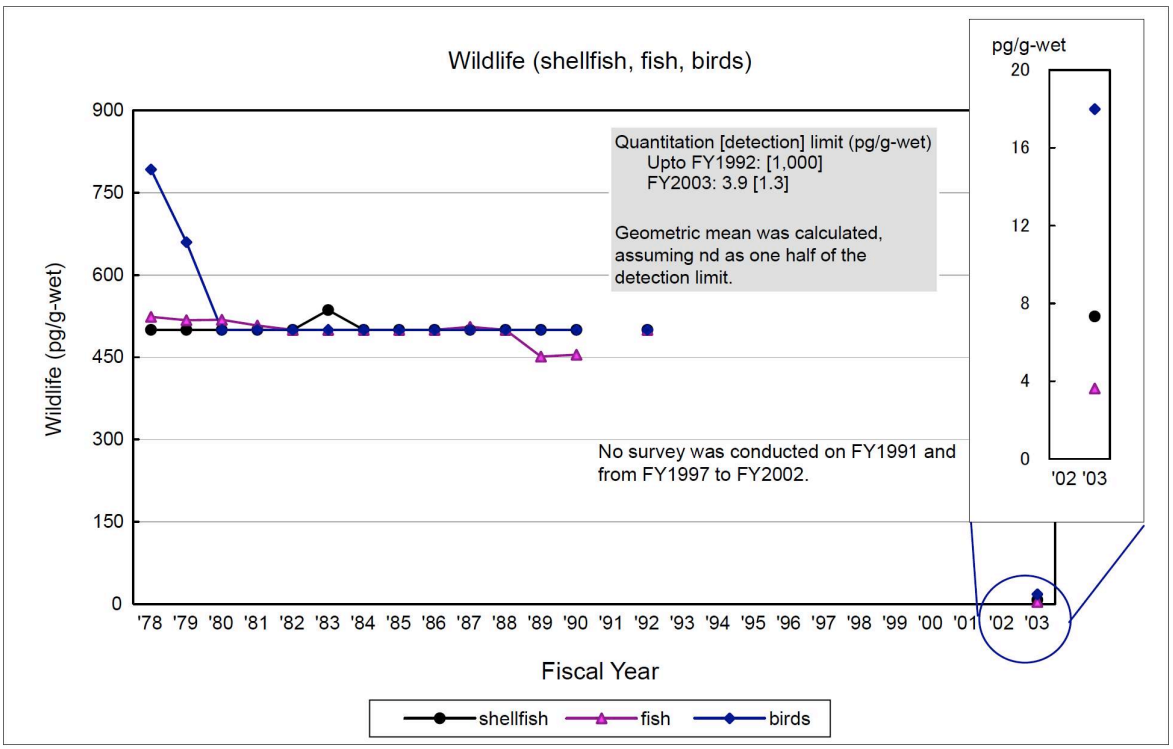


Figure 4-20 Annual Change of δ-HCH (geometric mean)

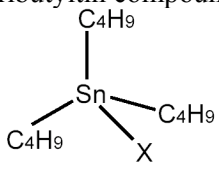


Note: No monitoring investigations of δ-HCH in surface water and bottom sediment were conducted before FY2001.



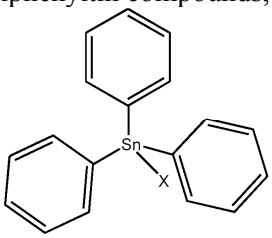
[10] Organotin compounds (TBT, DBT, TPT, DPT, MPT)

TBT (Tributyltin compounds, CAS RN: mixture)



X = anion

TPT (Triphenyltin compounds, CAS RN: mixture)



X = anion

Persistence of both TBT and TPT in bottom sediment showed a decreasing tendency from the start of the survey to recent years. Detected concentrations of them in FY2003 remain at the same level as in FY2002, indicating the persistence of both TBT and TPT in wide spread areas as before. Monitoring of DBT, DPT and MPT was conducted for the first time in FY2003. They were detected at the same concentration level as in the data of the General Inspection Survey of Chemical Substances in FY1999, indicating widespread persistence of them.

TBT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (ng/g-dry)	FY2002	4.9	4.0	ND - 390	3.6 [1.2]	126/189	48/63
	FY2003	3.0	4.4	ND - 450	1.2 [0.4]	127/186	46/62

DBT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (ng/g-dry)	FY1999	11	11	ND - 190	[2.5]	122/153	45/51
	FY2003	5.5	6.3	ND - 640	1.2 [0.4]	152/186	57/62

TPT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (ng/g-dry)	FY2002	tr (0.69)	ND	ND - 490	1.6 [0.55]	76/189	30/63
	FY2003	tr (0.27)	tr (0.16)	ND - 540	0.28 [0.09]	96/186	37/62

DPT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (ng/g-dry)	FY1999	0.89	ND	ND - 59	[0.61]	65/149	26/50
	FY2003	tr (0.14)	tr (0.10)	ND - 120	0.16 [0.06]	100/186	38/62

MPT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (ng/g-dry)	FY1999	ND	ND	ND - 160	[16]	28/152	12/51
	FY2003	tr (1.9)	ND	ND - 1000	2.4 [0.8]	86/186	35/62

Persistence of TBT and TPT in shellfish showed a decreasing tendency in the initial years of survey. However, no tendency is observed in the change of their persistence in recent years. Detected values in the FY2003 survey remain at the same concentration level as in FY2002, indicating the persistence of both TBT and TPT in widespread areas as before. An environmental survey of DBT, DPT and MPT in shellfish was conducted for the first time in FY2003 and the concentration of DBT in shellfish was found to be higher than that in fish. Concentrations of DPT and MPT in shellfish were nearly the same as in fish.

Persistence of TBT and TPT in fish showed a decreasing tendency in the initial years of survey. However, no tendency is observed in the change of their persistence in recent years. Detected values in the FY2003 survey remain at the same concentration level as in FY2002, indicating the persistence of both TBT and TPT in widespread areas. Monitoring Investigation of DBT, DPT and MPT in fish was conducted for the first time in FY2003 and concentrations of them were detected at the same level as in the data of the General Inspection Survey of Chemical Substances in FY1999, indicating widespread persistence of DBT.

Detected values of organotin compounds in birds were all below the detection limit (TBT: 10-50 ng/g-wet, TPT: 20 ng/g-wet until FY2001; TBT: 1 ng/g-wet, TPT: 0.5 ng/g-wet in FY2002) with the exception of one area where TPT was detected in FY1989 and FY1990. In the FY2003 survey conducted under the QL 3 ng/g-wet (DL 1 ng/g-wet) for TBT and QL 1.5 ng/g-wet (DL 0.5 ng/g-wet) for TPT, they were not detected in any samples except one sample (tr (1) ng/g-wet), indicating little change in the status of there persistence. Monitoring Investigation of DBT, DPT and MPT in birds was conducted for the first time in FY2003. In this survey, DBT was not detected in gray starling but was detected in black-tailed gull with the concentration of tr (1) – tr (3) ng/g-wet, suggesting the effect of bait.

TBT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (ng/g-wet)	FY2002	12	12	tr (2) - 57	3 [1]	38/38	8/8
	FY2003	10	12	tr (2) - 25	3 [1]	30/30	6/6
Fish (ng/g-wet)	FY2002	6	6	ND - 500	3 [1]	55/70	13/14
	FY2003	7	6	ND - 72	3 [1]	63/70	13/14
Birds (ng/g-wet)	FY2002	ND	ND	ND	3 [1]	0/10	0/2
	FY2003	ND	ND	ND - tr (1)	3 [1]	1/10	1/2

DBT	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (ng/g-wet)	FY2003	14	14	tr (2) - 53	3 [1]	30/30	6/6
Fish (ng/g-wet)	FY1999	2.6	2.7	ND - 71	[2.3]	75/140	29/47
	FY2003	tr (1)	tr (1)	ND - 7	3 [1]	39/70	12/14
Birds (ng/g-wet)	FY2003	ND	ND	ND - tr (3)	3 [1]	4/10	1/2

TPT	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]	Detection frequency Sample	Area
Shellfish (ng/g-wet)	FY2002	2.7	4.5	ND - 25	1.5 [0.5]	31/38	7/8
	FY2003	2.8	3.6	ND - 27	1.5 [0.5]	26/30	6/6
Fish (ng/g-wet)	FY2002	6.4	7.9	ND - 520	1.5 [0.5]	69/70	14/14
	FY2003	5.3	5.4	ND - 30	1.5 [0.5]	68/70	14/14
Birds (ng/g-wet)	FY2002	ND	ND	ND	1.5 [0.5]	0/10	0/2
	FY2003	ND	ND	ND	1.5 [0.5]	0/10	0/2

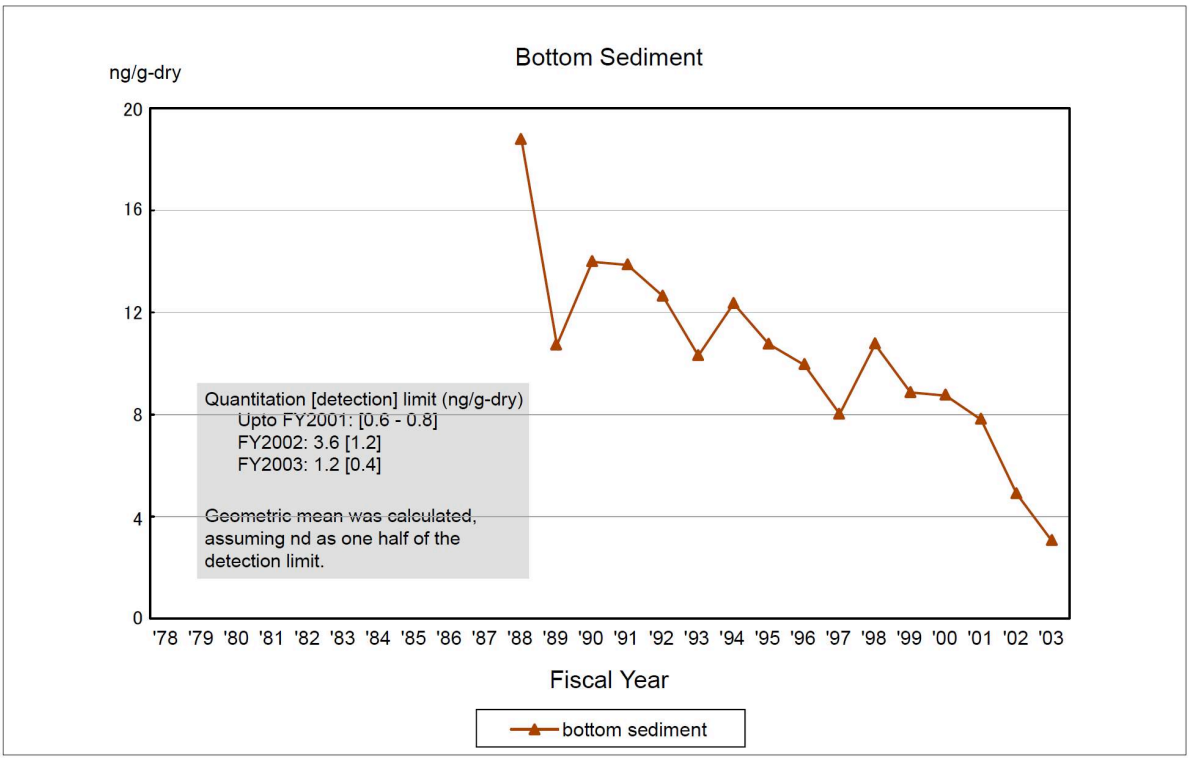
DPT	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]	Detection frequency Sample	Area
Shellfish (ng/g-wet)	FY2003	ND	ND	ND - 1.6	1.5 [0.5]	3/30	2/6
Fish (ng/g-wet)	FY1999	ND	ND	ND - 3.9	[0.13]	41/134	20/45
	FY2003	ND	ND	ND - tr (1.3)	1.5 [0.5]	3/70	2/14
Birds (ng/g-wet)	FY2003	ND	ND	ND	1.5 [0.5]	0/10	0/2

MPT	Year	Geometric mean	Median value	Range	Quantitation limit [Detection limit]	Detection frequency Sample	Area
Shellfish (ng/g-wet)	FY2003	ND	ND	ND	15 [5]	0/30	0/6
Fish (ng/g-wet)	FY1999	ND	ND	ND - 8.3	[3.2]	5/134	3/45
	FY2003	ND	ND	ND	15 [5]	0/70	0/14
Birds (ng/g-wet)	FY2003	ND	ND	ND	15 [5]	0/10	0/2

Considering the status of TBT and TPT production (seldom produced or used for the domestic open system), the status of pollution by TBT and TPT, and their decomposition products DPT and MPT, will improve further in the future. However, there remains a possibility of pollution related to the existence of unrestricted countries and areas, and it is necessary to successively monitor the status of environmental pollution, as well as to continue providing environmental pollution countermeasures in the future. It is also necessary to collect toxicity-related knowledge and related information since organotin compounds are pointed out as being chemical substances suspected of possessing endocrine disrupting effects.

Further, it is necessary to collect the information including the clarification of its emission source, as well as to monitor the change of its persistence, since the production amount of DBT is 6,597 t (total amount as stabilizer of organotin compounds) in FY1998 and 5,428 t (ibid) in FY2002 and persistence of it in bottom sediment and wildlife is recognized.

Figure 4-21 Annual Change of TBT (geometric mean)



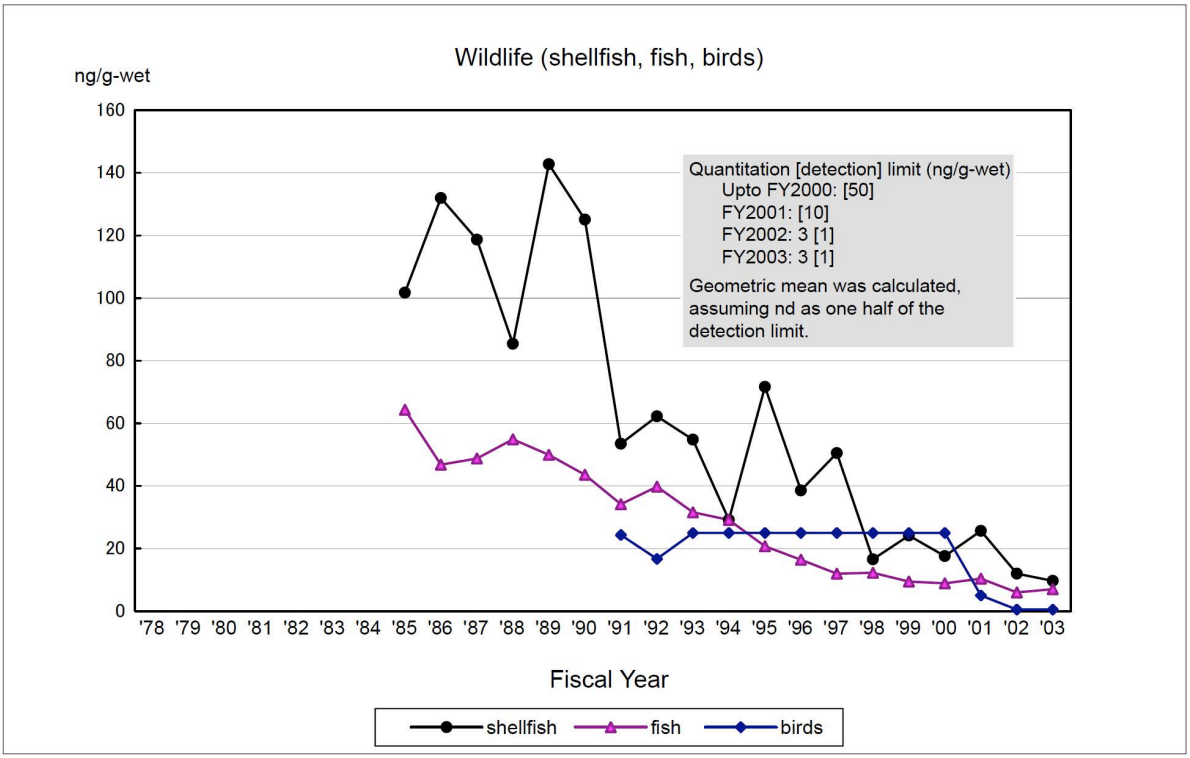
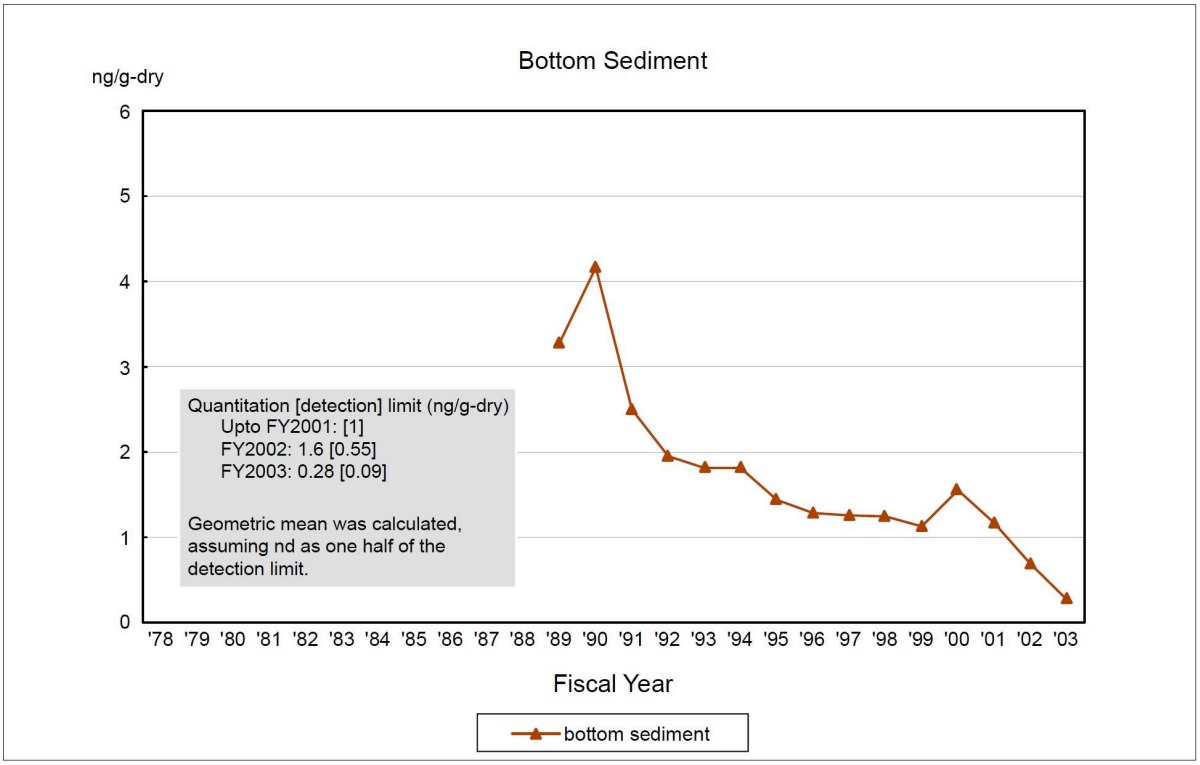
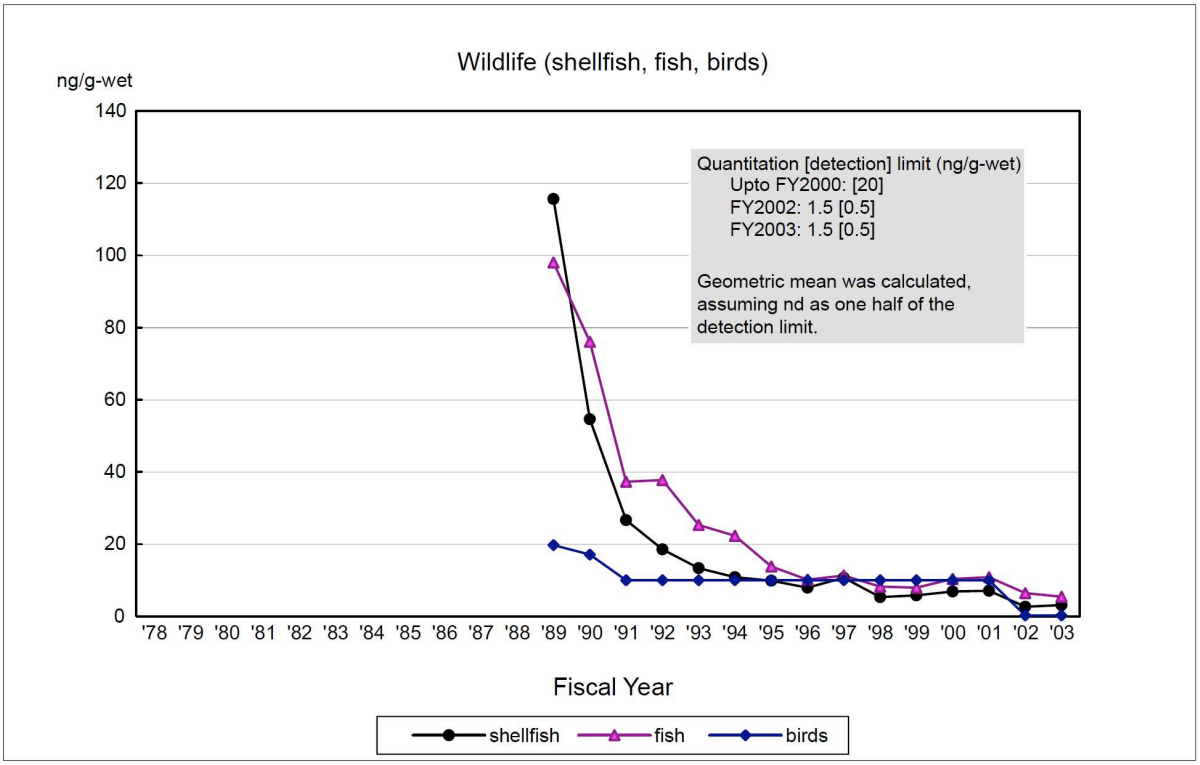


Figure 4-22 Annual Change of TPT (geometric mean)





[11] Tetrabromobisphenol A

Although Monitoring Investigation of tetrabromobisphenol A was started in FY2003, its environmental survey in surface water, bottom sediment and aquatic wildlife (fish) was already conducted by the General Inspection Survey of Chemical Substances in FY1977, FY1987, FY1988 and FY2000 (except aquatic wildlife in FY1977).

In the FY1987 survey, it was detected in bottom sediment in 6 areas out of 22 (14 samples out of 66) with the detected range of 2 - 150 ng/g-dry. In the FY1988 survey, it was detected in 9 areas out of 34 (20 samples out of 130) with the detected range of 2 - 108 ng/g-dry. Although it was not detected in any of the surveyed areas in the FY2000 and FY2003 investigation, it is difficult to grasp the change of its nationwide persistence, as the detection limit was 2 ng/g-dry for FY1987 and FY1988, 5.5 ng/g-dry for FY2000 and FY2003 (QL of FY2003: 18 ng/g-dry) and the detected values in FY1987/FY1988 were below the detection limit of FY2000/FY2003 with the exception of 3 areas.

Further, in the FY2003 survey, tetrabromobisphenol A was not detected at the area where extraordinary high concentration (43 - 150 ng/g-dry) was detected in the FY1987 and FY1988 survey (no survey was conducted at there in FY2000).

Tetrabromo-bisphenol A	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Bottom sediment (ng/g-dry)	FY2000	ND	ND	ND	[5.5]	0/27	0/9
	FY2003	ND	ND	ND	18 [5.5]	0/186	0/62

An environmental survey of tetrabromobisphenol A in shellfish was conducted for the first time and it was detected in 3 areas out of 6, the 95% value of it being tr (0.074) ng/g-wet.

Although tetrabromobisphenol A was not detected in fish in the past, it is difficult to grasp the change of its persistence, as the detection limit in the past (1 - 20 ng/g-wet) is greater than the maximum detected value in the FY2003 survey (0.15 ng/g-wet). The 95% value of it was tr (0.056) ng/g-wet.

An environmental survey of tetrabromobisphenol A in birds was conducted for the first time and it was not detected in all areas/samples.

Tetrabromo-bisphenol A	*Year*	*Geometric mean*	*Median value*	*Range*	*Quantitation limit [Detection limit]*	*Detection frequency* Sample	Area
Shellfish (ng/g-wet)	FY2003	ND	ND	ND - 0.16	0.090 [0.030]	12/30	3/6
Fish (ng/g-wet)	FY2000	ND	ND	ND	[20]	0/27	0/9
	FY2003	ND	ND	ND - 0.15	0.090 [0.030]	10/70	5/14
Birds (ng/g-wet)	FY2003	ND	ND	ND	0.090 [0.030]	0/10	0/2

Considering the status of the current production and use of brominated flame retardants in Japan, it is necessary to successively monitor the status of environmental pollution, as well as to continue providing environmental pollution countermeasures in the future.

Figure 4-A Locations of the Monitoring Investigation for Surface Water (FY2003)

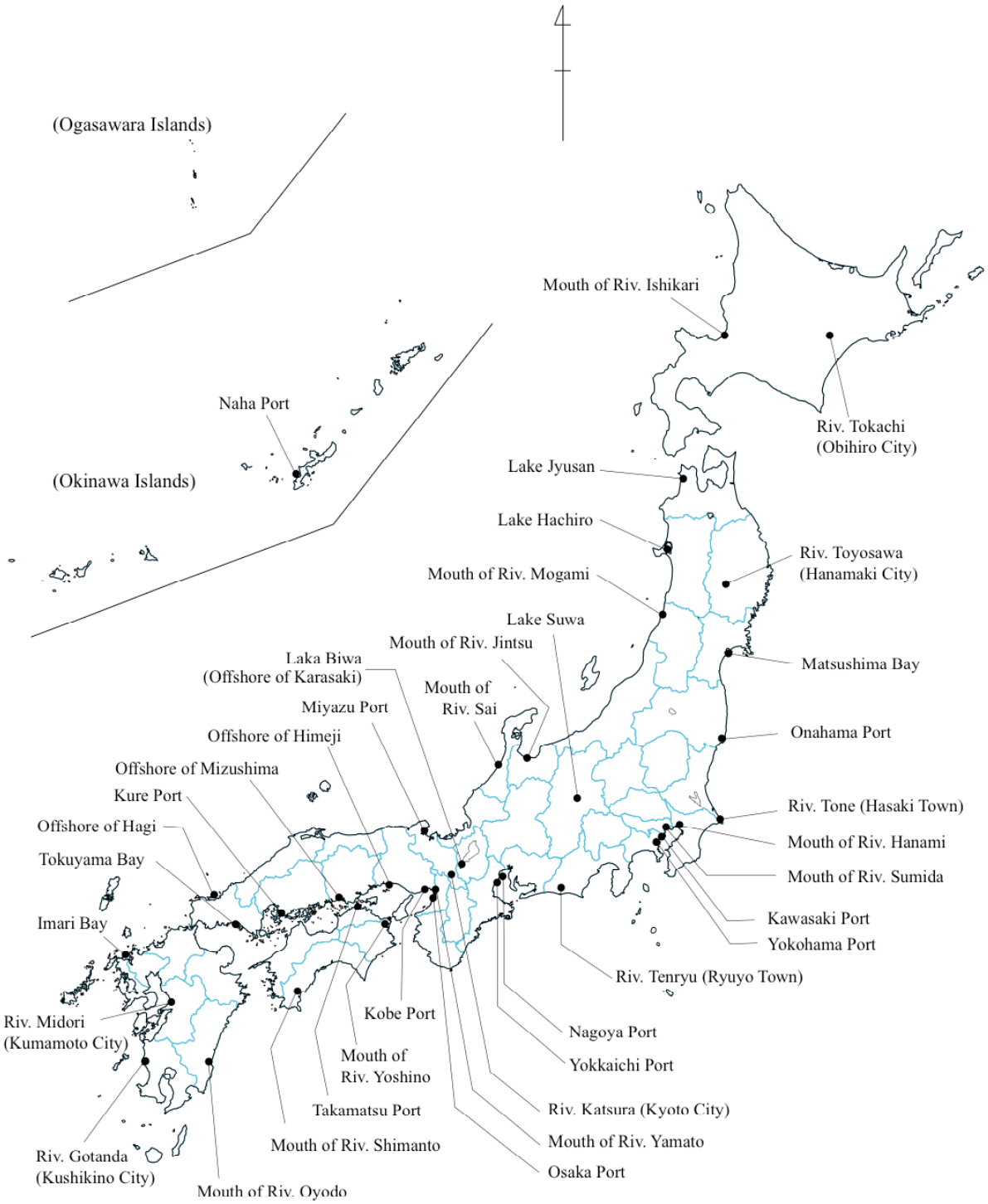


Figure 4-B Locations of the Monitoring Investigation for Bottom Sediment (FY2003)

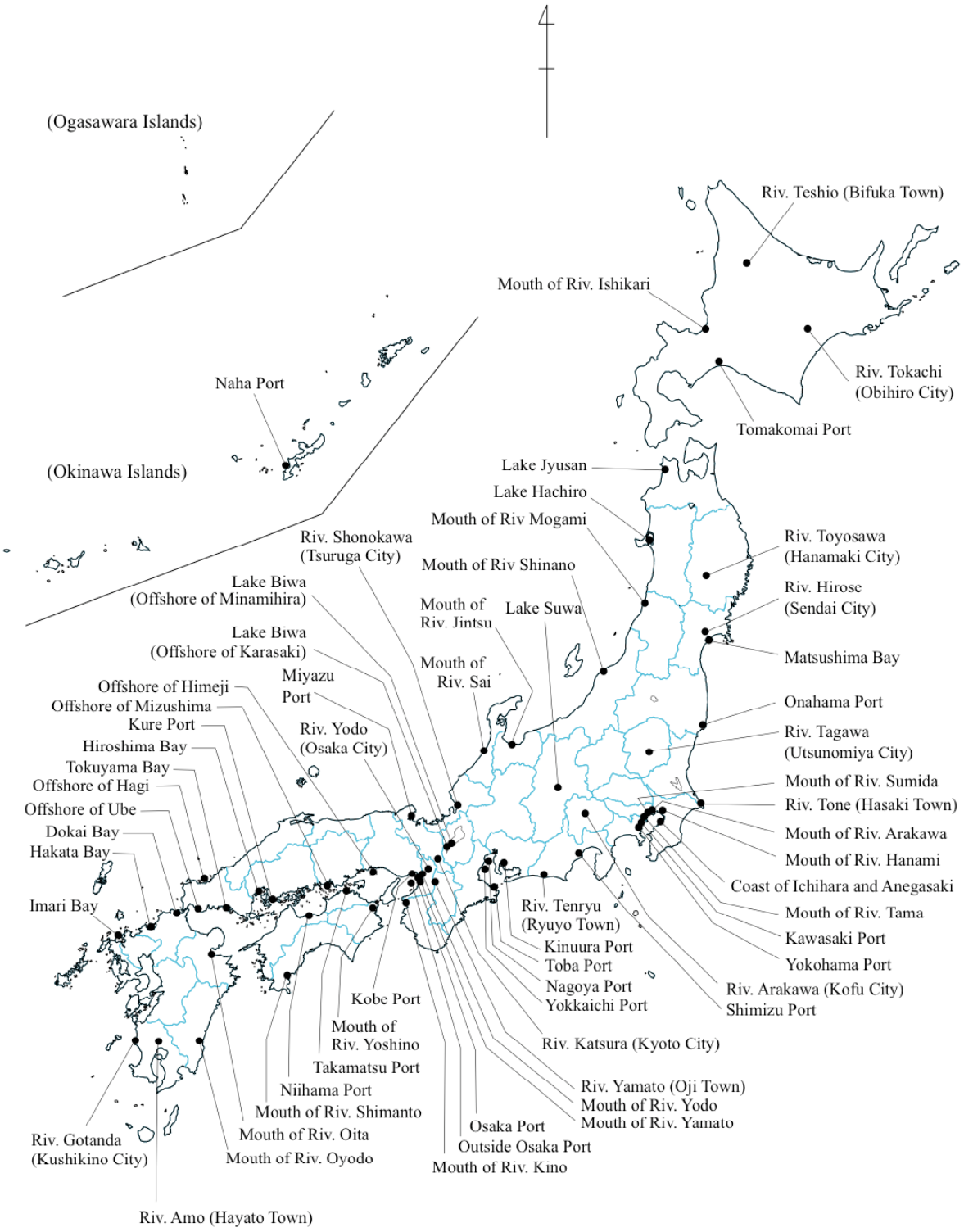


Figure 4-C Locations of the Monitoring Investigation for Wildlife (FY2003)

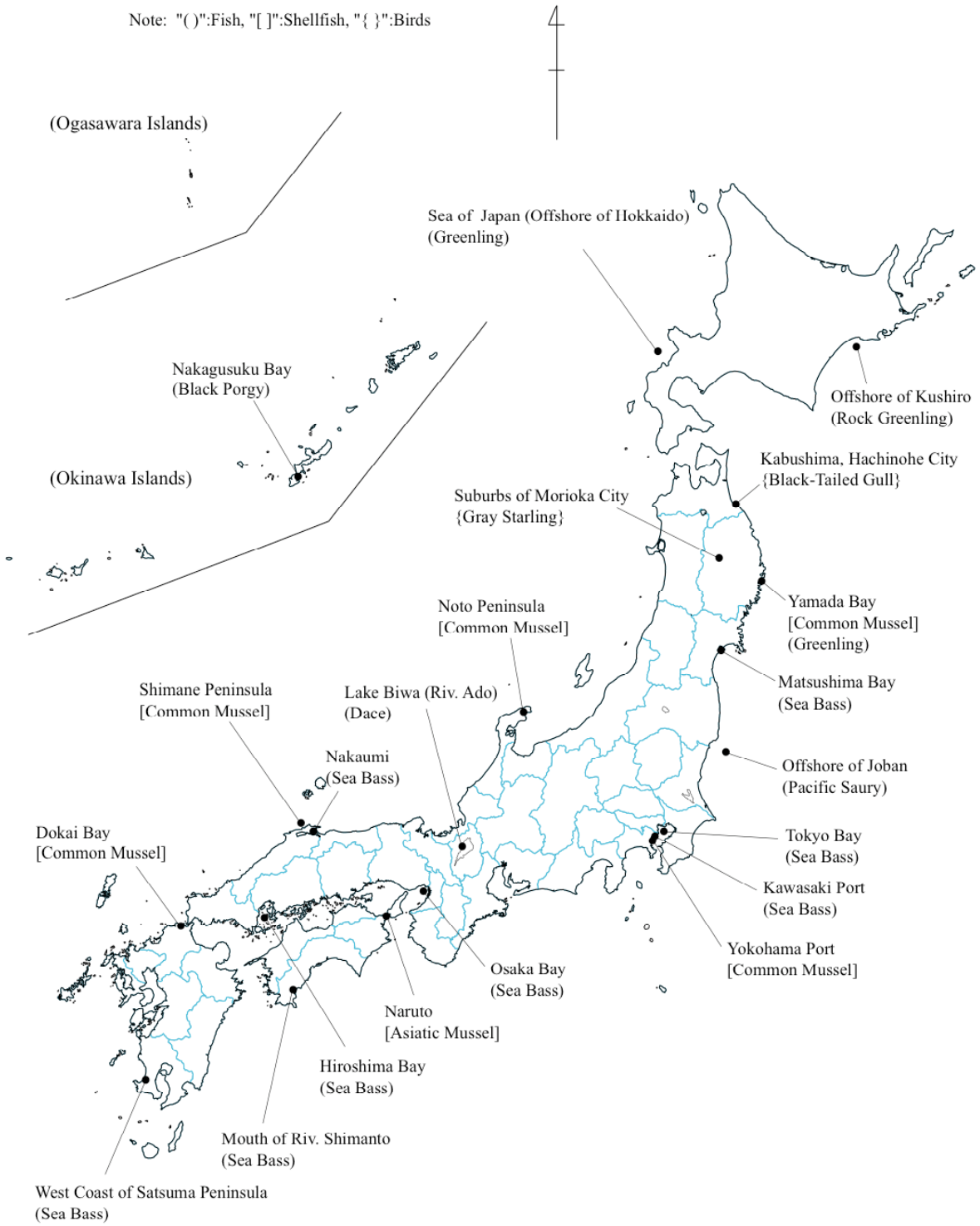


Figure 4-D Locations of the Monitoring Investigation for Air (FY2003)

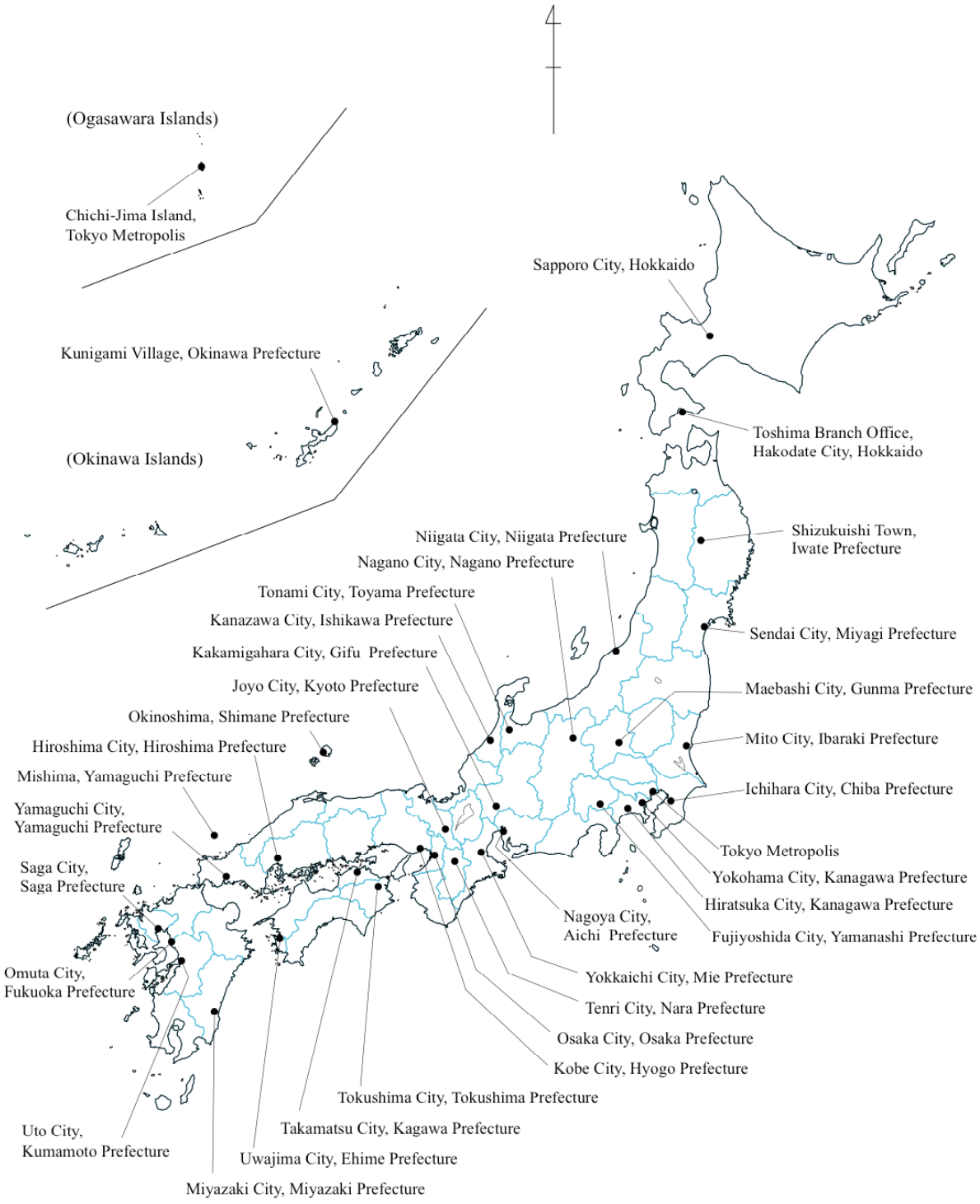


Table 4-2 Characteristics of Species Subject to Wildlife Monitoring

Species		*Characteristics of species*	*Sampling areas*	*Object of investigation*	*Notes*
Fish	Greenling *(Hexagrammos otakii)*	1. Distributed from Hokkaido to southern Japan, the Korean Peninsula, and China 2. Lives in shallow seas of 5-50 m	Sea of Japan (offshore of Hokkaido), Yamada Bay in Iwate Prefecture	To grasp the pollution level in specific areas	
	Rock Greenling *(Hexagrammos lagocephalus)*	1. Lives in cold-current areas east of Hidaka (Hokkaido) 2. Larger than greenling and lives in deeper seas; eats fish (smaller than their mouth size) at the sea bottom	Offshore of Kushiro in Hokkaido	To grasp the pollution level in specific areas	
	Pacific Saury *(Cololabis saira)*	1. Distributed widely in the northern Pacific Ocean 2. Goes around the Japanese Archipelagos; in the Kurils in autumn, and offshore Kyushu in winter 3. The bioaccumulation of chemical substances is said to be medium	Pacific Ocean (offshore of Jyoban)	To grasp the pollution level around the Japanese Archipelagos	
	Sea Bass *(Lateolabrax japonicus)*	1. Distributed around the shores of various areas in Japan, the Korean Peninsula, and China 2. In its growing process, sometimes comes to fresh water or mixed sea and fresh water 3. The bioaccumulation of chemical substances is said to be high	Matsushima Bay in Miyagi Prefecture, Tokyo Bay in Tokyo Metropolis, Kawasaki Port in Kanagawa Prefecture, Osaka Bay in Osaka Prefecture, Nakaumi in Tottori Prefecture, Hiroshima Bay of Seto Inland Sea in Hiroshima Prefecture, Shimanto River in Kochi Prefecture, West Coast of Satsuma Peninsula in Kagoshima Preffecture	To grasp the pollution level in specific areas	8 areas with different levels of pollution were investigated
	Black Porgy *(Acanthopagrus sivicolus)*	1. Distributed in the Nansei Islands 2. Lives in coral reef seas and in bays into which rivers flow	Nakagusuku Bay in Okinawa Prefecture	To grasp the pollution level in specific areas	
	Dace *(Tribolodon hakonensis)*	1. Distributed widely in the fresh water throughout Japan 2. Predator of mostly insects	Lake Biwa in Shiga Prefecture	To grasp the pollution level in specific areas	

Table 4-2 Characteristics of Species Subject to Wildlife Monitoring (Continued)

Species		*Characteristics of species*	*Sampling areas*	*Object of investigation*	*Notes*
Shell-fish	Common Mussel *(Mytilus edulis galloprovincialis)*	1. Distributed worldwide, excluding tropical zones 2. Sticks to the rocks of inner bays and bridge piers	Yamada Bay in Iwate Prefecture, Miura Peninsula in Kanagawa Prefecture, Yokohama Port in Kanagawa Prefecture, Noto Peninsula in Ishikawa Prefecture, Coast of Shimane Peninsula in Shimane Prefecture, Dokai Bay in Fukuoka Prefecture	To grasp the pollution level in specific areas	6 areas with different levels of pollution were investigated
	Asiatic Mussel *(Mytilus coruscus)*	1. Distributed in various areas south of southern Hokkaido 2. Sticks to rocks where the current is fast (1-10 m/s)	Naruto in Tokushima Prefecture	To grasp the pollution level in specific area	
Birds	Gray Starling *(Sturnus cineraceus)*	1. Distributed widely in the Far East (The affinity distributed world wide.) 2. Staple food is insects	Suburbs of Morioka City in Iwate Prefecture	To grasp the pollution level in northern Japan	
	Black-tailed Gull *(Larus crassirostris)*	1. Breeds mainly in the sea off Japan 2. Breeds in groups at shore reefs and fields of grass, etc. or coastal islands	Kabushima in Aomori Prefecture	To grasp the pollution level in specific areas	

Table 4-3 Summary of Results of the FY2003 Monitoring Investigation

Survey No.	Substance	Surface water 36 areas, 36 samples		Bottom sediment 62 areas, 186 samples		Wildlife						Air			
						Shellfish 6 areas, 30 samples		Fish 14 areas, 70 samples		Birds 2 areas, 10 samples		1st: warm season 35 areas, 35 samples		2nd: cold season 34 areas, 34 samples	
		Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean
		pg/L	pg/L	pg/g-dry	pg/g-dry	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/m^3	pg/m^3	pg/m^3	pg/m^3
1	PCBs	230 - 3,100	530	39 - 5,600,000	8,200	1,000 - 130,000	11,000	870 - 150,000	11,000	6,800 - 42,000	18,000	36 - 2,600	260	17 - 630	110
2	HCB	11 - 340	29	5 - 42,000	140	tr (21) - 660	44	28 - 1,500	170	790 - 4,700	1,700	81 - 430	150	64 - 320	94
3	Drins														
3.1	Aldrin	ND - 3.8	0.9	ND - 1,000	17	ND - 51	tr (1.6)	ND - tr (1.9)	ND	ND	ND	ND - 28	1.5	0.030 - 6.9	0.55
3.2	Dieldrin	9.7 - 510	57	ND - 9,100	59	46 - 78,000	410	29 - 1,000	210	790 - 2,200	1300	2.1 - 260	19	tr (0.82) - 110	5.7
3.3	ENDrin	0.7 - 78	5.7	ND - 29,000	11	6.3 - 5,000	36	ND - 180	14	5.4 - 96	21	0.081 - 6.2	0.74	0.042 - 2.1	0.23
4	DDTs														
4.1	*p,p'*-DDT	tr (2.8) - 740	14	3 - 55,000	240	49 - 1,800	290	tr (3.7) - 1,900	210	180 - 1,400	540	0.75 - 24	5.8	0.31 - 11	1.7
4.2	*p,p'*-DDE	5 - 380	26	9.5 - 80,000	710	190 - 6,500	1,100	180 - 12,000	2,000	18,000 - 240,000	63,000	1.2 - 51	7.2	1.1 - 22	2.8
4.3	*p,p'*-DDD	4 - 410	19	3.7 - 32,000	590	tr (7.5) - 2,600	380	43 - 3,700	500	110 - 3,900	590	0.063 - 1.4	0.30	tr (0.037) - 0.52	0.13
4.4	*o,p'*-DDT	tr (1.5) - 100	5.6	ND - 3,200	43	35 - 480	130	2.9 - 520	80	8.3 - 66	18	0.61 - 38	6.9	0.43 - 6.4	1.6
4.5	*o,p'*-DDE	tr (0.42) - 170	2.2	tr (0.5) - 24,000	43	17 - 460	84	ND - 2,500	48	ND - 4.2	tr (2.0)	0.17 - 7.5	1.4	0.18 - 1.7	0.50
4.6	*o,p'*-DDD	1.1 - 160	7.1	tr (1.0) - 8,800	140	6.5 - 1,900	200	ND - 920	73	tr (5.0) - 36	14	0.059 - 1.3	0.37	0.062 - 0.42	0.15

Note: Geometric mean was calculated, assuming ND as one half of the detection limit.

Table 4-3 Summary of Results of the FY2003 Monitoring Investigation (continued)

Survey No.	Substance	Surface water 36 areas, 36 samples		Bottom sediment 62 areas, 186 samples		Wildlife						Air			
						Shellfish 6 areas, 30 samples		Fish 14 areas, 70 samples		Birds 2 areas, 10 samples		1st: warm season 35 areas, 35 samples		2nd: cold season 34 areas, 34 samples	
		Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean
		pg/L	pg/L	pg/g-dry	pg/g-dry	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/m^3	pg/m^3	pg/m^3	pg/m^3
5	Chlordanes														
5.1	*trans*-Chlordane	6 - 410	34	tr (2.4) - 13,000	120	69 - 2,800	550	9.6 - 1,800	150	tr (5.9) - 27	11	6.5 - 2,000	130	2.5 - 290	37
5.2	*cis*-Chlordane	12 - 920	69	tr (3.6) - 19,000	170	110 - 14,000	1,100	43 - 4,400	490	6.8 - 370	47	6.4 - 1,600	110	2.5 - 220	30
5.3	*trans*-Nonachlor	4 - 450	26	2 - 11,000	100	140 - 3,800	780	85 - 5,800	880	350 - 3,700	1,100	5.1 - 1,200	87	2.1 - 180	24
5.4	*cis*-Nonachlor	1.3 - 130	8.0	ND - 6,500	59	48 - 1,800	290	19 - 2,600	350	68 - 660	200	0.81 - 220	12	0.18 - 23	2.7
5.5	Oxychlordane	tr (0.6) - 39	3.0	ND - 85	2.1	11 - 1,900	90	30 - 820	140	610 - 1,300	750	0.41 - 12	2.5	0.41 - 3.2	0.87
6	Heptachlors														
6.1	Heptachlor	tr (1.0) - 7	tr (1.8)	ND - 160	2.4	ND - 14	tr (2.8)	ND - 11	ND	ND	ND	1.1 - 240	27	0.39 - 65	10
6.2	*trans*-Heptachlor epoxide	ND - 2	ND	ND	ND	ND - 48	ND	ND	ND	ND	ND	ND - 0.30	tr (0.036)	ND - tr (0.094)	ND
6.3	*cis*-Heptachlor epoxide	1.2 - 170	9.8	ND - 160	3.7	9.7 - 880	42	7 - 320	42	370 - 770	520	0.45 - 28	3.5	0.49 - 6.6	1.3
7	Toxaphene														
7-1	Parlar-26	ND	ND	ND	ND	ND - tr (39)	ND	ND - 810	tr (29)	ND - 2,500	110	tr (0.17) - 0.77	tr (0.091) - 0.27	tr (0.17)	tr (0.091) - 0.27
7-2	Parlar-50	ND	ND	ND	ND	ND - 58	tr (13)	ND - 1,100	34	ND - 3,000	110	ND - tr (0.37)	ND	ND	ND
7-3	Parlar-62	ND	ND	ND	ND	ND	ND	ND - 580	ND	ND - 530	tr (96)	ND	ND	ND	ND
8	Mirex	ND - 0.8	tr (0.13)	ND - 1,500	1.8	tr (1.6) - 19	4.8	tr (1.7) - 25	7.9	31 - 450	110	0.047 - 0.19	0.024 - 0.099	0.044	0.024 - 0.099

Note: Geometric mean was calculated, assuming ND as one half of the detection limit.

Table 4-3 Summary of Results of the FY2003 Monitoring Investigation (continued)

Survey No.	Substance	Surface water 36 areas, 36 samples		Bottom sediment 62 areas, 186 samples		Wildlife						Air			
						Shellfish 6 areas, 30 samples		Fish 14 areas, 70 samples		Birds 2 areas, 10 samples		1st: warm season 35 areas, 35 samples		2nd: cold season 34 areas, 34 samples	
		Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean	Range	Geometric mean
		pg/L	pg/L	pg/g-dry	pg/g-dry	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/g-wet	pg/m^3	pg/m^3	pg/m^3	pg/m^3
9	HCHs														
9.1	α-HCH	13 - 970	120	2 - 9,500	140	9.9 - 610	45	2.6 - 590	41	30 - 230	70	38 - 5,000	9.9 - 1,400	49	9.9 - 1,400
9.2	β-HCH	14 - 1,700	250	5 - 39,000	220	23 - 1,100	77	tr (3.5) - 1,100	78	1,800 - 5,900	3,400	1.1 - 97	0.52 - 57	2.1	0.52 - 57
9.3	γ-HCH	32 - 370	92	tr (1.4) - 4,000	45	5.2 - 130	19	tr (1.7) - 130	16	3.7 - 40	14	8.8 - 2,200	3.1 - 330	14	3.1 - 330
9.4	δ-HCH	tr (1.1) - 200	14	ND - 5,400	37	ND - 1,300	7.2	ND - 16	tr (3.5)	12 - 31	18	0.48 - 120	0.11 - 47	0.97	0.11 - 47
10	Organotin compounds			ng/g-dry	ng/g-dry	ng/g-wet	ng/g-wet	ng/g-wet	ng/g-wet	ng/g-wet	ng/g-wet				
10.1	TBT			ND - 450	3.0	tr (2) - 25	10	ND - 72	7	ND - tr (1)	ND				
10.2	DBT			ND - 640	5.5	tr (2) - 53	14	ND - 7	tr (1)	ND - tr (3)	ND				
10.3	TPT			ND - 540	tr (0.27)	ND - 27	2.8	ND - 30	5.3	ND	ND				
10.4	DPT			ND - 120	tr (0.14)	ND - 1.6	ND	ND - tr (1.3)	ND	ND	ND				
10.5	MPT			ND - 1,000	tr (1.9)	ND	ND	ND	ND	ND	ND				
11	Tetrabromobis-phenol A			ND	ND	ND - 0.16	ND	ND - 0.15	ND	ND	ND				

Note 1: Hatched area are not targeted in the FY2003 survey.
Note 2: Geometric mean was calculated, assuming ND as one half of the detection limit.

Table 4-4 Quantitation [Detection] Limit in the FY2003 Monitoring Investigation

Survey No.	Substance	Surface water	Bottom sediment	Wildlife			Air
				Fish	Shellfish	Birds	
		pg/L	pg/g-dry	pg/g-wet			pg/m^3
1	PCBs	0.3 - 6 [0.07 - 2]	0.4 - 6 [0.2 - 2]	2.1 - 11 [0.69 - 3.7]			0.013 - 3.2 [0.0043 - 1.1]
2	HCB	5 [2]	4 [2]	23 [7.5]			2.3 [0.78]
3	Drins						
3.1	Aldrin	0.6 [0.2]	2 [0.6]	2.5 [0.84]			0.023 [0.0077]
3.2	Dieldrin	0.7 [0.3]	4 [2]	4.8 [1.6]			2.1 [0.70]
3.3	Endrin	0.7 [0.3]	5 [2]	4.8 [1.6]			0.042 [0.014]
4	DDTs						
4.1	*p,p'*-DDT	3 [0.9]	2 [0.4]	11 [3.5]			0.14 [0.046]
4.2	*p,p'*-DDE	4 [2]	0.9 [0.3]	5.7 [1.9]			0.40 [0.13]
4.3	*p,p'*-DDD	2 [0.5]	0.9 [0.3]	9.9 [3.3]			0.054 [0.018]
4.4	*o,p'*-DDT	3 [0.7]	0.8 [0.3]	2.9 [0.97]			0.12 [0.040]
4.5	*o,p'*-DDE	0.8 [0.3]	0.6 [0.2]	3.6 [1.2]			0.020 [0.0068]
4.6	*o,p'*-DDD	0.8 [0.3]	2 [0.5]	6.0 [2.0]			0.042 [0.014]
5	Chlordanes						
5.1	*trans*-Chlordane	5 [2]	4 [2]	7.2 [2.4]			0.86 [0.29]
5.2	*cis*-Chlordane	3 [0.9]	4 [2]	3.9 [1.3]			0.51 [0.17]
5.3	*trans*-Nonachlor	2 [0.5]	2 [0.6]	3.6 [1.2]			0.35 [0.12]
5.4	*cis*-Nonachlor	0.3 [0.1]	3 [0.9]	4.8 [1.6]			0.026 [0.0088]
5.5	Oxychlordane	2 [0.5]	1 [0.4]	8.4 [2.8]			0.045 [0.015]
6	Heptachlors						
6.1	Heptachlor	2 [0.5]	3 [1]	6.6 [2.2]			0.25 [0.085]
6.2	*trans*-Heptachlor epoxide	2 [0.4]	9 [3]	13 [4.4]			0.099 [0.033]
6.3	*cis*-Heptachlor epoxide	0.7 [0.2]	3 [1]	6.9 [2.3]			0.015 [0.0048]
7	Toxaphene						
7.1	Parlar-26	40 [20]	90 [30]	45 [15]			0.20 [0.066]
7.2	Parlar-50	70 [30]	200 [50]	33 [11]			0.81 [0.27]
7.3	Parlar-62	300 [90]	4000 [2000]	120 [40]			1.6 [0.52]
8	Mirex	0.3 [0.09]	2 [0.4]	2.4 [0.81]			0.0084 [0.0028]

Note 1: Detection limits are given in brackets [].
Note 2: Quantitation Limit is defined as tree times the detection limit.
Note 3: Values of quantitation/detection limit of PCBs are shown as a range of homologs and coplanar PCBs.

Table 4-4 Quantitation [Detection] Limit in the FY2003 Monitoring Investigation (continued)

Survey No.	Substance	Surface water	Bottom sediment	Wildlife			Air
				Fish	Shellfish	Birds	
9	HCHs	pg/L	pg/g-dry	pg/g-wet			pg/m^3
9.1	α-HCH	3 [0.9]	2 [0.5]	1.8 [0.61]			0.71 [0.24]
9.2	β-HCH	3 [0.7]	2 [0.7]	9.9 [3.3]			0.19 [0.063]
9.3	γ-HCH	7 [2]	2 [0.4]	3.3 [1.1]			0.57 [0.19]
9.4	δ-HCH	2 [0.5]	2 [0.7]	3.9 [1.3]			0.03 [0.01]
10	Organotin compounds		ng/g-dry	ng/g-wet			
10.1	TBT		1.2 [0.4]	3 [1]			
10.2	DBT		1.2 [0.4]	3 [1]			
10.3	TPT		0.28 [0.09]	1.5 [0.5]			
10.4	DPT		0.16 [0.06]	1.5 [0.5]			
10.5	MPT		2.4 [0.8]	15 [5]			
11	Tetrabromobisphenol A		18 [5.5]	0.090 [0.030]			

Note 1: Detection limits are given in brackets [].
Note 2: Quantitation Limit is defined as tree times the detection limit.
Note 3: Values of quantitation/detection limit of PCBs are shown as a range of homologs and coplanar PCBs.
Note 4: Hatched areas are not targeted in the FY2003 survey.

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Appendix A

Outline of the Chemical Substances Control Law

Appendix A Outline of the Chemical Substances Control Law

The Chemical Substances Control Law was enacted in October 1973 as a result of the environmental pollution caused by PCB, and was enforced in April 1974. Under this Law, new chemical substances are examined before manufacture or import to determine whether or not they change chemically in nature (low biodegradability), are easily accumulated in biological organisms (high bioaccumulation) or are suspected of having toxicity to human health when consumed for a long period of time (chronic toxicity). (That is, the system of examination of new chemical substances before manufacture or import). Substances with the above properties were designated as Class 1 Specified Chemical Substances, and their manufacture, import and use, etc. were restricted. There have been 7,894 notifications for new chemical substances (as of the end of December 2002).

On the other hand, existing chemical substances have been examined for safety in principle by the government, based on the resolution of the National Diet at the time of the enactment of the Chemical Substances Control Law in 1973, and if necessary, were designated as Class 1 Specified Chemical Substances, etc. Existing chemical substances were investigated by the Ministry of Economy, Trade and Industry for biodegradability by microorganisms and bioaccumulation in fish and shellfish, by the Ministry of Health, Labour and Welfare for toxicity and the status of their persistence in the general environment, and by the MOE for effects to the ecosystem. 13 substances, PCB, HCB, PCN, aldrin, dieldrin, endrin, DDT, chlordanes, bis(tributyltin) oxide, (*N,N'*-ditolyl, *N*-tolyl-*N'*-xylyl, *N,N'*-dixylyl)-*p*-phenylene diamine, 2,4,6-tri-*tert*-butylphenol, toxaphene and mirex, have been designated as Class 1 Specified Chemical Substances (as of the end of January 2004).

The Law was amended in May 1986 as a result of groundwater pollution by TCE, etc. and was enforced in April 1987. Since this amendment, substances with low bioaccumulation, but low biodegradability and suspicion of chronic toxicity, are designated as Designated Chemical Substances, and their production or importation volume are reported. If toxicity to human health is expected by environmental pollution caused by these Designated Chemical Substances, a governmental order of conduct and a report of toxicity test takes place for manufacturers, etc., and if toxicity is observed, these substances are to be designated as Class 2 Specified Chemical Substances and the production or importation volume etc. is regulated. So far, 739 substances including chloroform and 1,2-DCE have been designated as Designated Chemical Substances (as of the end of January 2004). Concerning Class 2 Specified Chemical Substances, 3 substances from Designated Chemical Substances, i.e. carbon tetrachloride, PERC and TCE, were designated as Class 2 Specified Substances in April 1989, which is the first time for such an occurrence. So far, 23 substances have been designated in this manner (as of the end of January 2004).

The system of the Chemical Substances Control Law is displayed in Fig. 1, and within this framework MOE has the following responsibilities and authorities:

[1] To provide testing items and other technical items for the examination of new chemical substances by the Ministerial Ordinances of the Prime Minister's Office, the Ministry of Health, Labour and Welfare and the Ministry of Economy, Trade and Industry (Article 4, Clause 5).

[2] To request necessary explanations and express opinions to the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through the examination and judgment of new chemical substances (Article 4, Clause 7).

[3] To request that the competent minister take measures (Article 34, Clause 1) following the designation of a Class 1 Specified Chemical Substance (Article 22).

[4] To request that the Ministers of Health, Labour and Welfare and Economy, Trade and Industry (Article 34, No. 2) order toxicity tests concerning Designated Chemical Substances (Article 24, Clause 1).

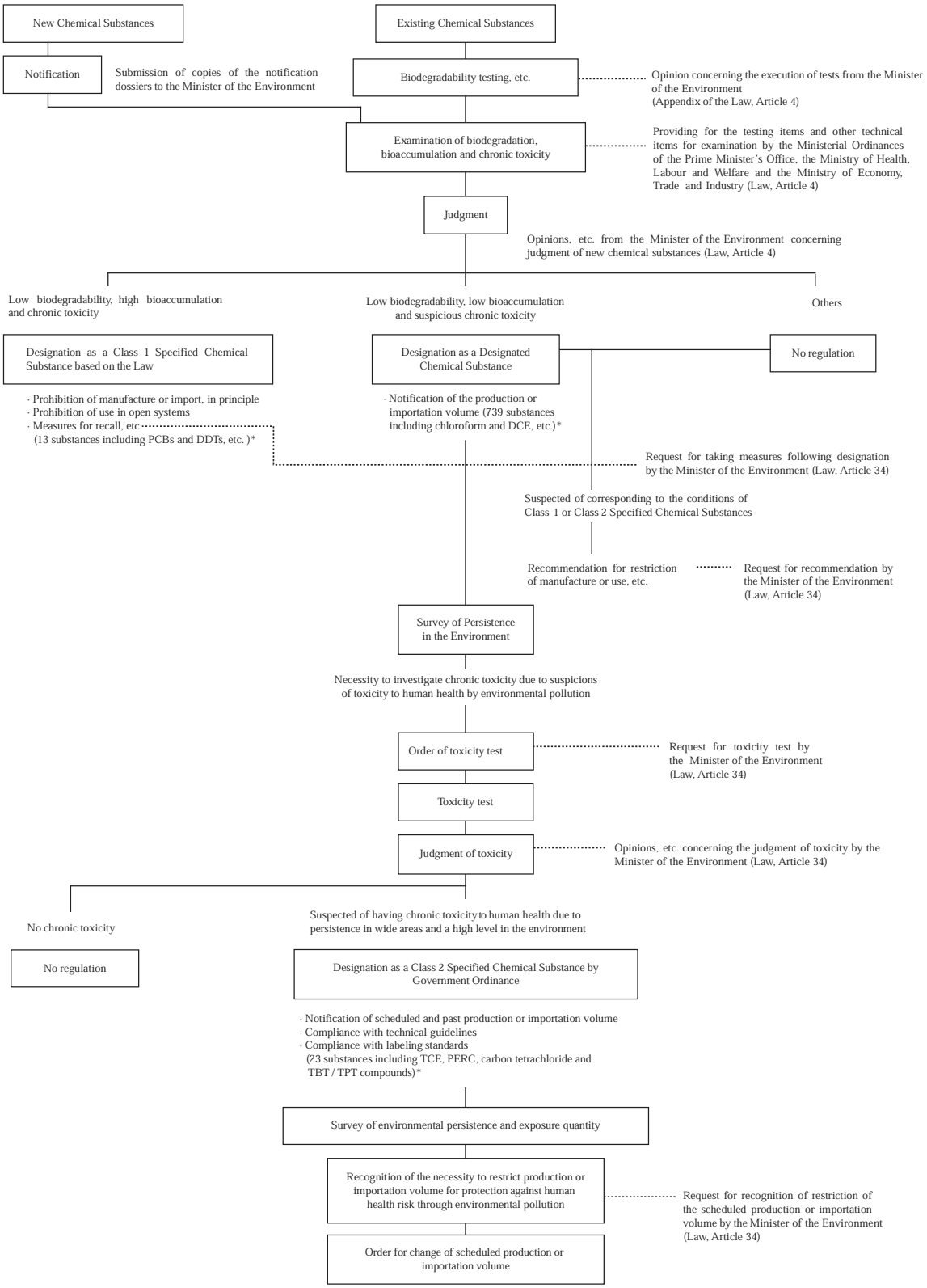
[5] To request that the Ministers of Health, Labour and Welfare and Economy, Trade and Industry (Article 34, No. 3) recognize the necessity to restrict the manufacture, etc. of Class 2 Specified Chemical Substances (Article 26, No. 4).

[6] To request that the competent minister (Article 34, No. 4) make the necessary recommendations concerning the restriction of the manufacture, import and use, etc. of chemical substances (Article 29) for which there is sufficient reason to suspect as Class 1 Specified Substances concerning substances other than Class 1 Specified Chemical Substances, and as Class 2 Specified Chemical Substances concerning those other than Class 2 Specified Chemical Substances.

[7] To express opinions as to whether existing chemical substances correspond to Designated Chemical Substances, etc. when the Ministers of Health, Labour and Welfare and Economy Trade and Industry conduct toxicity tests (Supplementary Regulations, Article 4).

This law was amended (effective in April 2004) in order to introduce evaluation and regulation that could take into account the adverse effects on living organisms in the environment, and to improve the effectiveness and efficiency of the system from the standpoint of risk management.

Figure System of the Law Concerning the Examination and Manufacture, etc. of Chemical Substances



* The numbers of chemical substances are as of January 2004.

Appendix B

Surveyed Chemical Substances and Detected Levels in the Environment (A Cumulative List for Fiscal Years 1974–2003) [Extraction]

The first 2 pages of the 46-page list are included in this document.

The entire list is provided on CD-ROM.

Surveyed Chemical Substances and their Detected Levels in the Environment (A Cumulative List for Fiscal Year 1974 - 2003)

A/B: Number of detections / Number of samples; C/D: Number of detected stations / Number of sampling stations;
Unit: Surface water ug/L; Bottom sediment ug/g-dry; Fish ug/g-wet; Air ppb or ng/m3 at 20degreeC latm

#	Substance	CAS RN	FY	Number of detection and range of detection																#
				Surface water(ug/L)				Bottom sediment(ug/g-dry)				Fish(ug/g-wet)				Others A:Air; R:Rain Water; P:Plankton				
				A/B	C/D	Range of detection	Limit of detection	A/B	C/D	Range of detection	Limit of detection	A/B	C/D	Range of detection	Limit of detection	A/B	C/D	Range of detection	Limit of detection	
1	acrylamide	79-06-1	1975	0/95		---	(1)													1
			1991	11/153		0.05 - 0.1	(0.05)	20/150		0.00052 - 0.003	(0.0005)	0/147		---	(0.0013)					
			1998	0/33	0/11	---	(0.15)	0/30	0/10	---	(0.009)									
2	ethyl acrylate	140-88-5	1980	0/51		---	(0.3 - 50)	0/51		---	(0.0041 - 0.12)									2
			2001													A 3/18	1/6	0.6 - 1.8ng/m^3	(0.5ng/m^3)	
3	2-ethylhexylacrylate	103-11-7	1980	0/51		---	(1.1 - 12)	0/24		---	(0.04 - 0.13)									3
4	butyl acrylate	141-32-2	1980	0/51		---	(0.7 - 30)	0/51		---	(0.0080 - 0.07)									4
5	methyl acrylate	96-33-3	1980	0/51		---	(0.6 - 50)	0/51		---	(0.0083 - 0.12)									5
			2001													A 0/18	0/6	--- ng/m^3	(0.6ng/m^3)	
6	acrylonitrile	107-13-1	1977	0/ 9		---	(20 - 50)	0/ 9		---	(0.4 - 0.5)									6
			1987	0/75		---	(2)	4/66		0.014 - 0.114	(0.007)					A 16/65		42 - 2,400ng/m^3	(40)	
			1991													A 15/40		46 - 390ng/m^3	(40)	
			1992	0/162		---	(2.2)	8/151		0.007 - 0.016	(0.007)	0/144		---	(0.01)					
7	acrolein	107-02-8	1978	0/21		---	(7 - 10)	0/15		---	(0.02 - 0.1)									7
			1987	0/75		---	(1.9)									A 0/61		--- ng/m^3	(800)	
8	adipic acid	124-04-9	1985	0/27		---	(2)	6/27		0.07 - 0.41	(0.03)									8
9	diisodecyl adipate	6938-94-9	1978	0/30		---	(0.8 - 100)	0/30		---	(0.04 - 5)									9
10	octyl adipate	103-23-1	1978	0/30		---	(0.4 - 25)	0/30		---	(0.02 - 1)									10
			1984													A 47/72		0.23 - 16.7ng/m^3	(0.1 - 0.61)	
			1995	0/33		---	(0.7)	11/29		0.016 - 0.1	(0.012)					A 31/41		1.0 - 22ng/m^3	(1)	
			1998													A 26/33	11/12	1 - 26ng/m^3	(1)	
11	dibutyl adipate	105-99-7	1999	0/36	0/12	---	(0.054)	2/36	1/12	0.022-0.023	(0.021)									11
12	dibuthyldiglycol adipate	141-17-3	1978	0/30		---	(0.8 - 50)	0/30		---	(0.04 - 2)									12
13	adiponitrile	111-69-3	1978	0/21		---	(10)	0/21		---	(0.1 - 0.3)									13
14	azinphosmethyl	86-50-0	1993													A 0/24		--- ng/m^3	(21)	14
15	acetaldehyde	75-07-0	1977	0/ 6		---	(10)	3/ 6		2 - 4	(2.5)									15
			1987	0/75		---	(1)									A 43/57		930 - 22,000ng/m^3	(800)	
			1995	0/33		---	(1)									A 46/47		1,80 - 45,000ng/m^3	(500)	
16	acetonitrile	75-05-8	1977	0/9		---	(120 - 200)	0/ 9		---	(2 - 24)									16
			1987	0/72		---	(3)	11/60		0.021 - 0.54	(0.021)					A 44/70		210 - 42,000ng/m^3	(200)	
			1991													A 33/51		200 - 3,700ng/m^3	(200)	
			1992	15/147		1.1 - 7.4	(1)	25/155		0.03 - 1.9	(0.03)									
			2001													A 17/17	7/7	93 - 1,200ng/m^3	(76ng/m^3)	
17	acetone	67-64-1	1995													A 49/49		150 - 31,000ng/m^3	(2)	17

Surveyed Chemical Substances and their Detected Levels in the Environment (A Cumulative List for Fiscal Year 1974 - 2003)

A/B: Number of detections / Number of samples; C/D: Number of detected stations / Number of sampling stations;
Unit: Surface water ug/L; Bottom sediment ug/g-dry; Fish ug/g-wet; Air ppb or ng/m3 at 20degreeC latm

#	Substance	CAS RN	FY	Number of detection and range of detection																#
				Surface water(ug/L)				Bottom sediment(ug/g-dry)				Fish(ug/g-wet)				Others A:Air; R:Rain Water; P:Plankton				
				A/B	C/D	Range of detection	Limit of detection	A/B	C/D	Range of detection	Limit of detection	A/B	C/D	Range of detection	Limit of detection	A/B	C/D	Range of detection	Limit of detection	
18	acenaphthylene	208-96-8	1983	0/33		---	(0.06 - 0.4)	13/33		0.008 - 0.053	(0.008 - 0.041)									18
			1984	4/138		0.08 - 1.3	(0.002 - 1)	63/138		0.0007 - 0.671	(0.00006 - 0.088)	14/138		0.0008 - 0.024	(0.0002 - 0.05)					
19	acenaphthene	83-32-9	1983	0/33		---	(0.09 - 0.4)	13/33		0.008 - 0.13	(0.008 - 0.041)									19
			1984	3/138		0.05 - 0.1	(0.001 - 1)	58/138		0.00004 - 0.084	(0.00004 - 0.088)	15/138		0.001 - 0.50	(0.0001 - 0.05)					
			1999	1/39	1/13	0.012	(0.011)	35/39	12/13	0.00062 - 0.24	(0.00045)	11/39	6/13	0.00081 - 0.0047	(0.00077)					
20	acephate	30560-19-1	1993	0/30		---	(0.2)	0/30		---	(0.02)	0/30		---	(0.01)					20
21	azobisisobutyronitrile	78-67-1	1979	0/15		---	(10)	0/15		---	(0.1)									21
22	o-anisidine	90-04-0	1976	6/68		0.2 - 1.3	(0.2 - 0.8)	27/68		0.003 - 0.079	(0.003 - 0.004)									22
			1990	2/48		0.02 - 0.027	(0.02)	3/41		0.0067 - 0.0073	(0.005)	0/54		---	(0.002)	A 0/51		--- ng/m^3	(500)	
23	m-anisidine	536-90-3	1976	3/68		0.016 - 0.028	(0.01 - 0.2)	6/68		0.0004 - 0.018	(0.0002 - 0.0016)									23
			1990	5/48		0.02 - 0.058	(0.02)	0/57		---	(0.02)	1/54		0.0046	(0.002)	A 0/51		--- ng/m^3	(500)	
24	p-anisidine	104-94-9	1976	4/68		0.06 - 0.72	(0.06 - 0.2)	12/68		0.001 - 0.006	(0.0007 - 0.004)									24
			1990	0/57		---	(0.4)	0/54		---	(0.017)	0/54		---	(0.02)	A 0/51		--- ng/m^3	(1,500)	
25	aniline	62-53-3	1976	40/68		0.02 - 28	(0.04 - 0.2)	48/68		0.0007 - 0.50	(0.0008)									25
			1990	33/104		0.02 - 0.33	(0.02)	81/116		0.003 - 0.24	(0.002)	27/89		0.001 - 0.0077	(0.001)	A 1/48		480ng/m^3	(150)	
			1997													A 1/42		18ng/m^3	(15)	
			1998	1/141	1/47	0.074	(0.06)	95/120	36/43	0.0021 - 0.21	(0.002)									
26	1-aminoanthraquinone	82-45-1	1985	0/27		---	(0.2)	1/21		0.022	(0.02)									26
27	2-aminoanthraquinone	117-79-3	1985	0/27		---	(0.6)	0/18		---	(0.04)									27
28	2-amino-5-chloro-4-methylbenzenesulfonic acid	88-53-9	1980	0/24		---	(10 - 200)	0/24		---	(0.5 - 11)									28
29	3-amino-1,2,4-triazole	61-82-5	1984	0/24		---	(4)	0/24		---	(0.005 - 0.02)									29
30	1-aminonaphthalene-4-sulfonic acid	84-86-6	1985	0/33		---	(0.5)	0/33		---	(0.007)									30
31	2-aminonaphthalene-1-sulfonic acid	81-16-3	1985	0/30		---	(0.5)	0/30		---	(0.007)									31
32	2-aminonaphthalene-5-sulfonic acid	81-05-0	1985	0/33		---	(0.5)	0/33		---	(0.007)									32
33	2-aminonaphthalene-6-sulfonic acid	93-00-5	1985	0/33		---	(0.5)	0/33		---	(0.007)									33
34	2-aminonaphthalene-7-sulfonic acid	494-44-0	1985	0/33		---	(0.5)	0/33		---	(0.007)									34
35	2-aminonaphthalene-8-sulfonic acid	86-06-2	1985	0/33		---	(0.5)	0/33		---	(0.007)									35
36	1-amino-8-naphthol-3,6-disulfonic acid	90-20-0	1980	0/24		---	(4)	0/24		---	(0.04 - 0.1)									36
37	2-amino-5-naphthol-7-sulfonic acid	87-02-5	1980	0/24		---	(4)	0/24		---	(0.04 - 0.1)									37
38	2-aminobiphenyl	90-41-5	1977	0/ 6		---	(0.05)	0/ 3		---	(0.02)									38
39	2-aminopyridine	504-29-0	1983	0/30		---	(0.1 - 0.4)	0/30		---	(0.002 - 0.05)									39
40	3-aminopyridine	462-08-8	1983	0/30		---	(0.1 - 2)	0/30		---	(0.002 - 0.098)									40
41	4-aminopyridine	504-24-5	1983	0/30		---	(0.1 - 3)	0/30		---	(0.005 - 0.12)									41
42	o-aminophenol	95-55-6	1986	0/27		---	(0.1)	0/27		---	(0.02)									42
43	m-aminophenol	591-27-5	1986	1/27		1.1	(0.7)	0/27		---	(0.03)									43

Appendix C

Suggested Sampling Method for Environmental Surveys Concerning Chemical Substances

Appendix C Suggested Sampling Method for Environmental Surveys Concerning Chemical Substances

1. Sampling method

(1) Water

[1] Sampling time

Water sampling was conducted at a time when the days preceding the day of sampling had been relatively sunny and the water quality was stable.

[2] Sampling depth

The location for sampling was, in principle, the surface water (0–50 cm from the surface) in the centerline of the system of the surveyed point. However, water 1–2 cm in depth was avoided for sampling so that floating garbage and oils were not mixed into the samples.

[3] Preparation for analysis

Supernatant-removing garbage, etc. was used. In doing so, care was taken not to include the surface water. No filtration or centrifugal separation, etc. was conducted.

(2) Bottom sediments

[1] Bottom sampling method

With consideration to the properties, the bottom sediments collected with the Ekman-Birge bottom sampler or other proportionate bottom samplers were placed in a clean tray and after removing extraneous substances such as pebbles, shells and bits of animals and plants, and then sieving with a 16-mesh sieve (hole diameter of 1 mm), they were provided for analysis. The sludge content (weight of sample through the sieve / weight of original sample) (%) was measured. Dry weight (105–110°C for about 2 hours) and ignition loss (600 ± 25°C for about 2 hours) was measured for part of the samples.

[2] Other points

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

(3) Wildlife

[1] Samples

Samples were those fish reproduced at the place of survey. In the sea areas, sea bass or young sea bass (if not available, goby, striped mullet or flatfish were accepted), and in the lakes, marshes and rivers, dace were used (if not available, then carp or crucian carp was accepted) as standard samples. It was preferable to use a single body for the samples, but the use of several bodies was also allowed. However, a small-bodied sample was used after sufficient cleansing.

[2] Preparation for analysis

(a) Fish

Edible parts (muscles) were used in fish samples. The part to be collected for samples did not matter, but more than approximately 100 g was carved and homogenized for samples. For cases in which the body weight of the fish was under 100 g, the edible parts of several fish were carved and homogenized. In the case of small fish, 100 g was collected by carving the muscles from several bodies, and then homogenized.

(b) Shellfish (for cases in which fish were not available)

For shellfish, the edible parts of the required quantity were collected and homogenized for use as samples. In this case, sludge was removed as much as possible.

[3] Other points

For wildlife samples, lipid weight (%) was calculated by the following method:

Five grams of the sample was placed in a homogenizer cup, after which 20 ml of chloroform and 40 ml of methanol was added, and then the sample was homogenized for 2 minutes. An additional 20 ml of chloroform was added, followed by 2 minutes of homogenizing. The sample was then filtered with a Buchner funnel and the precipitate was homogenized with 80 ml of chloroform: methanol (1:1). The entire chloroform and methanol fraction was placed in the separation funnel, after which 60 ml of distilled water was added and then the mixture was shaken gently. The lower chloroform fraction was collected and after drying with anhydrous sodium sulfate, the solvent was evaporated using a rotary evaporator. The residue was dried using phosphorus pentoxide, and the weight was measured.

(4) Air

[1] Sampling time

Sampling took place between September and November when the weather was stable, for 3 continuous days, once a day, beginning at 10 a.m., in principle, for 24 hours.

[2] Sampling method

Samples were collected by adsorption to resin or glass fiber filters, etc. or were sucked by canister.

2. Sampling sites

(1) The primary purpose of this survey was to investigate the persistence of chemical substances in the environment, and to determine whether they persist in the environment more than usual. Thus, the points where surveyed chemical substances were being released (for example, 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 avoided as points for sampling.

(2) Three samples were collected within a range of 500 square meters as a unit in the survey for water and bottom sediments, so that they were collected in as widespread a point as possible. In this case, the sampling for bottom sediments was a mixture of samples from 3 spots in equal quantities within the surrounding 50 m. In the surveys for fish, a collection of 3 samples from the area was considered sufficient. (It was preferable to collect extra samples for frozen preservation in case a problem should arise.)

(3) The points for air sampling were where it was possible to grasp the status of the air. Points strongly affected by a particular source or by transportation facilities, etc. were avoided.

3. Investigation items on the samples

(1) Water samples: temperature, color by visual (eye) observation, transparency and turbidity

(2) Bottom sediment samples: appearance, odor, foreign substance, depth of water at sampling point, water content, ignition loss and sludge content

(3) Wildlife samples: standard Japanese vernacular name, length of body (excluding tail), body weight and lipid weight.

(4) Air samples: Weather, temperature, humidity, wind direction, wind velocity and surrounding geography and status of roads at the sampling time.

4. Storage, etc. of samples

Collected samples were placed in bags or containers so that the samples would not elute or adsorb, and were analyzed as soon as possible. When preserving samples, they were placed in refrigerators or freezers, etc. to prevent change in quality.

Appendix D

Summary of Analytical Methods for Environmental Surveys

Appendix D Summary of Analytical Methods for Environmental Surveys

1. Initial Environmental Survey

Development and study of analytical methods for the target substances in the FY2002 initial environmental survey was conducted in FY2001. For surface water and bottom sediment, screening tests for degradability were conducted prior to the development of analytical methods by the following procedure to identify the suitability of the method.

(1) Degradability screening test (rapid method)

As some of the chemical substances degrade under various environmental conditions, it was necessary to conduct screening tests for degradability under the assumed environmental condition and develop appropriate analytical methods. Screening tests were conducted establishing water and light conditions simultaneously since both conditions are considered very important in environmental degradation (in the light-related degradation test, only one pH condition was tested). For volatile substances, concentrations of the substances in the void space of the vials were properly measured so as not to misinterpret degradation of the substances.

<Preparation>

A volume of 100 ml of distilled water (pH: 5, 7 and 9) was added to 130-mL vials containing a stir bar (for magnetic stirrer) after which the vials were sealed. Next, a standard solution dissolved in hydrophilic solvent such as acetone (% order concentration recommended) was added to these vials using a microsyringe so that the concentration of the solution would be below 100 ppm, followed by 10 minutes of stirring by magnetic stirrer.

<Experiment>

a) Test solutions with the respective pH values were removed from the vials one hour after the preparation and analyzed immediately (Concentration A).
b) The solutions were analyzed after 5 days of storage in a dark place (Concentration B).
c) In order to examine the occurrence of degradation by light, analysis of the test solution with pH 7 (stored for 5 days) was conducted in a sunny room (Concentration C).

The above experiments were conducted at the temperature of 20 ±5°C.

<Result>

Degradability of the test substances was examined by calculating B/A×100, C/A×100 for the respective pH.

The combinations of experiments are shown below.

pH	*Initial concentration (μg/mL)*	*Residual rate after one hour (%)*	*Residual rate after 5 days*	
			Dark place (%)	Light emission (%)
5	✓	✓	✓	–
7	✓	✓	✓	✓
9	✓	✓	✓	–

Furthermore, in the course of development of analytical methods for surface water and bottom sediment, recovery experiments were conducted to determine the detection limit and recovery rate.

(2) Additional recovery experiment at low concentration

<Distilled water>

Calibration curves were obtained setting the sensitivity of the analytical instrument as high as practically allowable.

Samples were prepared by dissolving standard samples of target substances corresponding to three different concentrations including the lowest concentration in the range of a positive linear regression relationship. And, total analysis was conducted four times for each concentration and the measured values were obtained. Based upon the results, the power of test D was calculated by the following equation after obtaining the standard deviation of the measured values at each concentration.

$$D = t(n-1, 0.05) \bullet \frac{\sigma_R}{n} \bullet \frac{dC}{dR}$$

σ_R: standard deviation C: concentration R: measured value (response value)

The power of test D for the established analytical method was obtained by calculating the average value of the power of test D for three different concentrations. The detection limit was defined as three times ($3\times D$) and the quantitation limit was defined as ten times ($10\times D$) the power of the test.

<Bottom sediment>

Assuming a concentration in bottom sediment corresponding to the detection limit ($3\times D$) obtained in the above-mentioned method as the estimated detection limit, a standard sample of the target substance was added to the common bottom sediment so that the concentration would be 2-5 times the estimated detection limit, and the hermetically sealed sample was stored overnight at 4°C. Next, all procedures for the analysis of the bottom sediment sample were conducted and it was confirmed that the target chemical substance would be properly detected. When the substance was detected, 5 additional recovery experiments were conducted at the same concentration and the detection limit of the common bottom sediment was calculated by the following equation based on the total 7 measured values.

Detection limit (DL) $= t(n-1, 0.01) \bullet Sc$

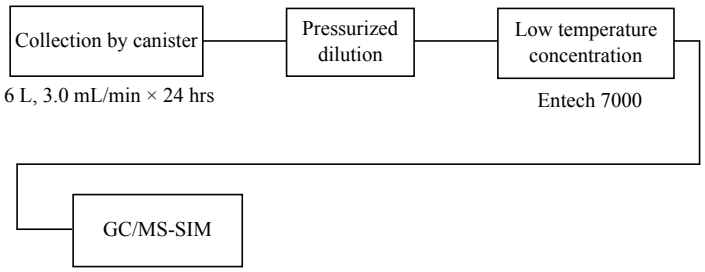
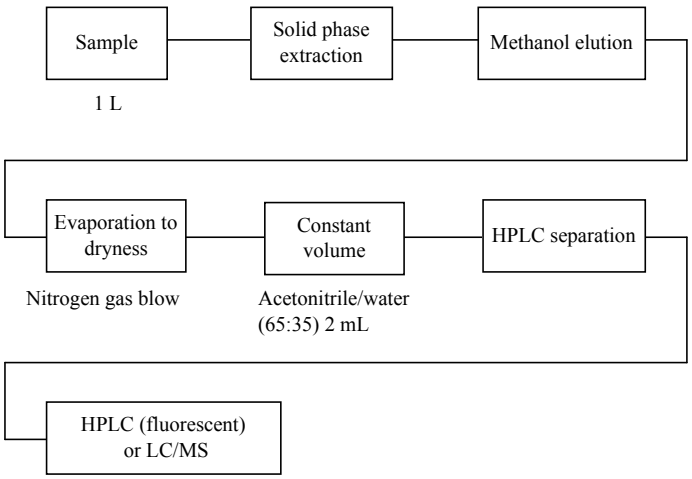
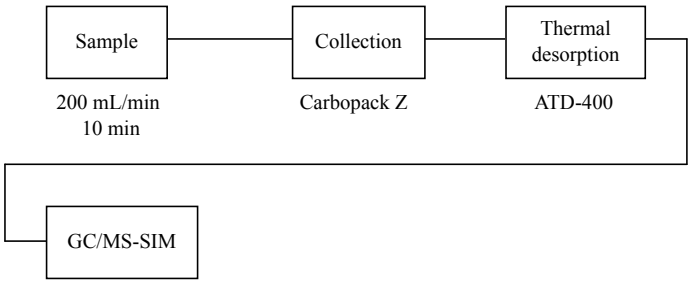
Sc: estimated value of the standard deviation

<River and sea water>

Ten times the detection limit amount of standard substances was added to the river water sample (from the Class B Water Area of Environmental Quality Standards) and the sea water sample (from the Class B of the Environmental Quality Standards, or, when not available, from the Class A Water Area or artificially prepared sea water) and they were analyzed immediately (more than twice). In addition, analysis was conducted on the river water and sea water without the addition of standard substances (more than twice for both samples). Recovery rate was calculated by subtracting the measured value (mean) of the sample water without the addition from the measured value (mean) with the addition.

In the practical survey, various studies such as extraction method, separation method and measurement conditions were conducted in parallel, in consideration of the existence of substances that interfere with the analysis.

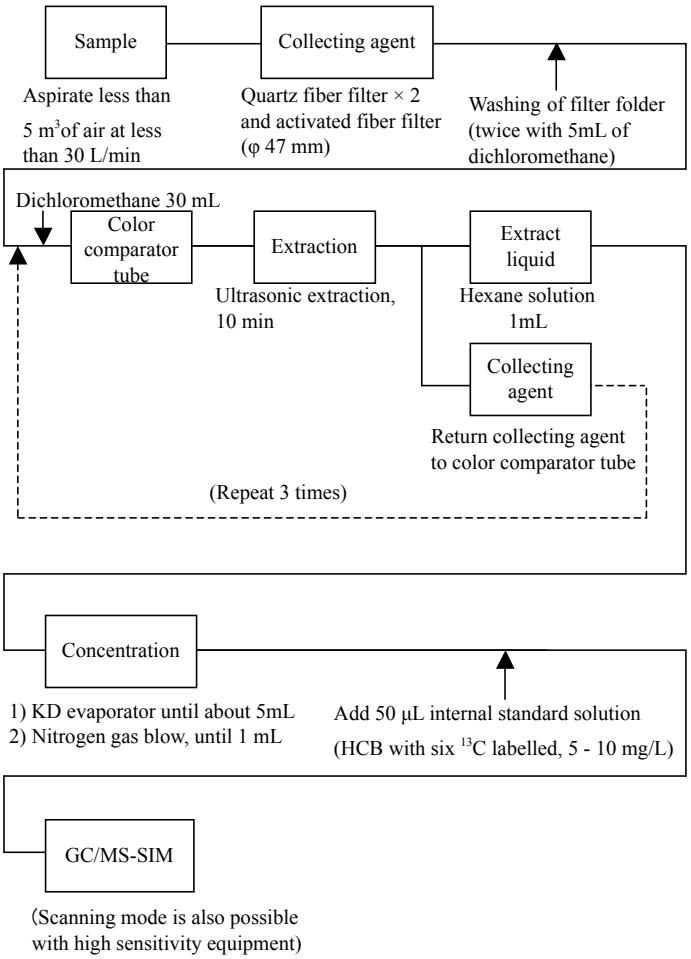
Analytical Method for the FY2003 Initial Environmental Survey

Substance	Analytical Method/Flow Chart	Remarks
(1) HCFCs (1.1) HCFC-141b (1.2) HCFC-22 (1.3) HCFC-123 (1.4) HCFC-142b (1.5) HCFC-225ca (1.6) HCFC-225cb (1.7) HFC-134a	**Air**  	GC/MS-SIM Column: HP-VOC Column length: 60 m Column I.D.: 0.32 mm Film thickness: 1.8 μm Detection limit: Air (ng/m^3) (1.1) 4 (1.2) 6 (1.3) 3 (1.4) 3 (1.5) 4 (1.6) 15 (1.7) 7
(2) Linear alkylbenzene sulfonic acid and its salt (LAS, carbon number of alkyl group: 10 - 14) (2.1) LAS_{10} (2.2) LAS_{11} (2.3) LAS_{12} (2.4) LAS_{13} (2.5) LAS_{14}	**Surface water**  	LC/MS Column: C_8 Column length: 0.25 m Column I.D.: 3.0 mm Detection limit: Surface water (μg/L) (2.1) 0.2 (2.2) 0.2 (2.3) 0.2 (2.4) 0.2 (2.5) 0.2
(3) Isoprene	**Air**  	GC/MS-SIM Column: DB-1 Column length: 60 m Column I.D.: 0.32 mm Film thickness: 3 μm Detection limit: Air (ng/m^3) (3) 12

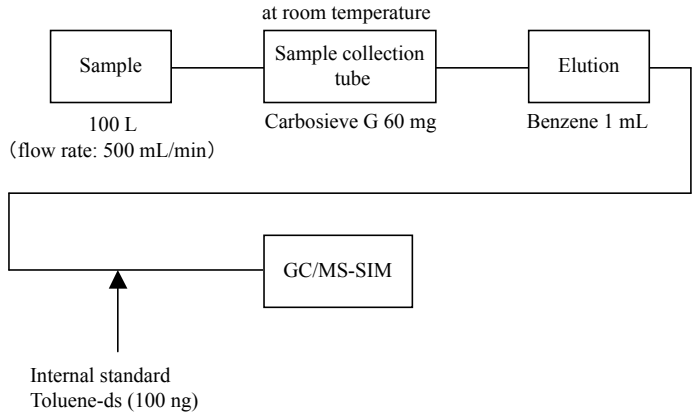
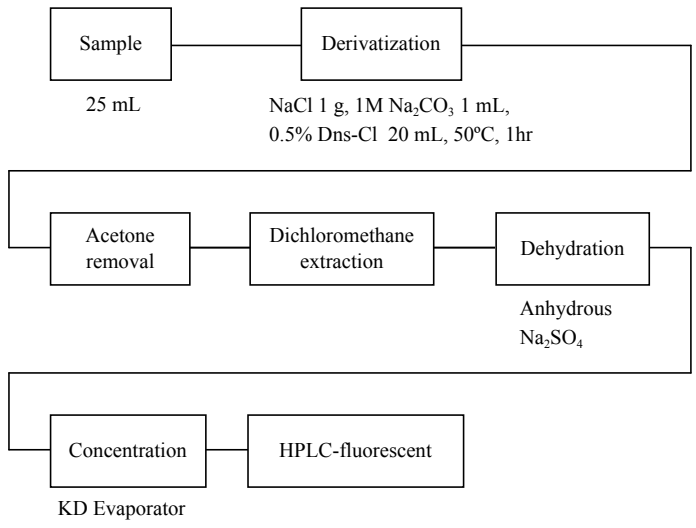
Analytical Method for the FY2003 Initial Environmental Survey (continued)

Substance	Analytical Method/Flow Chart	Remarks
(4) Chlordecone	**Air** Sample → Collection (10 L/min × 24 hrs, Quartz fiber filter) → Extraction (Acetone 5 mL) → Concentration (Nitrogen gas blow) → Redissolution (Methanol 1.0 mL) → LC/MS/MS-MRM (ESI-negative)	LC/MS Column: C30-UG-5 Column length: 0.15 m Column I.D.: 2.0 mm Detection limit: Air (ng/m^3) (4) 0.0005
(5) Chlorpyrifos	**Wildlife** Sample (20 g) → Solid-liquid extraction (1) Acetone 50 mL × 2 times, (2) Centrifuging (3000 rpm) → Dilution (Pour into 1% Na_2SO_4 400 mL) → Solvent redissolution (Dichloromethane 100mL, 50mL) → Concentration (1) Rotary evaporator (Below 40ºC, until 5 mL), (2) Nitrogen gas blow (until 1 mL) → Acetonitrile - *n*-hexane partition (1) Dissolve in *n*-hexane 15 mL, (2) *n*-Hexane saturated acetonitrile 50 mL × 2 times) → Concentration (1) Rotary evaporator (Below 40ºC, until 5 mL), (2) Nitrogen gas blow (until 1 mL) → Column chromatography (5% Hydrated Florisil 3 g (I.D.: 1 cm), Wash column with 50 mL *n*-hexane, Elute with 30 mL benzene) → Concentration (1) Rotary evaporator (Below 40ºC, until 5 mL), (2) Nitrogen gas blow (until 1 mL) → GC/MS-SIM or GC-FPD	GC/MS-SIM Column: DB-5 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 μm Detection limit: Wildlife (ng/g-wet) (5) 3

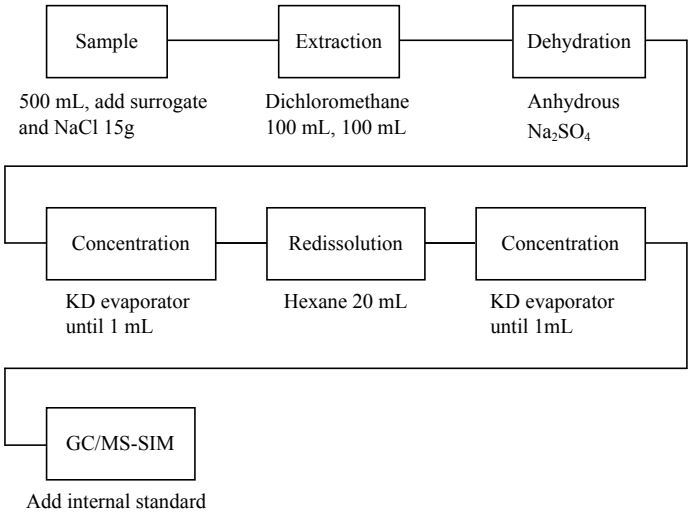
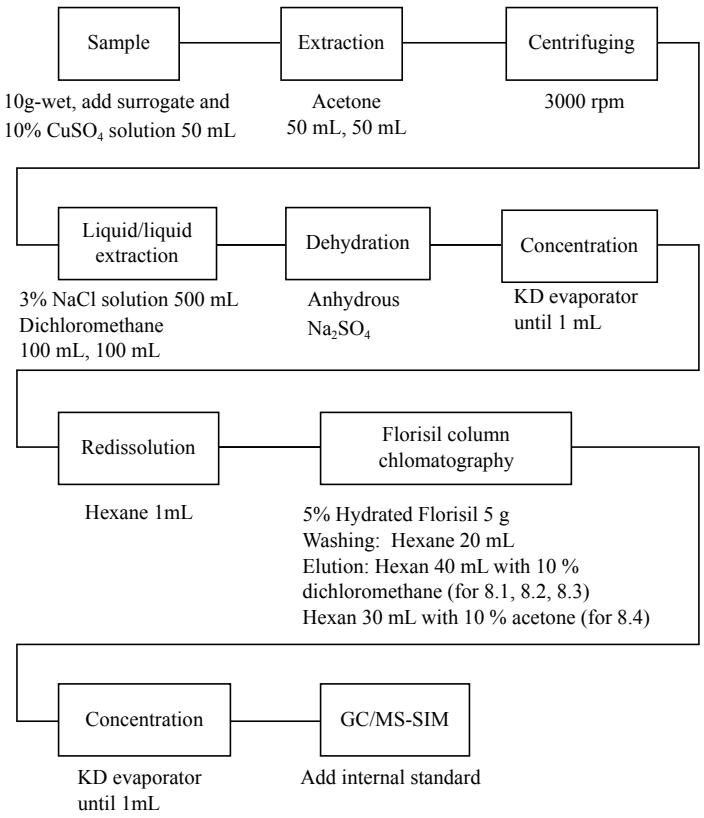
Analytical Method for the FY2003 Initial Environmental Survey (continued)

Substance	Analytical Method/Flow Chart	Remarks
(5) Chlorpyrifos (continued)	**Air**  	GC/MS-SIM Column: DB1-MS Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection limit: Air (ng/m3) (5) 2

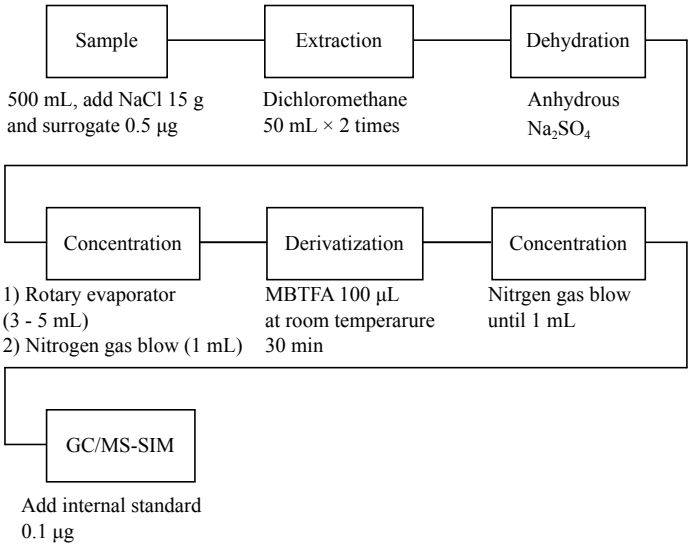
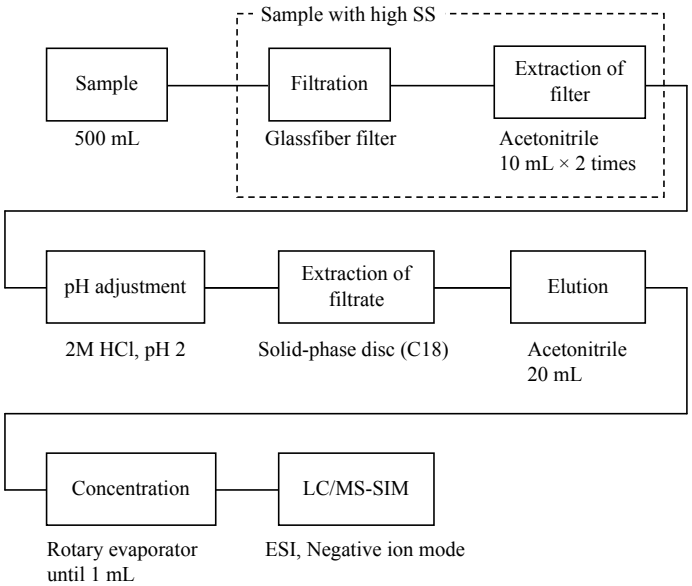
Analytical Method for the FY2003 Initial Environmental Survey (continued)

Substance	Analytical Method/Flow Chart	Remarks
(6) Chloropicrin	**Air** 	GC/MS-SIM Column: DB-624 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 1.4 μm Detection limit: Air (ng/m^3) (6) 220
(7) Diethylenetriamine and an another substance (7.1) Diethylenetriamine (7.2) Triethylenetetramine	**Surface water** 	HPLC-fluorescent Column: Lichrosorb RP18 (5 μm) Column length: 0.25 m Column I.D.: 4 mm Detection limit: Surface water (μg/L) (1) 2 (2) 8

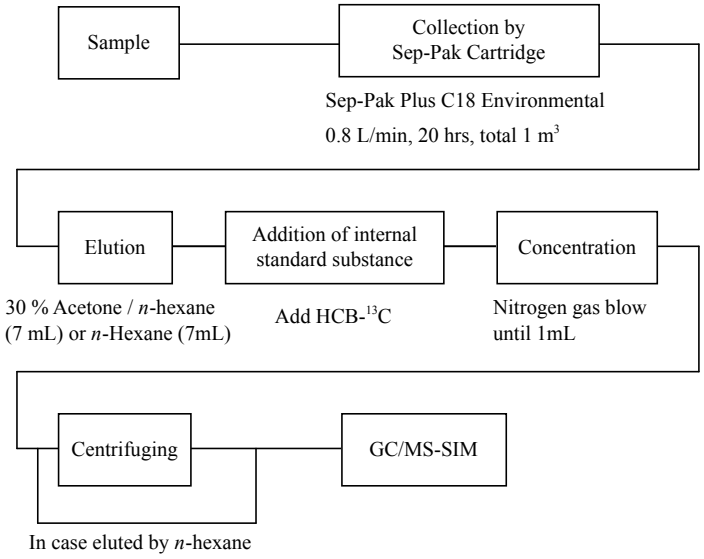
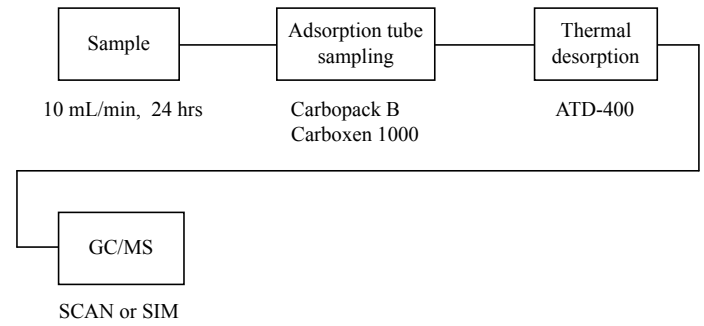
Analytical Method for the FY2003 Initial Environmental Survey (continued)

Substance	Analytical Method/Flow Chart	Remarks
(8) 1,4-Dichloro-2-nitrobenzene and 3 other substances (8.1) 1,4-Dichloro-2-nitrobenzene (8.2) 1,3 -Dichloro-4-nitrobenzene (8.3) 1-Chloro-3-nitrobenzene (8.4) 1,4-Dinitrobenzene	**Surface water**  **Bottom sediment**  	GC/MS-SIM Column: DB-1701 Column length: 30 m Column I.D.: 0.32 mm Film thickness: 0.25 μm Detection limit: Surface water (μg/L) (8.1) 0.05 (8.2) 0.06 (8.3) 0.05 (8.4) 0.05 Bottom sediment (ng/g-dry) (8.1) 2.5 (8.2) 1.9 (8.3) 3.2 (8.4) 3.1

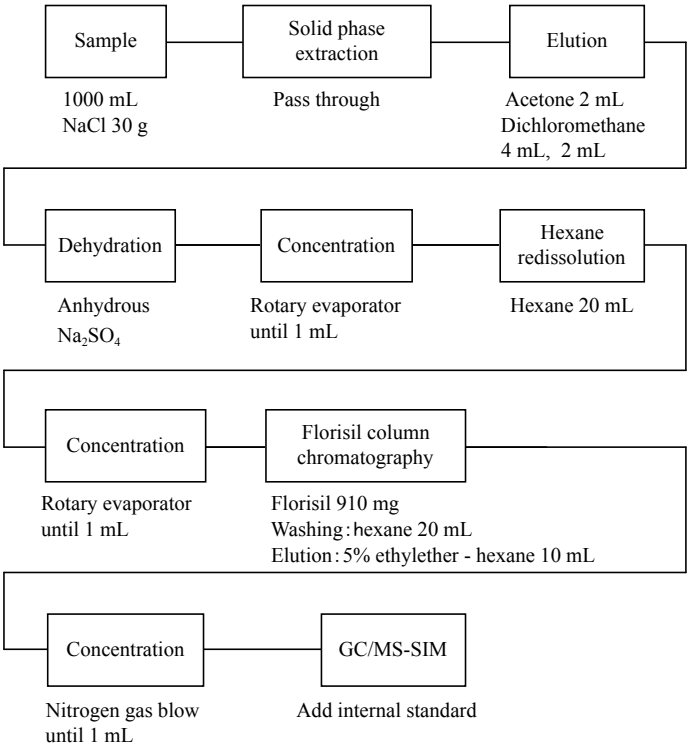
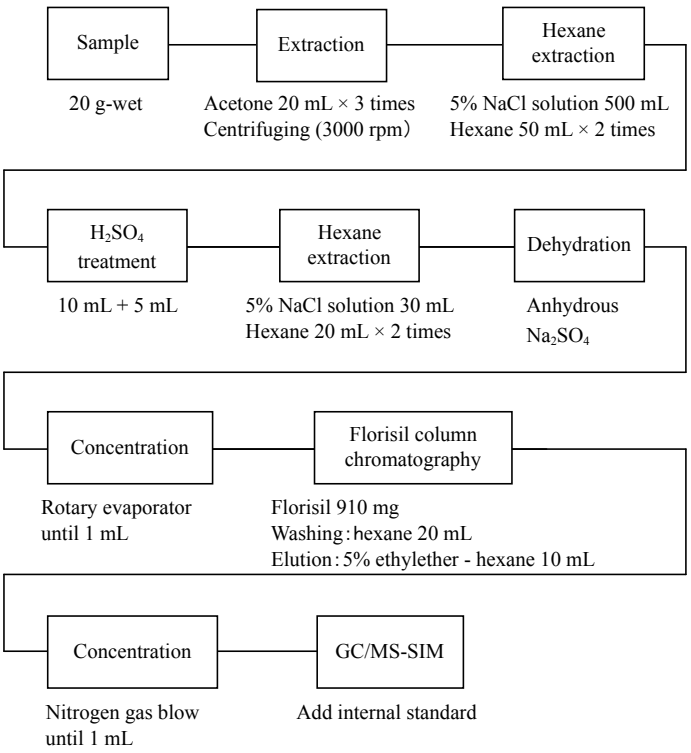
Analytical Method for the FY2003 Initial Environmental Survey (continued)

Substance	Analytical Method/Flow Chart	Remarks
(9) 3,3'-Dichlorobenzidine	**Surface water** 	GC/MS-SIM Column: HP-5 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection limit: Surface water (µg/L) (9) 0.010
(10) Pyridine-triphenylborane	**Surface water** 	LC/MS-SIM Column: Inertsil ODS-80A Column length: 0.25 m Column I.D.: 1.5 mm Surface water (µg/L) (10) 0.030

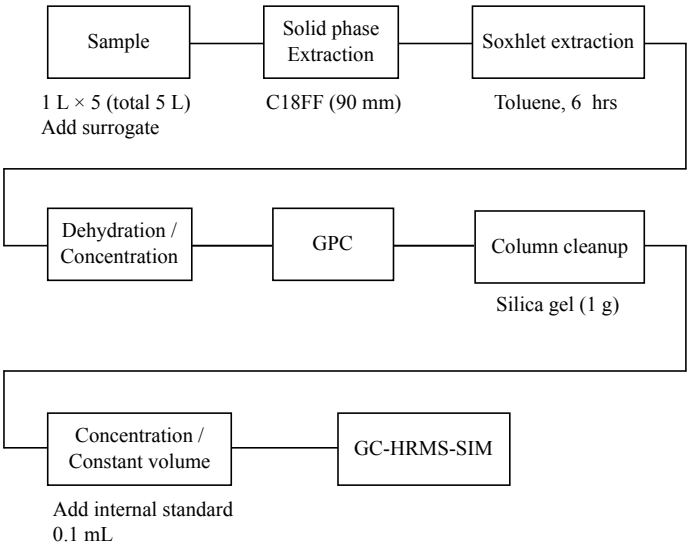
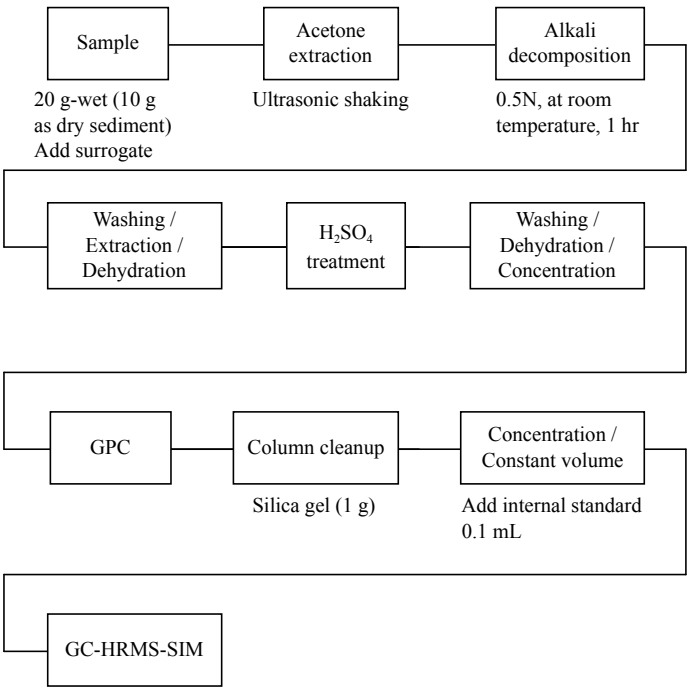
Analytical Method for the FY2003 Initial Environmental Survey (continued)

Substance	Analytical Method/Flow Chart	Remarks
(11) 2,4,6-Tri-*tert*-butylphenol	**Air**  	GC/MS-SIM Column: HP-5MS Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 μm Detection limit: Air (ng/m^3) (11) 0.9
(12) Bromomethane	**Air**  	GC/MS-SIM or GC/MS-SCAN Column: SPB-HAP Column length: 60 m Column I.D.: 0.32 mm Film thickness: 4.0 μm Detection limit: Air (ng/m^3) (12) 0.027

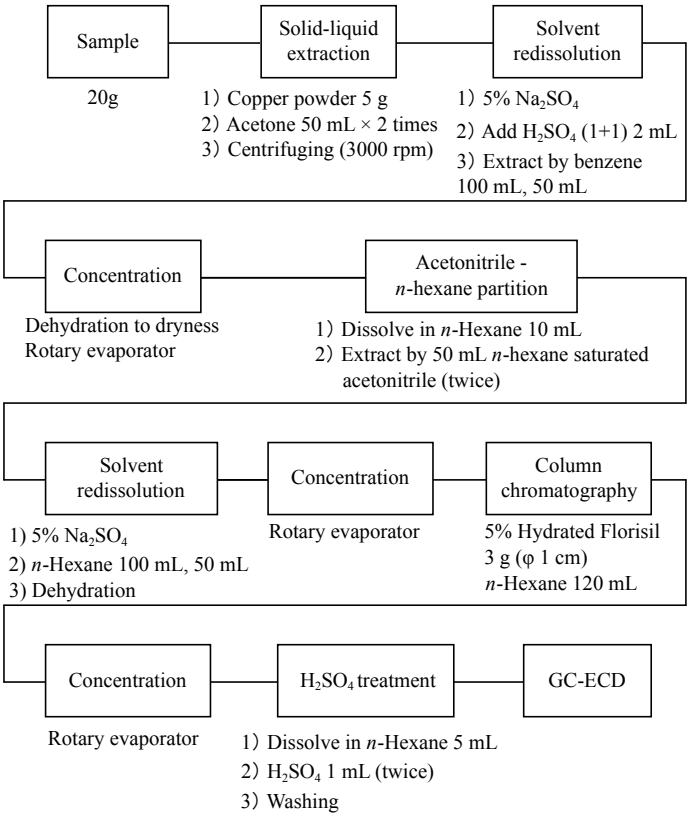
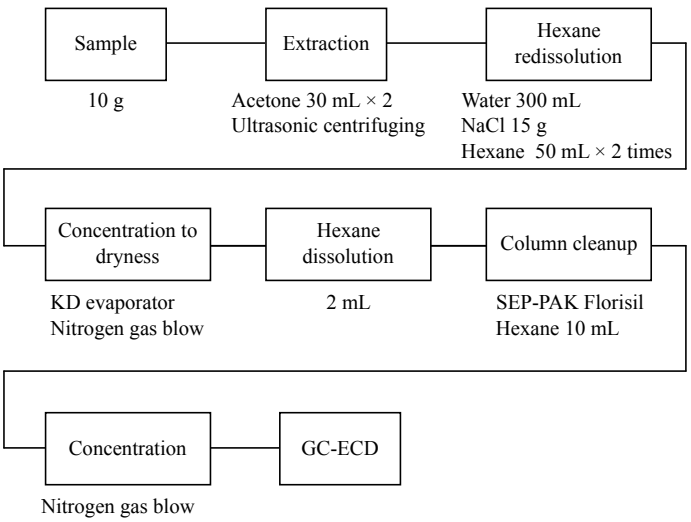
Analytical Method for the FY2003 Initial Environmental Survey (continued)

Substance	Analytical Method/Flow Chart	Remarks
(13) 1,2,5,6,9,10-Hexabromocyclododecane	**Surface water**  **Bottom sediment**  	GC/MS-SIM Column: DB-5ms Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.1 μm Detection limit: Surface water (μg/L) (13) 0.087 Bottom sediment (ng/g-dry) (13) 23

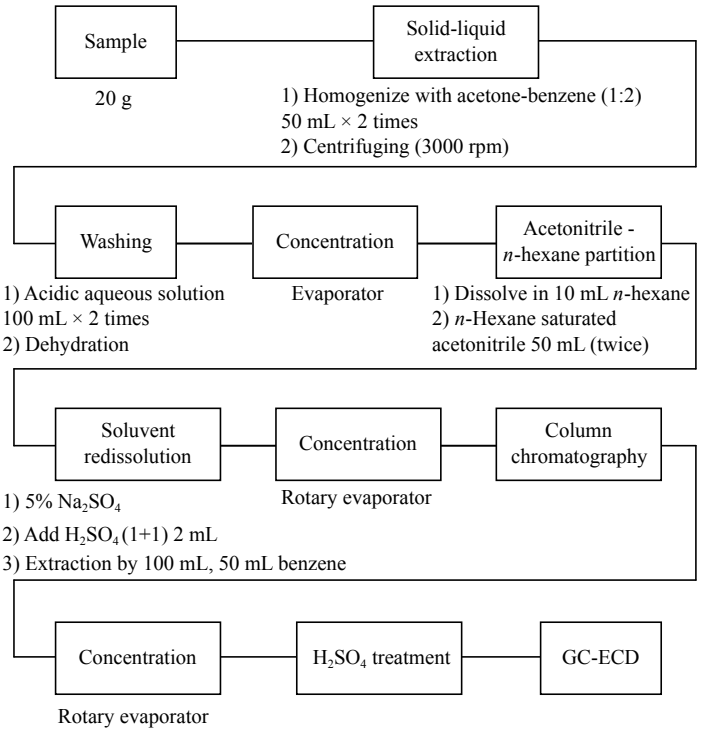
Analytical Method for the FY2003 Initial Environmental Survey (continued)

Substance	Analytical Method/Flow Chart	Remarks
(14) Hexabromobiphenyl (14.1) 2,2',4,4',6,6'-Hexabromobiphenyl (14.2) 2,2',4,4',5,5'-Hexabromobiphenyl (14.3) 3,3',4,4',5,5'-Hexabromobiphenyl	**Surface water**  **Bottom sediment**  	GC-HRMS-SIM Column: DB-1HT Column length: 15m Column I.D.: 0.25mm Film thickness: 0.1μm Column: HP-5MS Column length: 30m Column I.D.: 0.32mm Film thickness: 0.1μm Detection limit: Surface water (μg/L) (14.1) 0.012 (14.2) 0.019 (14.3) 0.012 Bottom sediment (ng/g-dry) (14.1) 0.0087 (14.2) 0.014 (14.3) 0.023

Analytical Method for the FY2003 Initial Environmental Survey (continued)

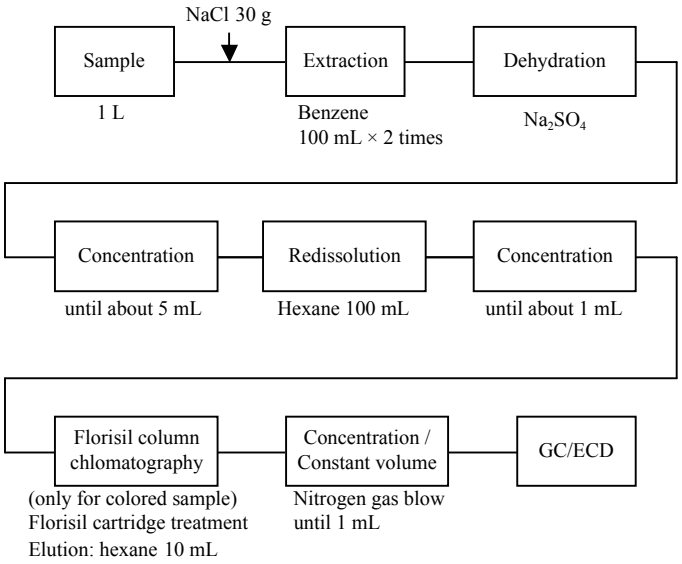
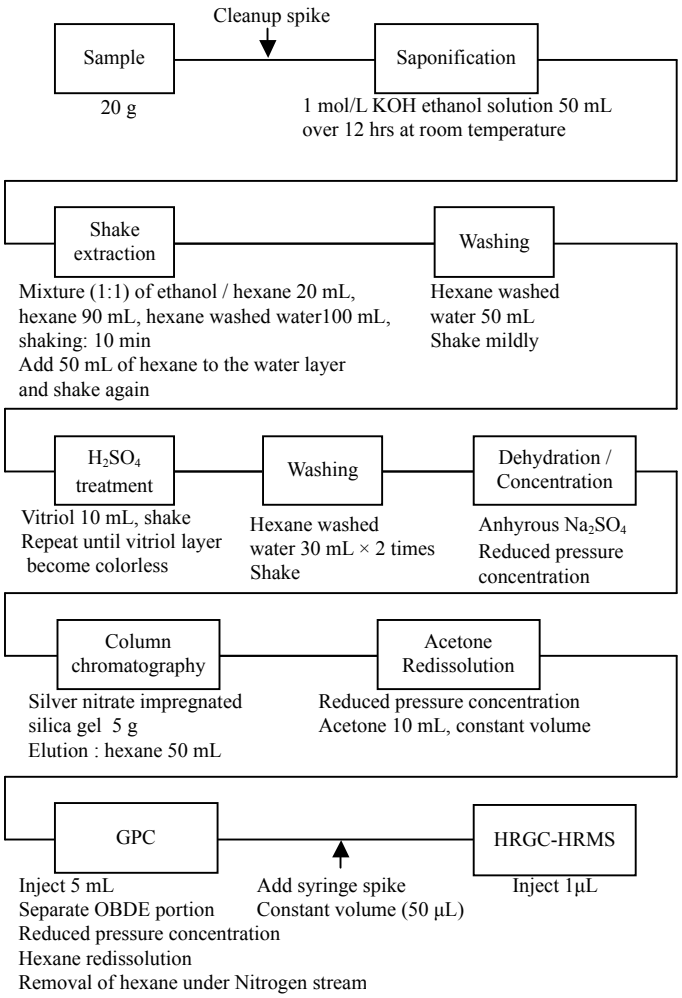
Substance	Analytical Method/Flow Chart	Remarks
(15) Polybrominated diphenyl ethers (15.1) Hexabromodiphenyl ether	**Bottom sediment** 	GC-ECD Column: Glass column Column length: 0.5 m Column I.D.: 3 mm Detection limit: Bottom sediment (ng/g-dry) (15.1) 0.5
(15.2) Decabromodiphenyl ether	**Bottom sediment** 	GC-ECD Column: DB-1 Column length: 5 m Column I.D.: 0.32 mm Film thickness: 0.1 μm Bottom sediment (ng/g-dry) (15.2) 8.7

Analytical Method for the FY2003 Initial Environmental Survey (continued)

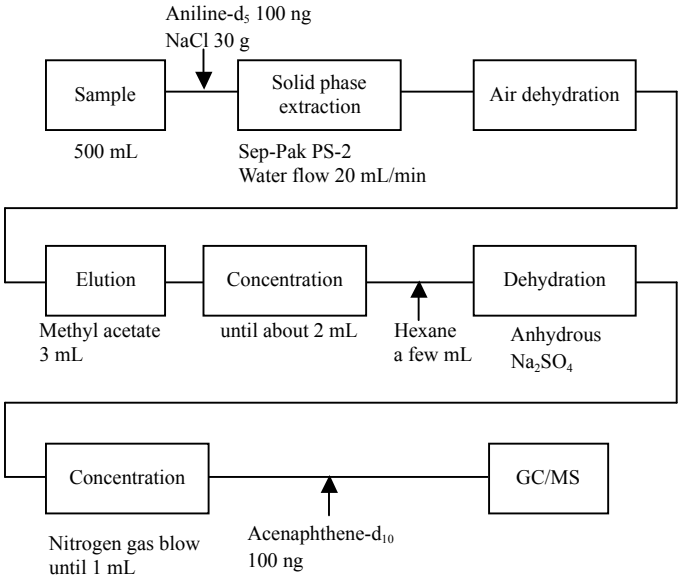
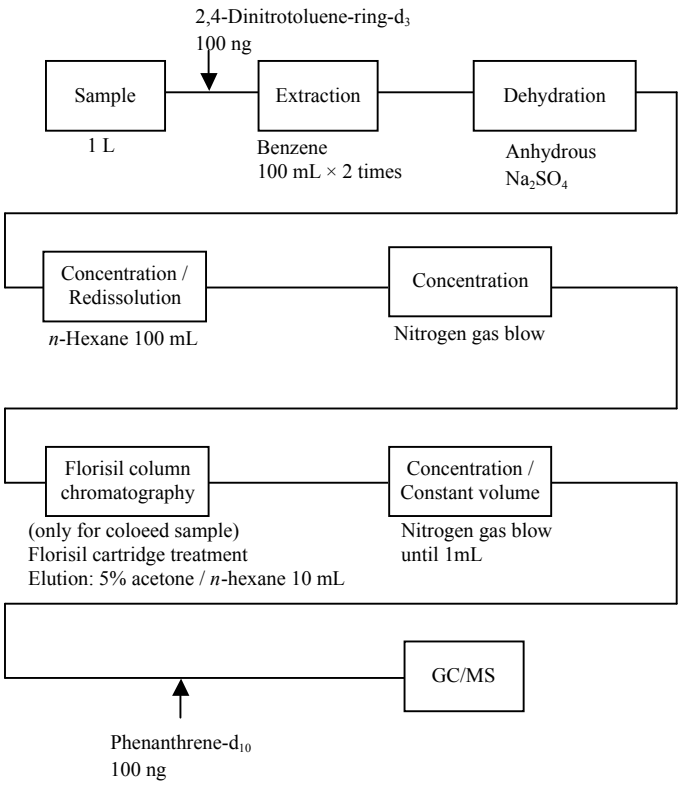
Substance	Analytical Method/Flow Chart	Remarks
(15) Polybrominated diphenyl ethers (continued) (15.1) Hexabromodiphenyl ether (15.2) Decabromodiphenyl ether	**Wildlife**  	GC-ECD Column: Glass column Column length: 0.5 m Column I.D.: 3 mm Detection limit: Wildlife (ng/g-wet) (15.1) 0.5 (15.2) 1

2. Environmental Survey for Exposure Study

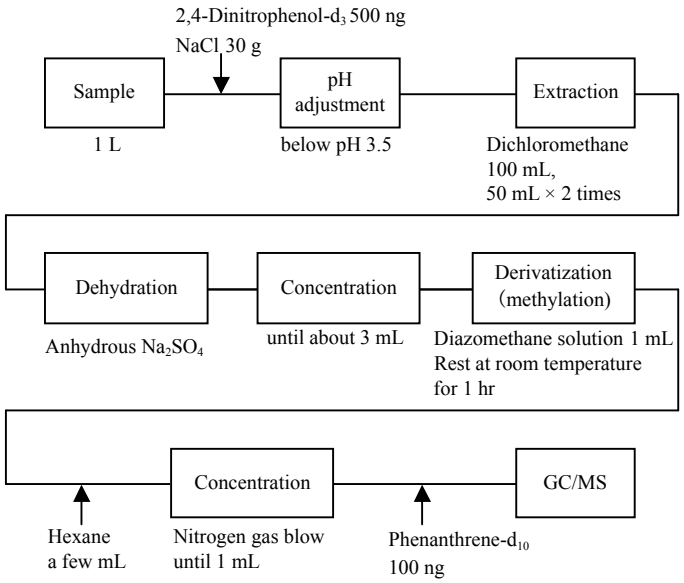
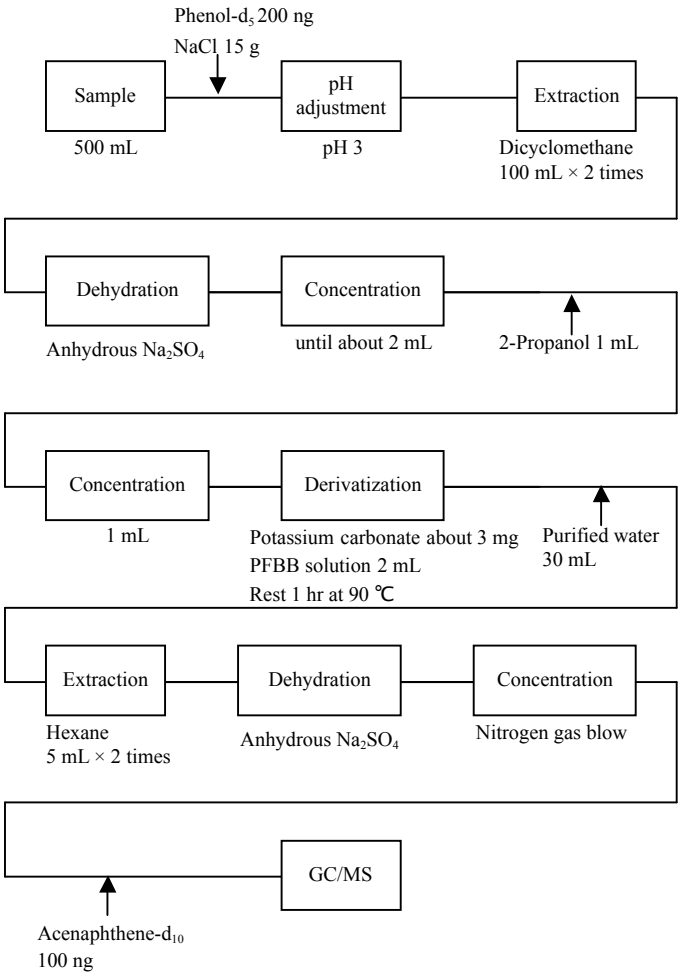
Analytical Method for the FY2003 Environmental Survey for Exposure Study

Substance	Analytical Method/Flow Chart	Remarks
(1) Octabromodiphenylether	**Surface water**  **Wildlife**  	GC/ECD Column: SGE BP-1 Column length: 12 m Column I.D.: 0.22 mm Film thickness: 0.1 µm Detection limit: Surface water (ng/L) (1) 3 HRGC-HRMS Detection limit: Wildlife (ng/g-wet) (1) 0.0007

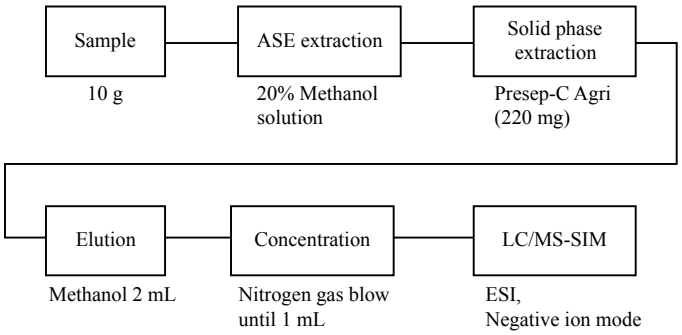
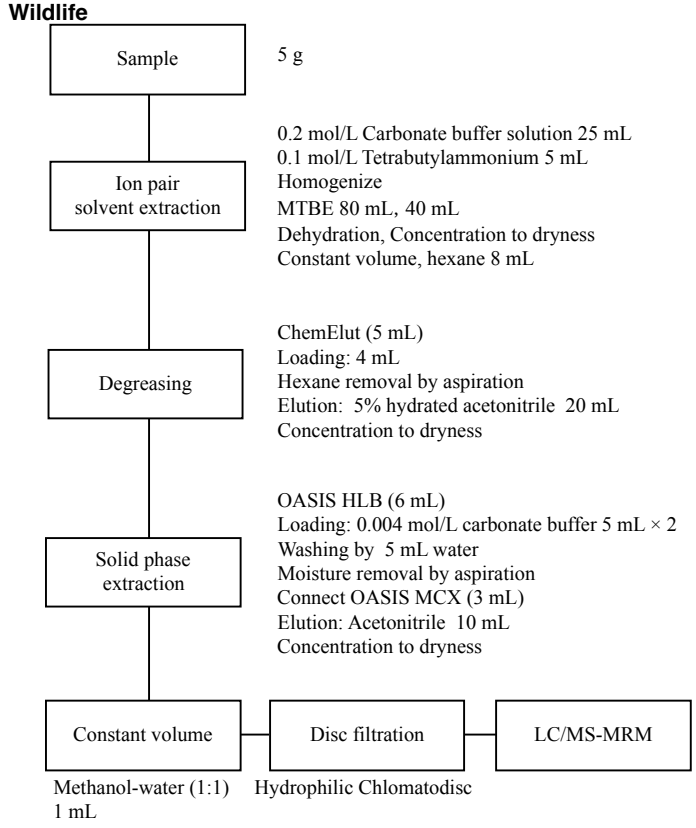
Analytical Method for the FY2003 Environmental Survey for Exposure Study (continued)

Substance	Analytical Method/Flow Chart	Remarks
(2) *o*-Chloroaniline	**Surface water** 	GC/MS-SIM Column: SGE BP-20 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 μm Detection limit: Surface water (μg/L) (2) 25
(3) 1-Chloro-2,4-dinitrobenzene	**Surface water** 	GC/MS Column: SGE BPX-5 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 μm Detection limit: Surface water (ng/L) (3) 10

Analytical Method for the FY2003 Environmental Survey for Exposure Study (continued)

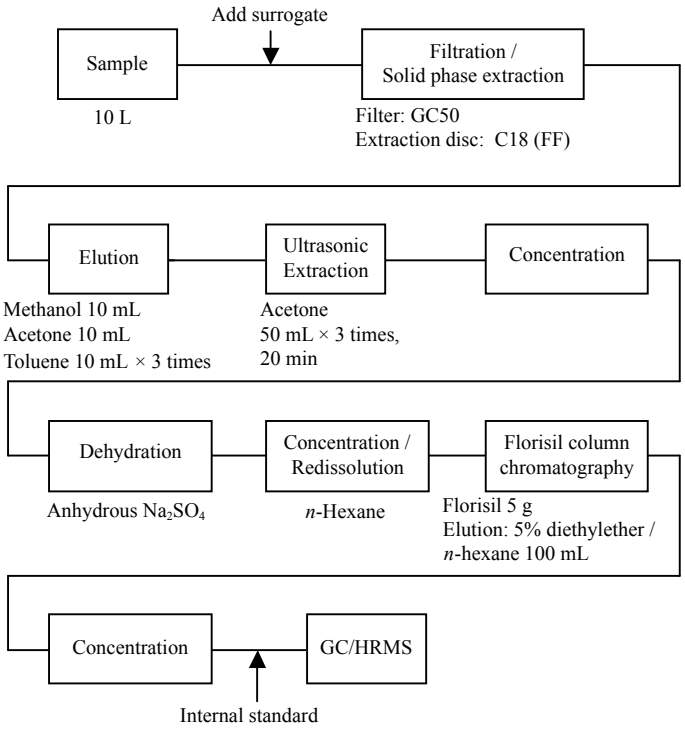
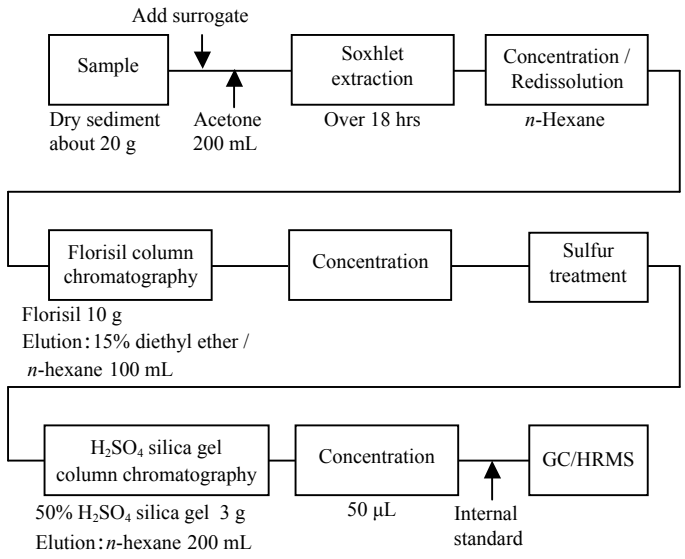
Substance	Analytical Method/Flow Chart	Remarks
(4) 2,4-Dinitrophenol	**Surface water** 	GC/MS Column: SGE BPX-5 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 μm Detection limit: Surface water (ng/L) (4) 19
(5) Phenol	**Surface water** 	GC/MS Column: SGE BP-10 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 μm Detection limit: Surface water (ng/L) (5) 28

Analytical Method for the FY2003 Environmental Survey for Exposure Study (continued)

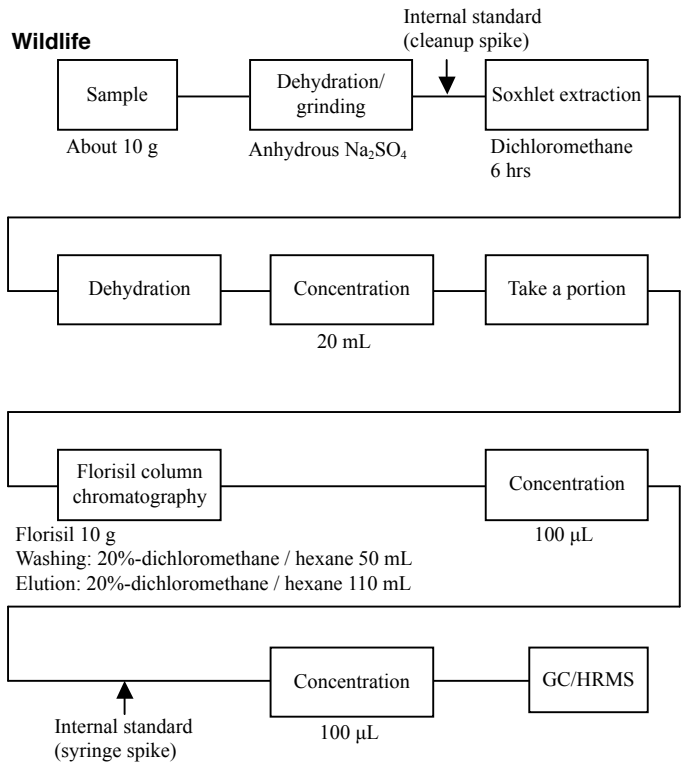
Substance	Analytical Method/Flow Chart	Remarks
(6) Perfluorooctane sulfonic acid (PFOS) (7) Perfluorooctanoic acid (PFOA)	**Bottom sediment**  **Wildlife**  	LC/MS-SIM Column: Zorbax XDB C-18 Column length: 150 mm Column I.D.: 2.1 mm Particle diameter: 3.5 μm Detection limit: Bottom sediment (ng/g-dry) (6) 0.022 (7) 0.016 LC/MS/MS-MRM Column: CAPCEL PAK C18 MG-II Column length: 150 mm Column I.D.: 2 mm Particle diameter: 5 μm Detection limit: Wildlife (ng/g-wet) (6) 0.033 (7) 0.059

3. Monitoring Investigation

Analytical Method for the FY2003 Monitoring Investigation

Substance	Analytical Method/Flow Chart	Remarks
(1) PCBs	**Surface water**  **Bottom sediment**  	GC/HRMS Resolution: 10,000 Column: HT8-PCB Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection/Quantitation limit: Surface water (pg/L) (1) Detection limit / Quantitation limit Mono-chloride 0.4 / 2 Di-chloride 0.2 / 0.5 Tri-chloride 0.2 / 0.4 Tetra-chloride 0.09 / 0.3 Penta-chloride 0.07 / 0.3 Hexa-chloride 0.09 / 0.3 Hepta-chloride 0.07 / 0.3 Octa-chloride 0.07 / 0.3 Nona-chloride 0.4 / 2 Deca-chloride 0.9 / 3 PCB 77, 81 0.3, 0.2 / 0.8, 0.6 PCB 105, 114 0.7, 0.1 / 3, 0.4 PCB 118, 123 2, 0.1 / 6, 0.4 PCB 126, 156 0.1. 0.2 / 0.4, 0.5 PCB 157, 167 0.2, 0.09 / 0.5, 0.3 PCB 169, 170 0.2, 0.3 / 0.4, 0.9 PCB 180, 189 0.5, 0.2 / 2, 0.5 Bottom sediment (pg/g-dry) (1) Detection limit / Quantitation limit Mono-chloride 0.4 / 2 Di-chloride 0.2 / 0.7 Tri-chloride 0.2 / 0.6 Tetra-chloride 0.2 / 0.4 Penta-chloride 0.2 / 0.5 Hexa-chloride 0.2 / 0.4 Hepta-chloride 0.3 / 0.7 Octa-chloride 0.3 / 0.8 Nona-chloride 0.6 / 2 Deca-chloride 0.6 / 2 PCB 77, 81 0.3, 0.3 / 0.8, 0.8 PCB 105, 114 2, 0.3 / 4, 0.8 PCB 118, 123 2, 0.3 / 6, 0.8 PCB 126, 156 0.2, 2 / 0.6, 5 PCB 157, 167 0.4, 0.2 / 2, 0.7 PCB 169, 170 0.4, 2 / 2, 5 PCB 180, 189 0.2, 0.4 / 0.4, 2

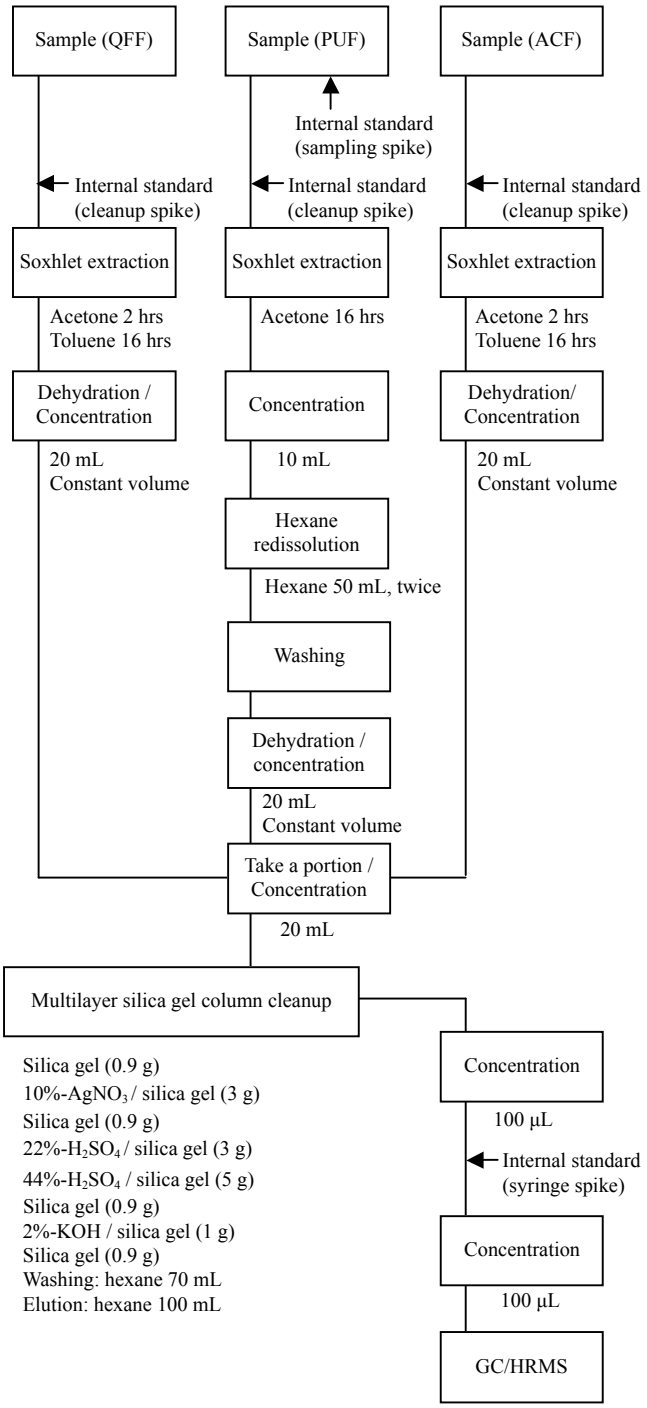
Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(1) PCBs (continued)		GC/HRMS Resolution: 10,000 Column: DB-5MS Column length: 60 m Column I.D.: 0.32 mm Film thickness: 0.25 μm Detection/Quantitation limit: Wildlife (pg/g-wet)

(1)	Detection limit	Quantitation limit
Mono-chloride	0.69	2.1
Di-chloride	2.5	7.5
Tri-chloride	2	6
Tetra-chloride	2.3	6.9
Penta-chloride	1.9	5.7
Hexa-chloride	1.1	3.3
Hepta-chloride	1.6	4.8
Octa-chloride	1.8	5.4
Nona-chloride	1.3	3.9
Deca-chloride	1.5	4.5
PCB 77	0.69	2.1
PCB 81	1.5	4.5
PCB 105	2.2	6.6
PCB 114	1.1	3.3
PCB 118	3.7	11
PCB 123	0.97	2.9
PCB 126	0.96	2.9
PCB 156	0.84	2.5
PCB 157	1.2	3.6
PCB 167	0.71	2.1
PCB 169	1.4	4.2
PCB 170	1.8	5.4
PCB 180	1.5	4.5
PCB 189	1.5	4.5

Analytical Method for the FY2003 Monitoring Investigation (continued)

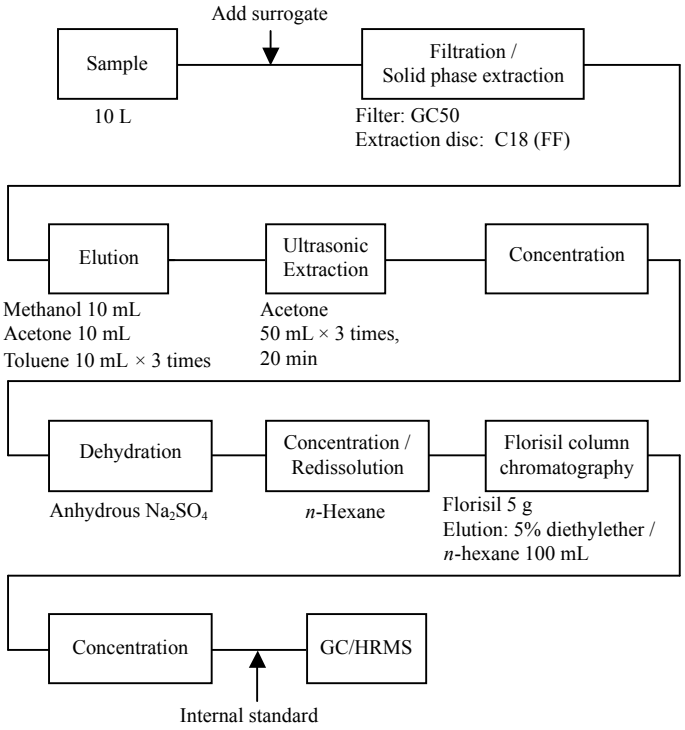
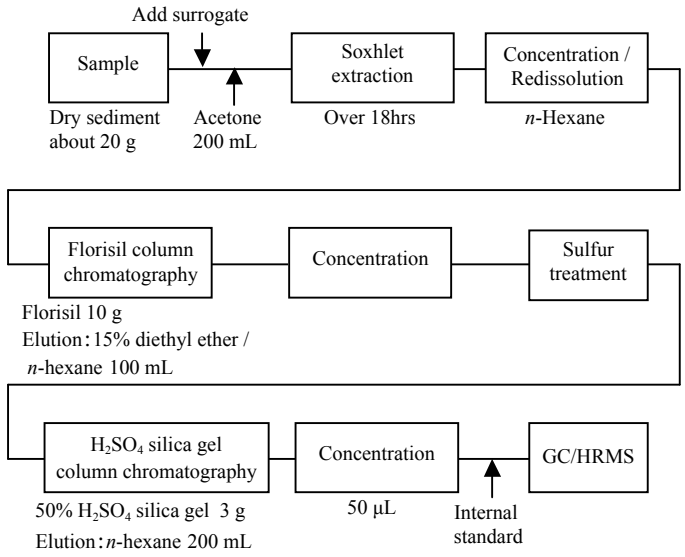
Substance	Analytical Method/Flow Chart	Remarks
(1) PCBs (continued)	**Air** Sampled by high-volume air sampler (HV) with quartz-fiber-filter (QFF), polyurethane form (PUF) and active carbon felt (ACF) sorbent media.	GC/HRMS Resolution: 10,000 Column: DB-5MS Column length: 60 m Column I.D.: 0.32 mm Film thickness: 0.25 μm Detection/Quantitation limit:



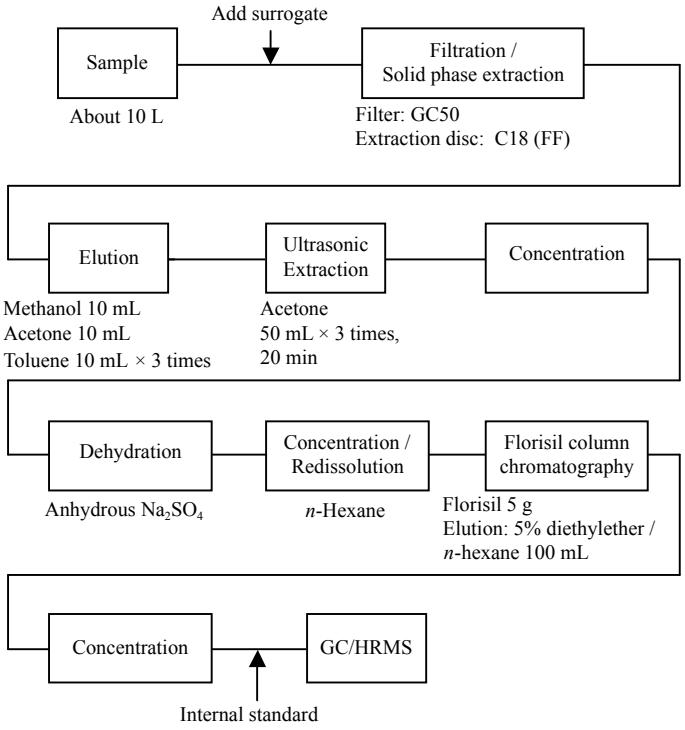
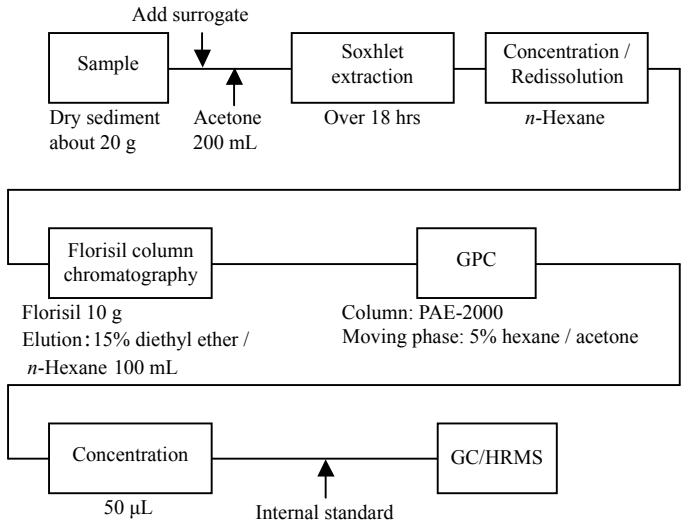
Air (pg/m^3)

(1)	Detection limit	Quantitation limit
Mono-chloride	0.041	0.12
Di-chloride	0.33	1.0
Tri-chloride	1.1	3.2
Tetra-chloride	0.58	1.7
Penta-chloride	0.11	0.32
Hexa-chloride	0.029	0.086
Hepta-chloride	0.01	0.03
Octa-chloride	0.019	0.057
Nona-chloride	0.013	0.039
Deca-chloride	0.0057	0.017
PCB 77	0.0043	0.013
PCB 81	0.0051	0.015
PCB 105	0.0072	0.022
PCB 114	0.0082	0.025
PCB 118	0.0050	0.015
PCB 123	0.0052	0.016
PCB 126	0.0089	0.027
PCB 156	0.0083	0.025
PCB 157	0.0077	0.023
PCB 167	0.007	0.021
PCB 169	0.0098	0.029
PCB 170	0.0098	0.029
PCB 180	0.016	0.048
PCB 189	0.0083	0.025

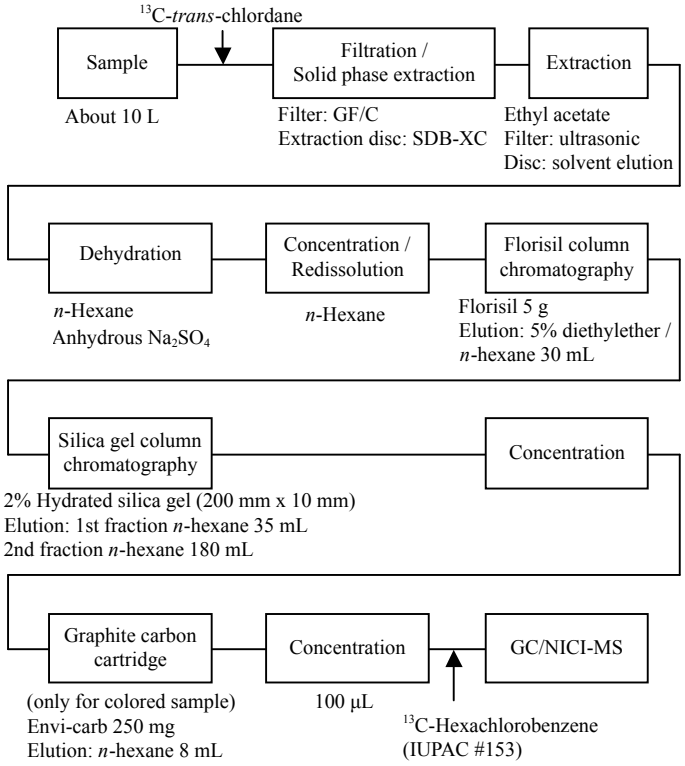
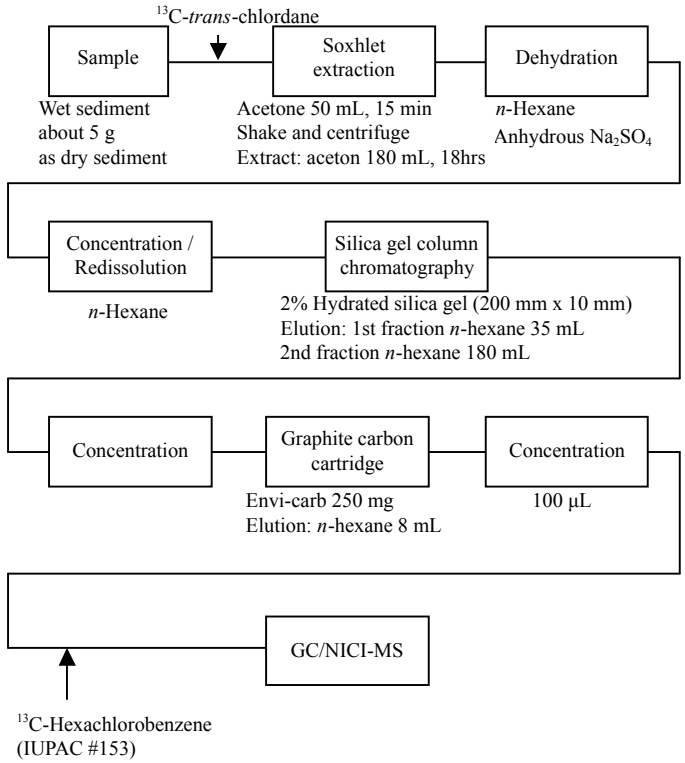
Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(2) HCB (4) DDTs (4.1) *p,p′*-DDT (4.2) *p,p′*-DDE (4.3) *p,p′*-DDD (4.4) *o,p′*-DDT (4.5) *o,p′*-DDE (4.6) *o,p′*-DDD (5) Chlordanes (5.1) *trans*-Chlordane (5.2) *cis*-Chlordane (5.3) *trans*-Nonachlor (5.4) *cis*-Nonachlor (5.5) Oxychlordane (6) Heptachlors (6.1) Heptachlor (8) Mirex (9) HCHs (9.1) α-HCH (9.2) β-HCH (9.3) γ-HCH (9.4) δ-HCH	**Surface water**  **Bottom sediment**  	GC/HRMS Resolution: 10,000 Column: HT8-PCB Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection/Quantitation limit: Surface water (pg/L) (2) 2 5 (4.1) 0.9 3 (4.2) 2 4 (4.3) 0.5 2 (4.4) 0.7 3 (4.5) 0.3 0.8 (4.6) 0.3 0.8 (5.1) 2 5 (5.2) 0.9 3 (5.3) 0.5 3 (5.4) 0.1 0.3 (5.5) 0.5 2 (6.1) 0.5 2 (8) 0.09 0.3 (9.1) 0.9 3 (9.2) 0.7 3 (9.3) 2 7 (9.4) 0.5 2 Bottom sediment (pg/g-dry) (2) 2 4 (4.1) 0.4 2 (4.2) 0.3 0.9 (4.3) 0.3 0.9 (4.4) 0.3 0.8 (4.5) 0.2 0.6 (4.6) 0.5 2 (5.1) 2 4 (5.2) 2 4 (5.3) 0.6 2 (5.4) 0.9 3 (5.5) 0.4 1 (6.1) 1 3 (8) 0.4 2 (9.1) 0.5 2 (9.2) 0.7 2 (9.3) 0.4 2 (9.4) 0.7 2

Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(3) Drins (3.1) Aldrin (3.2) Dieldrin (3.3) Endrin (6) Heptachlors (6.2) *trans*-Heptachlor epoxide (6.3) *cis*-Heptachlor epoxide	**Surface water**  **Bottom sediment**  	GC/HRMS Resolution: 10,000 Column: RH17 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 μm Detection/Quantitation limit: Surface water (pg/L) (3.1) Detection limit 0.2, Quantitation limit 0.6 (3.2) Detection limit 0.3, Quantitation limit 0.7 (3.3) Detection limit 0.3, Quantitation limit 0.7 (6.2) Detection limit 0.4, Quantitation limit 2 (6.3) Detection limit 0.2, Quantitation limit 0.7 Bottom sediment (pg/g-dry) (3.1) Detection limit 0.6, Quantitation limit 2 (3.2) Detection limit 2, Quantitation limit 4 (3.3) Detection limit 2, Quantitation limit 5 (6.2) Detection limit 3, Quantitation limit 9 (6.3) Detection limit 1, Quantitation limit 3

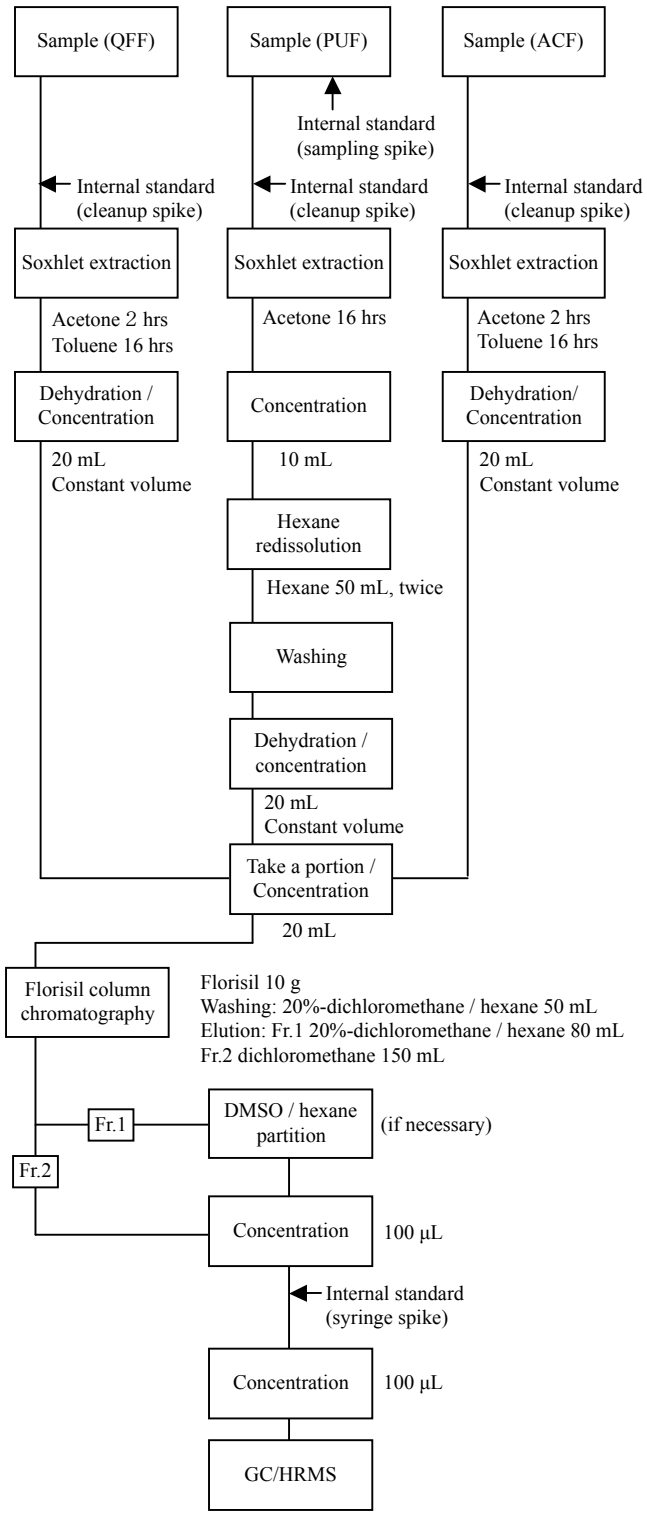
Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(7) Toxaphene (7.1) Parlar-26 (7.2) Parlar-50 (7.3) Parlar-62	**Surface water**  **Bottom sediment**  	GC/NICI-MS Column: RH12 Column length: 60 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection/Quantitation limit: Surface water (pg/L) (7.1) Detection limit 20, Quantitation limit 40 (7.2) Detection limit 30, Quantitation limit 70 (7.3) Detection limit 90, Quantitation limit 300 Bottom sediment (pg/g-dry) (7.1) Detection limit 30, Quantitation limit 90 (7.2) Detection limit 50, Quantitation limit 200 (7.3) Detection limit 2000, Quantitation limit 4000

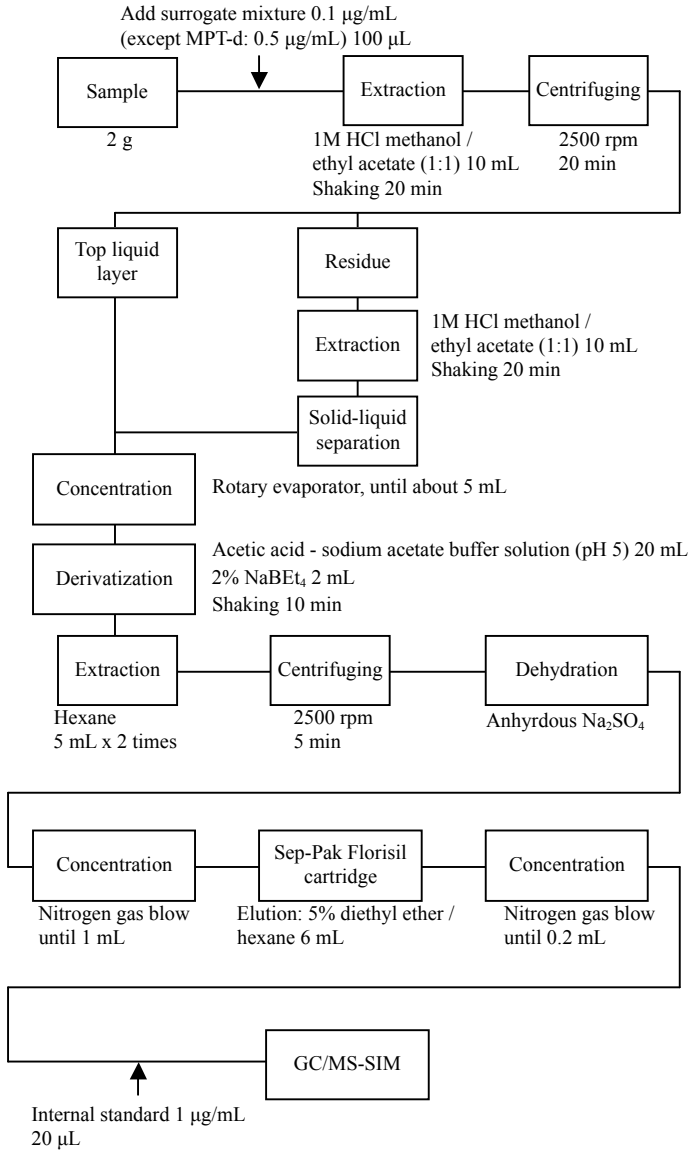
Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(2) HCB (3) Drins (3.1) Aldrin (3.2) Dieldrin (3.3) Endrin (4) DDTs (4.1) *p,p′*-DDT (4.2) *p,p′*-DDE (4.3) *p,p′*-DDD (4.4) *o,p′*-DDT (4.5) *o,p′*-DDE (4.6) *o,p′*-DDD (5) Chlordanes (5.1) *trans*-Chlordane (5.2) *cis*-Chlordane (5.3) *trans*-Nonachlor (5.4) *cis*-Nonachlor (5.5) Oxychlordane (6) Heptachlors (6.1) Heptachlor (6.2) *trans*-Heptachlor epoxide (6.3) *cis*-Heptachlor epoxide (7) Toxaphene (7.1) Parlar-26 (7.2) Parlar-50 (7.3) Parlar-62 (8) Mirex (9) HCHs (9.1) α-HCH (9.2) β-HCH (9.3) γ-HCH (9.4) δ-HCH	**Wildlife** Sample (About 10 g) → Dehydration/grinding (Anhydrous Na_2SO_4) ← Internal standard (cleanup spike) → Soxhlet extraction (Dichloromethane 6 hrs) → Dehydration → Concentration (20 mL) → Take a portion → Florisil column chromatography Florisil 10 g Washing: 20%-dichloromethane / hexane 50 mL Elution: Fr.1 20%-dichloromethane / hexane 110 mL Fr.2 dichloromethane 170 mL → Fr.1, Fr.2 → Further cleanup for samples containing a large amount of fat → Fr.2 † Fr.1 / Fr.2 → Concentration (100 µL) ← Internal standard (syringe spike) → Concentration (100 µL) → GC/HRMS Fr.1: HCB, DDTs, chlordanes, aldrin, heptachlor, HCHs, *trans*-heptachlor epoxide, mirex, toxaphene Note: GC/NICI-MS method is applied for toxaphene. Fr.2: endrin, dieldrin, *cis*-heptachlor epoxide Further cleanup of the Fr.2 is to be conducted by the following procedure for samples containing a large amount of fat Fr.2 † → DMSO / hexane partition (25 mL, 4 times) → DMSO layer (H_2O 100 mL) / Hexane layer → Hexane reverse-phase partition (75 mL, 3 times) → Hexane layer → Water washing (Twice) → Dehydration → †	Other than toxaphene GC/HRMS Column: DB-17HT Column length: 30 m Column I.D.: 0.32 mm Film thickness: 0.15 µm Toxaphene GC/NICI-MS Column: HT8 Column length: 60 m Column I.D.: 0.25 mm Film thickness: 0.15 µm Detection/Quantitation limit: Wildlife (pg/g-wet) (2) 7.5 / 23 (3.1) 0.84 / 2.5 (3.2) 1.6 / 4.8 (3.3) 1.6 / 4.8 (4.1) 3.5 / 11 (4.2) 1.9 / 5.7 (4.3) 3.3 / 9.9 (4.4) 0.97 / 2.9 (4.5) 1.2 / 3.6 (4.6) 2.0 / 6.0 (5.1) 2.4 / 7.2 (5.2) 1.3 / 3.9 (5.3) 1.2 / 3.6 (5.4) 1.6 / 4.8 (5.5) 2.8 / 8.4 (6.1) 2.2 / 6.6 (6.2) 4.4 / 13 (6.3) 2.3 / 6.9 (7.1) 15 / 45 (7.2) 11 / 33 (7.3) 40 / 120 (8) 0.81 / 2.4 (9.1) 0.61 / 1.8 (9.2) 3.3 / 9.9 (9.3) 1.1 / 3.3 (9.4) 1.3 / 3.9 (Detection limit / Quantitation limit)

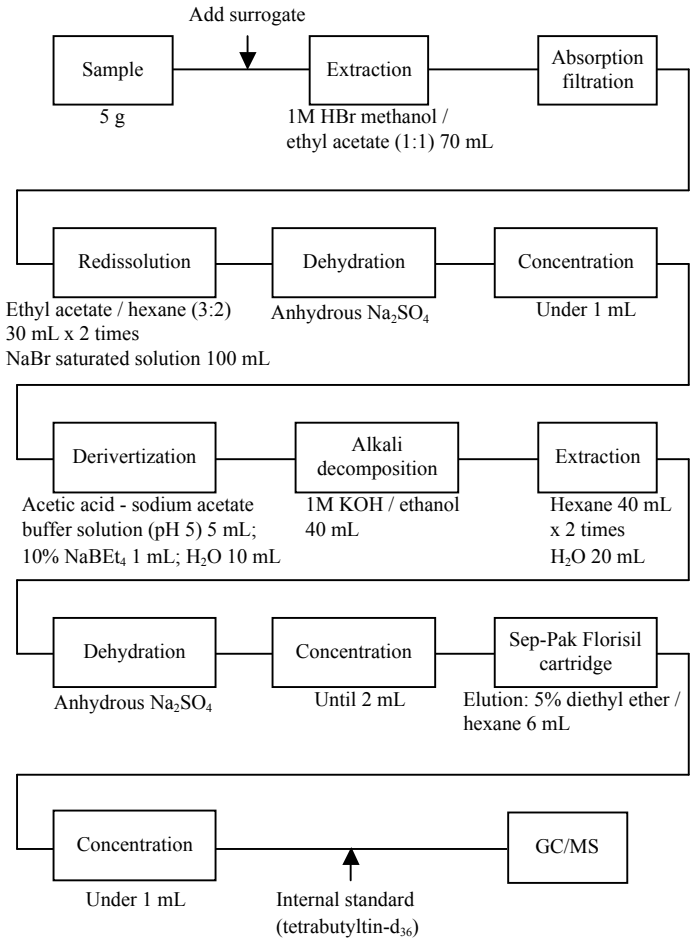
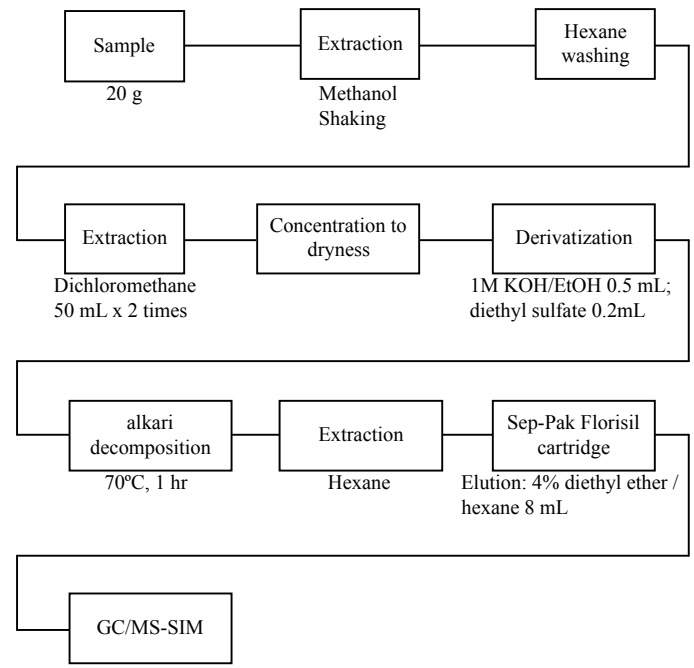
Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(2) HCB (3) Drins (3.1) Aldrin (3.2) Dieldrin (3.3) Endrin (4) DDTs (4.1) *p,p′*-DDT (4.2) *p,p′*-DDE (4.3) *p,p′*-DDD (4.4) *o,p′*-DDT (4.5) *o,p′*-DDE (4.6) *o,p′*-DDD (5) Chlordanes (5.1) *trans*-Chlordane (5.2) *cis*-Chlordane (5.3) *trans*-Nonachlor (5.4) *cis*-Nonachlor (5.5) Oxychlordane (6) Heptachlors (6.1) Heptachlor (6.2) *trans*-Heptachlor epoxide (6.3) *cis*-Heptachlor epoxide (7) Toxaphene (7.1) Parlar-26 (7.2) Parlar-50 (7.3) Parlar-62 (8) Mirex (9) HCHs (9.1) α-HCH (9.2) β-HCH (9.3) γ-HCH (9.4) δ-HCH	**Air** Sampled by high-volume air sampler (HV) with quartz-fiber-filter (QFF), polyurethane form (PUF) and active carbon felt (ACF) sorbent media.  Fr.1: HCB, DDTs, chlordanes, aldrin, heptachlor, HCHs, *trans*-heptachlor epoxide, mirex, toxaphene Note: GC/NICI-MS method is applied for toxaphene. Fr.2: endrin, dieldrin, *cis*-heptachlor epoxide	Other than toxaphene GC/HRMS Column: DB-17HT Column length: 30 m Column I.D.: 0.32 mm Film thickness: 0.15 µm Toxaphene GC/NICI-MS Column: HT8 Column length: 60 m Column I.D.: 0.25 mm Film thickness: 0.15 µm Detection/Quantitation limit: Air (pg/m^3) (2) 0.78 2.3 (3.1) 0.0077 0.023 (3.2) 0.70 2.1 (3.3) 0.014 0.042 (4.1) 0.046 0.14 (4.2) 0.13 0.40 (4.3) 0.018 0.054 (4.4) 0.040 0.12 (4.5) 0.0068 0.020 (4.6) 0.014 0.042 (5.1) 0.29 0.86 (5.2) 0.17 0.51 (5.3) 0.12 0.35 (5.4) 0.0088 0.026 (5.5) 0.015 0.045 (6.1) 0.085 0.25 (6.2) 0.033 0.099 (6.3) 0.0048 0.015 (7.1) 0.066 0.20 (7.2) 0.27 0.81 (7.3) 0.52 1.6 (8) 0.0028 0.0084 (9.1) 0.24 0.71 (9.2) 0.063 0.19 (9.3) 0.19 0.57 (9.4) 0.01 0.03 Detection limit / Quantitation limit

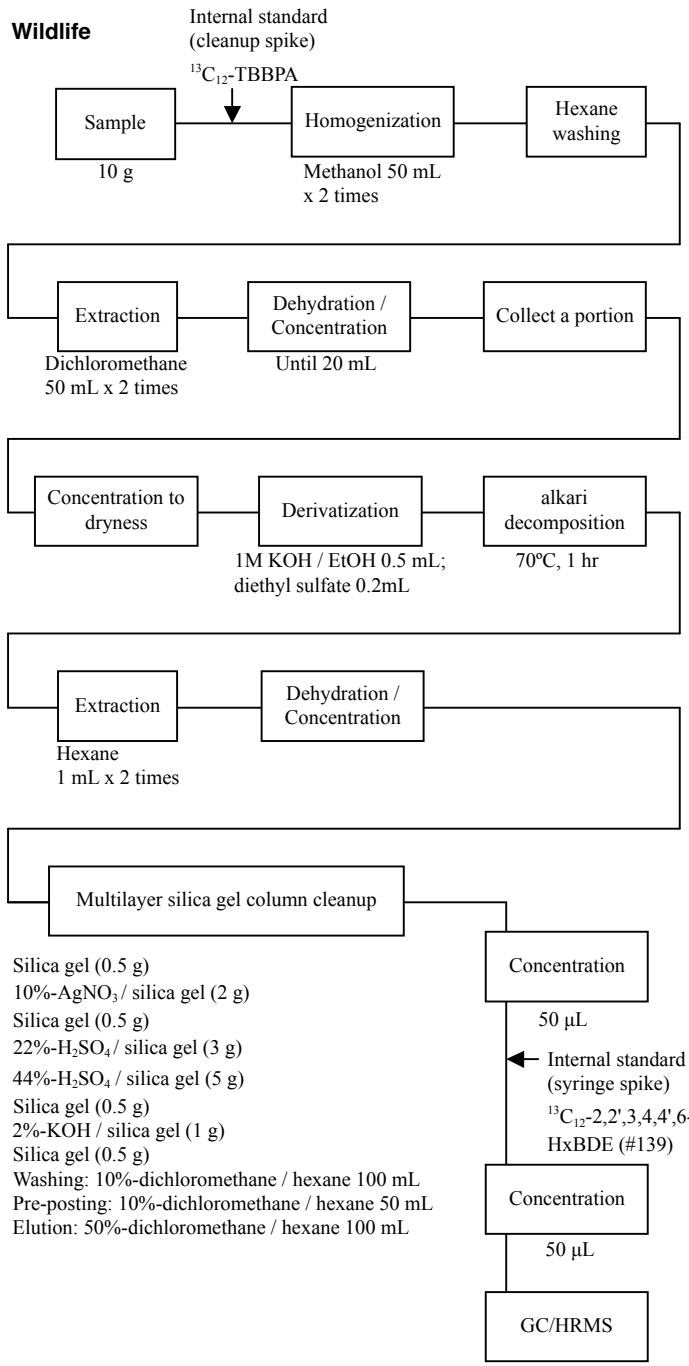
Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(10) Organotin compounds (10.1) TBT (10.2) DBT (10.3) TPT (10.4) DPT (10.5) MPT	**Bottom sediment**  	GC/MS (QP-MS) Column: DB-5MS Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection/Quantitation limit: Bottom sediment (ng/g-dry) (10.1) Detection limit 0.4, Quantitation limit 1.2 (10.2) Detection limit 0.4, Quantitation limit 1.2 (10.3) Detection limit 0.09, Quantitation limit 0.28 (10.4) Detection limit 0.06, Quantitation limit 0.16 (10.5) Detection limit 0.8, Quantitation limit 2.4

Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(10) Organotin compounds (continued) (10.1) TBT (10.2) DBT (10.3) TPT (10.4) DPT (10.5) MPT	**Wildlife**  	GC/MS Column: DB-5MS Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection/Quantitation limit: Wildlife (ng/g-wet) (10.1) Detection limit 1, Quantitation limit 3 (10.2) Detection limit 1, Quantitation limit 3 (10.3) Detection limit 0.5, Quantitation limit 1.5 (10.4) Detection limit 0.5, Quantitation limit 1.5 (10.5) Detection limit 5, Quantitation limit 15
(11) Tetrabromo bisphenol A	**Bottom sediment**  	GC/MS-SIM Column: SGE BPX-5 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection/Quantitation limit: Bottom sediment (ng/g-dry) (11) Detection limit 5.5, Quantitation limit 18

Analytical Method for the FY2003 Monitoring Investigation (continued)

Substance	Analytical Method/Flow Chart	Remarks
(11) Tetrabromo bisphenol A (continued)		GC/HRMS Column: DB-5MS Column length: 60 m Column I.D.: 0.32 mm Film thickness: 0.25 μm or Column: DB-17HT Column length: 60 m Column I.D.: 0.32 mm Film thickness: 0.15 μm Detection/Quantitation limit: Wildlife (ng/g-wet) (11) Detection limit 0.030, Quantitation limit 0.090