CHEMICALS
IN THE ENVIRONMENT

Report on Environmental Survey
and Wildlife Monitoring of Chemicals
in FY2002

Environmental Health Department
Ministry of the Environment
Government of JAPAN

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List of Acronyms

Substance

BHC (HCH)	Benzenehexachloride (Hexachloro cyclohexane)
BHT	2,6-Di-*tert*-butyl-4-methylphenol
DCE	Dichloroethane
DCP	Dichloropropane
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
HCB	Hexachlorobenzene
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-*p*-dioxin
PCDF	Polychlorinated dibenzofuran
PCN	Polychlorinated naphthalene
PERC	Perchloroethylene (Tetrachloroethylene)
TBP	Tributyl phospate
TBT	Tributyltin compounds
TPT	Triphenyltin compounds
TCE	Trichloroethylene

Other

CAS RN	CAS (Chemical Abstracts Service) Registry Number
FY	Fiscal Year (from April to March)
MOE	Ministry of the Environment
ND	Not Detected
POPs	Persistent Organic Pollutants
PRTR	Pollutant Release and Transfer Register
UNEP	United Nations Environment Programme
WHO	World Health Organization

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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 on the other hand, they may affect human health and the ecosystem, depending on the method employed for their production, use and disposal.

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 publishes the results in "Chemicals in the Environment." Results of the environmental surveys of FY2001 are compiled in "Chemicals in the Environment (FY2002)." 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

FY2001 General Inspection Survey of Chemical Substances on Safety: Target chemical substances to be investigated were selected annually classified by aquatic system and air in order to grasp their persistence in the environment throughout Japan. A total of 798 substances were investigated from FY1974 to FY2001.

Monitoring Investigation: Chemical substances and media that were recognized by the above-mentioned survey as being necessary to investigate for persistence have been investigated on a successive basis. 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 Cyanogen, etc.
Environmental Investigation on Agrochemicals	Soil, Agricultural products, Air, Suface 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

Chapter 1 Outline of Environmental Investigation on Chemical Substances

1. General Inspection Survey of Chemical Substances on Environmental Safety

The Law Concerning the Examination and Manufacture, etc. of Chemical Substances (the Chemical Substances Control Law, see Table 1-1 and Appendix A) was enacted in 1973 to prevent environmental pollution by chemical substances such as polychlorinated biphenyl-like chemicals. In response to the enactment of the law, the Environment Agency of Japan (the former MOE) began successive environmental safety inspections a year later, including environmental survey for existing chemicals.

Many substances suspected of posing risks to humans have been regulated on the basis of the results of these environmental surveys. At present, several programs for environmental survey of surface water, bottom sediment, aquatic wildlife and air are being carried out in cooperation between MOE and all local governments in Japan. These surveys have been designed to collect information about the chemical contamination across the entire country, to measure change and variation in chemical contamination over time and space, and also to examine measures for reducing the risks posed by chemical substances. Furthermore, the data obtained may contribute to an understanding of environmental contamination by chemical substances in Japan and in other industrial countries.

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.

2. System of Comprehensive Survey

In order to effectively and systematically investigate the tens of thousands of existing chemical substances, the three-phase system shown in Fig. 1-1 was adopted. The First (FY1979-1988) and Second (FY1989-1998) Comprehensive Survey of Chemical Substances on Environmental Safety were conducted.

Approximately 40% of the substances thus far have been detected (Table 1-2).

Table 1-2 The Results of Environmental Surveys (FY1974-2001)

	Media				
	Water	Bottom sediment	Fish	Air	Total
Surveyed substances	762	738	249	243	798
Detected substances	149	233	100	157	339
Detection ratio (%)	19.6	31.6	40.2	64.6	42.5

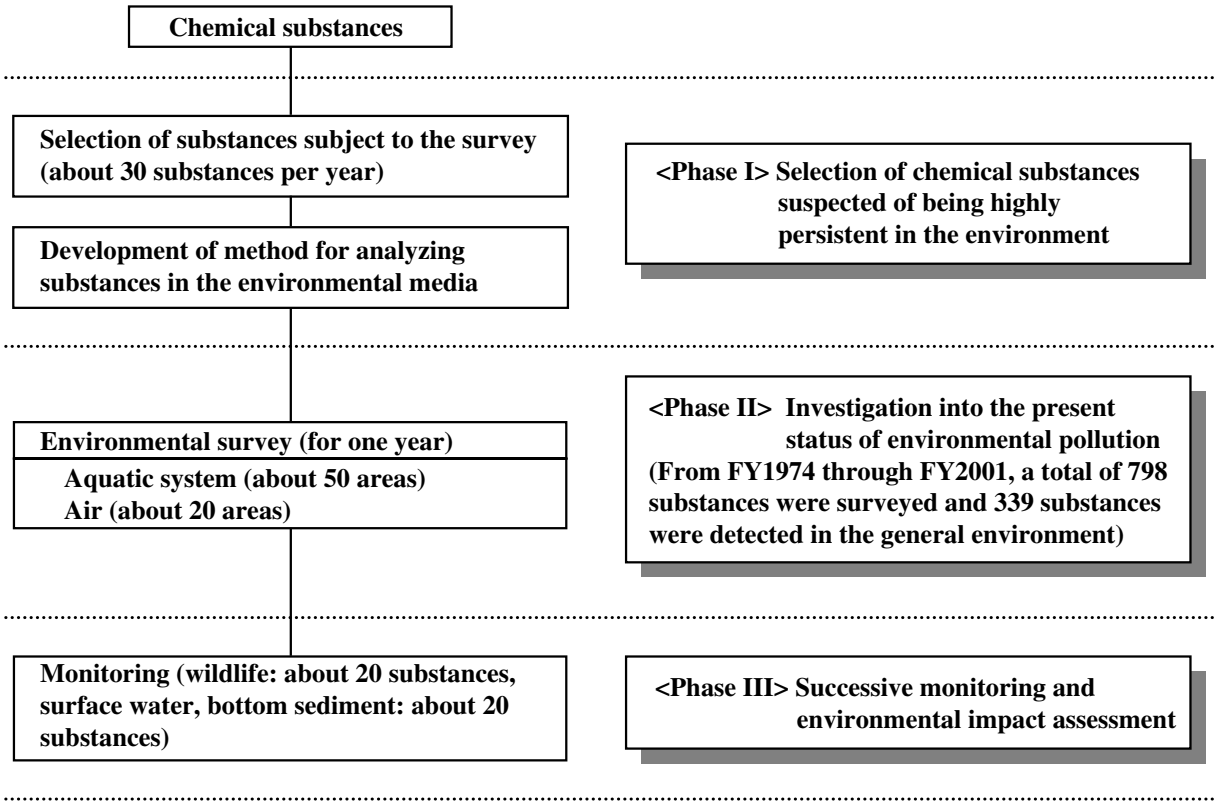

Figure 1-1 System of Comprehensive Survey in FY2001

3. Monitoring of Major Chemical Substances

In order to grasp the persistence of toxic chemical substances artificially produced in the manufacturing and disposing processes of chemical substances, such as Designated Chemical Substances designated by the Chemical Substance Control Law, toxic substances unintentionally formed in the natural reaction processes, and other toxic substances, consecutive measurement as shown in Table 1-3 has been conducted by MOE since the middle of the 1970s.

Locations of the environmental survey, sample number, detection frequency, range of detected values and detection limit for each substance have been summarized in tables and figures.

Table 1-3 Target Chemical Substances and Media for Monitoring

		Media				
	Chemical substance	Surface water	Bottom sediment	Wildlife	Air	Indoor air and diet
1	PCBs			B		
2	HCB		A	B		
3	Dieldrin			B		
4	DDTs and their derivatives		A	B		
5	Chlordanes		A	B		
6	HCHs		A	B		
7	Dichlorobenzenes		A	B		
8	BHT		A			
9	Terphenyls		A			
10	Tributyl phosphate		A			
11	Benzo[*a*]pyrene		A			
12	TBT	C	C	B		
13	TPT	C	C	B		
14	1,4-Dioxane	C	C			
15	TCE, PERC				D	D
16	Carbon tetrachloride				D	D
17	Chloroform				D	D
18	1,2-DCE				D	D
19	1,2-DCP				D	D

Indication	Name of Investigation
A	Monitoring of Bottom Sediment
B	Wildlife Monitoring
C	Investigation and Survey of Designated Chemical Substances – Survey of the Persistence in the Environment
D	Same as the above – Survey of the Exposure Route

4. Other Investigations

In relation to the environmental pollution problems resulting from chemical substances unintentionally formed during the synthesis and combustion processes of chemical substances, persistence of dioxins (PCDDs, PCDFs, coplanar-PCBs) in the general environment had been investigated from FY1985 to FY1997. However, as the investigation of dioxins has been conducted by another division of MOE since 1998 in a related simultaneous survey of the environment, dioxins were excluded from the items investigated in this survey. In FY2001, PCBs (total, each homolog, coplanar-PCBs) were investigated in four media, namely surface water, bottom sediment, wildlife (fish) and air.

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note:

PCB Homolog

"Homologs" are subcategories of PCB congeners having equal numbers of chlorine substituents. For example, the "Tetrachlorobiphenyls" (or "T4CBs", "Tetra-CBs" and "TeCBs") are all PCB congeners with exactly 4 chlorine substituents that may be in any arrangement.

PCB Congener

Any single, unique, well-defined chemical compound in the PCB category is called a "Congener." The name of a congener specifies the total number of chlorine substituents and the position of each one. For example, 4,4'-Dichlorobiphenyl is a congener comprising the Biphenyl structure with two chlorine substituents, one on each of the two carbons at the "4" (also called "para") positions of the two rings. There are 209 PCB congeners.

Chapter 2 Summary of Fiscal Year 2001 General Inspection Survey of Chemical Substances on Environmental Safety

1. Purpose of the Survey

The purpose of this survey is to determine the persistence of chemical substances in the general environment at an early stage, and to grasp its concentration level.

2. Surveyed substances and areas

Twenty-five substances or groups (including 3 newly selected substances) were surveyed in FY2001 for their persistence in the general environment of aquatic system (surface water, bottom sediment, fish) and air.

1) Environmental Survey (aquatic system)

Surveyed substances (12 substances or groups) are shown in Table 2-1 (surface water), Table 2-2 (bottom sediment) and Table 2-3 (fish), and surveyed areas (57 areas throughout Japan) are shown in Figure 2-1. As high priority substances, nitrobenzene and *p*-chloronitrobenzene were surveyed in 50 areas and 2,6-di-*tert*-butylphenol, 2,6-di-*tert*-butyl-4-methylphenol, 2,4,6-tri-*tert*-butylphenol and 2,6-di- *tert*-butyl-4-ethylphenol in 53 areas. Other substances were surveyed in 7 to 17 areas.

2) Environmental Survey (air)

Thirteen substances or groups, considered to be persistent in the air, were selected in the FY2001 survey and were each subject to survey in 6 to 16 areas (Table 2-4). The 22 areas surveyed throughout Japan are shown in Figure 2-2.

3. Sampling method and analytical method

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

4. Survey results

1) Environmental Survey (aquatic system)

Five substances (groups) in water (Table 2-1), 7 substances in bottom sediment were detected (Table 2-2). No substances (groups) were detected in fish (Table 2-3).

2) Environmental Survey (air)

Eleven substances (groups) were detected in air (Table 2-4).

5. Summary of surveyed substances

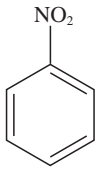
(1) Aquatic system

Although the detection frequencies were generally low in the aquatic system, 7 out of 12 surveyed substances were detected. It is necessary to obtain further information in the future, since the relevant information on these substances is presently limited.

√: detected substance

√ [1] Nitrobenzene
[2] *p*-Chloronitrobenzene
[3] Chlorothalonil
[4] Pyridaphenthion
[5] Butachlor
[6] Ethylene oxide
√[7] 2,6-Di-tert-butylphenol
√[8] 2,6-Di-*tert*-butyl-4-methylphenol
√[9] 2,4,6-Tri-*tert*-butylphenol
√[10] 2,6-Di-*tert*-butyl-4-ethylphenol
√[11] Polychlorinated naphthalene (PCN)
√[12] Long-chain chlorinated paraffins

[1] Nitrobenzene (CAS RN: 98-95-3)



Chemical formula / molecular weight: $C_6H_5NO_2$ / 123.11

Melting point: 6˚C, 5.7˚C

Boiling point: 210 – 211˚C, 211˚C

Water solubility (Sw): 1,900 mg/ℓ (20˚C)

n-Octanol/water partition coefficient (Log Pow): 1.85

Solubility in organic solvents: Soluble in alcohols, benzene and ethers. Soluble in acetone.

Use: Dye/flavor intermediates (aniline, benzidine, quinoline, azobenzene), poison gas (raw material for adamsite), oxidant, solvent (for nitrocellulose), dust suppressant.

Production / import amount:

Production: 146,363 t in 2000

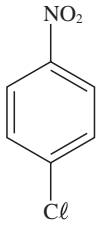
Survey results

In this survey, nitrobenzene was detected in 2 areas out of 49 (5 samples out of 147) in surface water, and in 3 areas out of 48 (6 samples out of 144) in bottom sediment. The range of detected values was 0.046 - 0.51 μg/ℓ in surface water, and 1.4 - 2.3 ng/g-dry in bottom sediment.

○Survey Results of Nitrobenzene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	3% (5/147)	4% (2/49)	0.046 - 0.51 μg/ℓ	0.037 μg/ℓ
Bottom sediment	FY2001	4% (6/144)	6% (3/48)	1.4 - 2.3 ng/g-dry	1.4 ng/g-dry

[2] *p*-Chloronitrobenzene (CAS RN: 100-00-5)



Chemical formula / molecular weight: $C_6H_4C\ell NO_2$ / 157.56

Melting point: 82 – 84˚C

Boiling point: 239 – 242˚C

Water solubility (Sw): Insoluble

n-Octanol/water partition coefficient (Log Pow): 2.39

Solubility in organic solvents: Soluble in alcohols, ethers and benzene. Slightly soluble in cold alcohols. Easily soluble in boiling alcohols, ethers, carbon disulfide.

Use: Raw material for intermediates of azo dyes and sulfide dyes (*p*-phenylenediamine, *p*-nitroaniline, *p*-anisidine, *p*-aminophenol, *p*-chloroaniline, etc.)

Production / import amount :

Production : 15,000 t in 2000 (estimated)

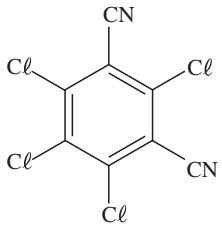
Survey results

In this survey, *p*-chloronitrobenzene was not detected in any samples of water (50 areas, 150 samples) or bottom sediment (48 areas, 144 samples).

○Survey Results of *p* -Chloronitrobenzene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	0% (0/150)	0% (0/50)	ND	0.087 μg/ℓ
Bottom sediment	FY2001	0% (0/144)	0% (0/48)	ND	2.2 ng/g-dry

[3] Chlorothalonil (CAS RN: 1897-45-6)



Chemical formula / molecular weight: $C_8Cℓ_4N_2$ / 265.91

Melting point: 250 – 251˚C

Boiling point: 350˚C

Water solubility (Sw): 0.6 mg/ℓ (room temperature)

n-Octanol/water partition coefficient (Log Pow): 4.37×10^2

Solubility in organic solvents: Soluble in xylene (8%), cyclohexane (3%), acetone (2%), kerosine (<1%), benzene.

Use: Bactericide (disease protection for vegetable, fruit tree and others)

Production / import amount:

Production (in Agricultural Year 2000):

Active ingredient: 3,574.5 t, Powder: 951.1 t (40%); 180.5 t (10%), Hydrate: 891t (40%), Hydrate (flowable): 49.6 t, Smoking agent: 9.9 t (28%), Smoking agent (granule): 2.1 t

Export: 1,701.0 t (active ingredient), 1,163.0 t (dosage form)

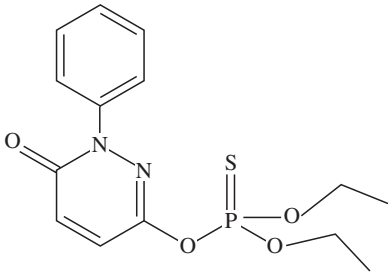
Survey results

In this survey, chlorothalonil was not detected in any water samples (17 areas, 51 samples).

○Survey Results of Chlorothalonil

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	0% (0/51)	0% (0/17)	ND	0.010 μg/ℓ

[4] Pyridaphenthion (CAS RN: 119-12-0)



Chemical formula / molecular weight : $C_{14}H_{17}N_2O_4PS$ / 340.33

Melting point: 53.0 – 57˚C

Boiling point: Unknown

Water solubility (Sw): 74 mg/ℓ , hardly soluble

n-Octanol/water partition coefficient (Log Pow): 3.2

Solubility in organic solvents: Soluble in almost all organic solvents excluding aliphatic hydrocarbon solvents.

Use: Pesticide (mainly used for rice in Japan)

Production / import amount:

Production (in Agricultural Year 2000):

Active ingredient: 105.6 t, Dust (DL): 161.4 t, Wettable powder: 22.4 t, Wettable powder (flowable): 14.6 t, Emulsifiable concentrate: 44.5 kℓ, Granule: 50.3 t (5%)

Export: 61.0 t (active ingredient), 7.0 t (dosage form)

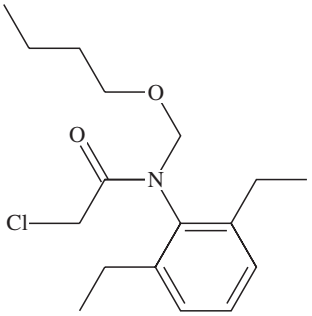
Survey results

In this survey, pyridaphenthion was not detected in any samples of water (17 areas, 51 samples), bottom sediment (17 areas, 51 samples) or fish (16 areas, 48 samples).

◯Survey Results of Pyridaphenthion

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	0% (0/51)	0% (0/17)	ND	0.11 μg/ℓ
Bottom sediment	FY2001	0% (0/51)	0% (0/17)	ND	11 ng/g-dry
Fish	FY2001	0% (0/48)	0% (0/16)	ND	6.9 ng/g-wet

[5] Butachlor (CAS RN: 23184-66-9)



Chemical formula / molecular weight: $C_{17}H_{26}O_2C\ell N$ / 311.85

Melting point: < -5˚C

Boiling point : 196˚C (67Pa), 156˚C (66 Pa, decomposes at 165˚C)

Water solubility (Sw): 20 mg/ℓ (20˚C)

n-Octanol/water partition coefficient (Log Pow): Unknown

Solubility in organic solvents: Soluble in almost all organic solvents. Easily soluble in acetone, methanol, tetrahydrofuran, ethers, benzene, etc.

Use: Herbicide for agricultural use (acetoanilide compound, used as a non-hormone type soil remediation agent and a herbicide)

Production / import amount:

Production: 2 t (granule) in Agricultural Year 1995

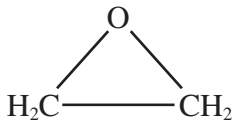
Survey results

In this survey, butachlor was not detected in any samples of water (17 areas, 51 samples), bottom sediment (17 areas, 51 samples) or fish (16 areas, 48 samples).

○Survey Results of Butachlor

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	0% (0/51)	0% (0/17)	ND	0.11 μg/ℓ
Bottom sediment	FY2001	0% (0/51)	0% (0/17)	ND	1.6 ng/g-dry
Fish	FY2001	0% (0/48)	0% (0/16)	ND	1.5 ng/g-wet

[6] Ethylene oxide (CAS RN: 75-21-8)



Chemical formula / molecular weight: C_2H_4O / 44.05

Melting point: -111˚C, -113˚C

Boiling point: 10.7˚C

Water solubility (Sw): Soluble. Easily soluble

n-Octanol/water partition coefficient (Log Pow): 0.30

Solubility in organic solvents: Soluble in alcohols, ethers, benzene, acetone. Miscible with carbon tetrachloride.

Use: Raw material for organic synthesis (ethylene glycol, ethanolamine, alkylethers, etc.), detergent, organic synthetic pigment, fumigant, disinfectant.

Production / import amount:

Production: 989,534 t in 2000

Export: 11,045 kg

Import: 16,629 kg

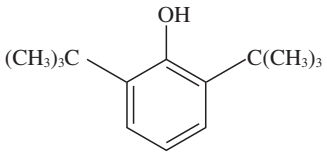
Survey results

In this survey, Ethylene oxide was not detected in any samples of water (9 areas, 27 samples), bottom sediment (9 areas, 27 samples) or fish (8 areas, 24 samples).

○Survey Results of Ethylene oxide

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	0% (0/27)	0% (0/9)	ND	0.098 μg/ℓ
Bottom sediment	FY2001	0% (0/27)	0% (0/9)	ND	2.1 ng/g-dry
Fish	FY2001	0% (0/24)	0% (0/8)	ND	1.9 ng/g-wet

[7] 2,6-Di-*tert*-butylphenol (CAS RN: 128-39-2)



Chemical formula / molecular weight: $C_{14}H_{22}O$ / 206.32

Melting point: 39˚C, 37˚C

Boiling point: 253 – 254˚C

Water solubility (Sw): Insoluble

n-Octanol/water partition coefficient (Log Pow): Unknown

Solubility in organic solvents: Easily soluble in benzene, toluene, hexane, methanol

Use: Raw material for hindered phenol-type antioxidant. Raw material for pesticides and medicines (in abroad).

Production / import amount:

Production: 4,300 t (estimated) in 2000

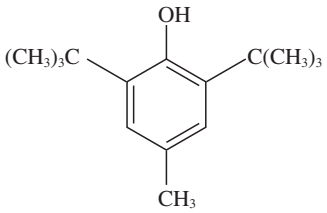
Survey results

In this survey, 2,6-di-*tert*-butylphenol was not detected in any water samples (53 areas, 159 samples). However, it was detected in bottom sediment (4 areas out of 51, 12 samples out of 153) and the range of detected values was 2.4 – 14 ng/g-dry.

○Survey Results of 2,6-Di-*tert* -butylphenol

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	0% (0/159)	0% (0/53)	ND	0.17 μg/ℓ
Bottom sediment	FY2001	8% (12/153)	8% (4/51)	2.4 - 14 ng/g-dry	1.9 ng/g-dry

[8] 2,6-Di-*tert*-butyl-4-methylphenol (CAS RN: 128-37-0)



Chemical formula / molecular weight: $C_{15}H_{24}O$ / 220.35

Melting point: 70˚C, 71˚C

Boiling point: 265˚C

Water solubility (Sw): Insoluble, 0.4 mg/ℓ (20˚C)

n-Octanol/water partition coefficient (Log Pow): Unknown

Solubility in organic solvents : Easily soluble in toluene. Soluble in almost any organic solvents such as methanol, ethanol, isopropanol, methyl-ethyl-ketone, acetone, cellosolve, petroleum ether, benzene.

Use: Food additive, feed additive; antioxidant for petroleum products, synthetic rubber, plastics, animal/vegetable oil, soap; anti-skinning agent for paint and ink.

Production / import amount: Unknown

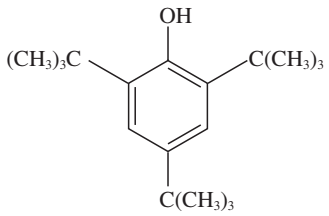
Survey results

In this survey, 2,6-di-*tert*-butyl-4-methylphenol was detected in 10 areas out of 52 (26 samples out of 156) in surface water, and in 15 areas out of 53 (36 samples out of 159) in bottom sediment. The range of detected values was 0.060 - 1.6 μg/ℓ in surface water, and 6.8 - 77 ng/g-dry in bottom sediment.

○Survey Results of 2,6-Di-*tert* -butyl-4-methylphenol

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	17% (26/156)	19% (10/52)	0.060 - 1.6 μg/ℓ	0.050 μg/ℓ
Bottom sediment	FY2000	23% (36/159)	28% (15/53)	6.8 - 77 ng/g-dry	6.4 ng/g-dry

[9] 2,4,6-Tri-*tert*-butylphenol (CAS RN: 732-26-3)



Chemical formula / molecular weight: $C_{18}H_{30}O$ / 262.43

Melting point: 129 – 132˚C

Boiling point: 277˚C

Water solubility (Sw): Unknown

n-Octanol/water partition coefficient (Log Pow): Unknown

Use: Anti-aging agent for rubber and plastic products.

Production / import amount: Unknown

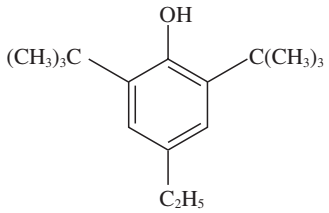
Survey results

In this survey, 2,4,6-tri-*tert*-butylphenol was not detected in any water samples (51 areas, 153 samples). However, it was detected in bottom sediment (1 areas out of 53, 2 samples out of 159) and the range of detected values was 9.3 - 14 ng/g-dry.

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

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	0% (0/153)	0% (0/51)	ND	0.020 μg/ℓ
Bottom sediment	FY2001	1% (2/159)	2% (1/53)	9.3 - 14 ng/g-dry	7.0 ng/g-dry

[10] 2,6-Di-*tert*-butyl-4-ethylphenol (CAS RN: 4130-42-1)



Chemical formula / molecular weight: $C_{16}H_{26}O$ / 234.38

Melting point: 43˚C over

Boiling point: Unknown

Water solubility (Sw): Hardly soluble

n-Octanol/water partition coefficient (Log Pow): Unknown

Use: Anti-aging agent for rubber, antioxidant for polyolefin.

Production / import amount: Approximately 1,000 t in 1996

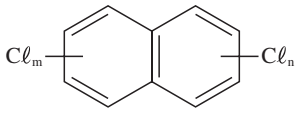
Survey results

In this survey, 2,6-di-*tert*-butyl-4-ethylphenol was detected in 2 areas out of 51 (5 samples out of 153) in surface water, and in 4 areas out of 53 (8 samples out of 159) in bottom sediment. The range of detected values was 0.063 – 0.21 μg/ℓ in surface water, and 3.5 – 74 ng/g-dry in bottom sediment.

○Survey Results of 2,6-Di-*tert* -butyl-4-ethylphenol

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	3% (5/153)	4% (2/51)	0.063 - 0.21 μg/ℓ	0.055 μg/ℓ
Bottom sediment	FY2001	5% (8/159)	8% (4/53)	3.5 – 74 ng/g-dry	3.3 ng/g-dry

[11] Polychlorinated naphthalene (PCN) (CAS RN: 70776-03-3)



Chemical formula : $C_{10}H_{8-(m+n)}C\ell_{m+n}$

	Tri-CNs	Tetra-CNs	Penta-CNs	Hexa-CNs	Hepta-CNs	Octa-CN
CAS RN:	1321-65-9	1335-88-2	1321-64-8	1335-87-1	32241-08-0	2234-13-1
Chemical formula:	$C_{10}H_5C\ell_3$	$C_{10}H_4C\ell_4$	$C_{10}H_3C\ell_5$	$C_{10}H_2C\ell_6$	$C_{10}HC\ell_7$	$C_{10}C\ell_8$
Molecular weight:	231.51	265.95	300.40	334.84	369.29	403.73
Melting point:	93˚C	182˚C, 115˚C	120˚C	137˚C	Unknown	192˚C, 198˚C
Boiling point:	304 - 354˚C	311.5 - 360˚C	327 - 371˚C	344 - 388˚C	Unknown	440˚C, 246 - 250˚C
Water solubility (Sw):	Insoluble, 0.0017 - 0.0064 mg/ℓ	Insoluble	Insoluble	Insoluble	Unknown	Insoluble, 0.08 μg/ℓ
n-Octanol/water partition coefficient (Log Pow):	5.12 - 5.35	5.5	Unknown	7.59	Unknown	6.42, 6.5

Solubility in organic solvent: Slightly soluble in alcohol (Octa-CN). Soluble in benzene, chloroform. Easily soluble in petroleum ether.

Use: Substitute for PCB (special high boiling point solvent)

Production amount: Chlorinated compounds with the chlorine number of 3 and more are designated as a Class 1 Specified Chemical Substance by the Chemical Substances Control Law and currently no data is available on production / import amount of them.

Survey results

In this survey, PCNs were detected in 5 areas out of 8 (12 samples out of 24) in surface water, and in 8 areas out of 8 (24 samples out of 24) in bottom sediment. The range of detected values was 5.2 – 94 pg/ℓ in surface water, and 0.020 – 4.1 ng/g-dry in bottom sediment.

○ Survey Results of Total Polychlorinated naphthalene (PCN)

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	50% (12/24)	62% (5/8)	5.2 – 94 pg/ℓ	4.0 – 20 pg/ℓ
Bottom sediment	FY2001	100% (24/24)	100% (8/8)	0.020 – 4.1 ng/g-dry	0.0005 – 0.005 ng/g-dry

[12] Long-chain chlorinated paraffins (average carbon chain length: C24) (CAS RN: 63449-39-8)

Chemical formula: $C_{24}H_{44}C\ell_6$ (chlorination rate: 40%) in average, $C_{24}H_{29}C\ell_{21}$ (chlorination rate: 70%)
Molecular weight: 545 – 1,062.5
Melting point: Unknown
Boiling point: Unknown
Water solubility (Sw): 0.01 g/mℓ (chlorination rate: 40-40.5%), 10 g/ℓ (chlorination rate: 52%), insoluble (chlorination rate: 68-72%).
n-Octanol/water partition coefficient (Log Pow): Unknown
Solubility in organic solvents: Slightly soluble in alcohols. Miscible with benzene, chloroform, ethers, carbon tetrachloride.
Use: Fireproof paint for ship, water/fire proofing material for sail cloth, curtain, etc., plasticiser for PVC, noninflammable lacquer enamel for synthetic resins, rubber, etc., road paint, printing ink, heavy duty lubricating oil, etc.
Production / import amount: Unknown

Survey results

In this survey, long-chain chlorinated paraffins (chlorination rate: 40%) were detected in 1 area out of 7 (2 samples out of 21) in surface water, and in 6 areas out of 7 (17 samples out of 21) in bottom sediment. However, it was not detected in fish (7 areas, 21 samples). The range of detected values was 0.49 - 0.77 μg/ℓ in surface water, and 42 - 2,000 ng/g-dry in bottom sediment.

○Survey Results of Long-chain chlorinated paraffins (chlorination rate: 40%)

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	10% (2/21)	14% (1/7)	0.49 – 0.77 μg/ℓ	0.28 μg/ℓ
Bottom sediment	FY2001	81% (17/21)	86% (6/7)	42 – 2,000 ng/g-dry	38 ng/g-dry

Long-chain chlorinated paraffins (chlorination rate: 70%) were detected in 1 area out of 7 (2 samples out of 21) in surface water, and in 6 areas out of 7 (16 samples out of 21) in bottom sediment. However, it was not detected in fish (7 areas, 21 samples). The range of detected values was 0.46 – 0.83 μg/ℓ in surface water, and 11 – 390 ng/g-dry in bottom sediment.

○Survey Results of Long-chain chlorinated paraffins (chlorination rate: 70%)

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2001	10% (2/21)	14% (1/7)	0.46 – 0.83 μg/ℓ	0.14 μg/ℓ
Bottom sediment	FY2001	76% (16/21)	86% (6/7)	11 – 390 ng/g-dry	11 ng/g-dry

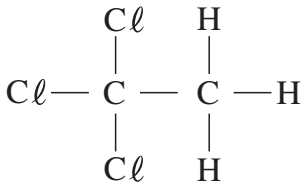
(2) Air

11 substances out of 13 were detected in air.

√ : detected substance

√ [1] 1,1,1-Trichloroethane
√ [2] 1,1,2-Trichloroethane
√ [3] Ethyl chloride
√ [4] Methyl chloride
√ [5] Dimethyl terephthalate
√ [6] Diethyl terephthalate
[7] Methyl acrylate
√ [8] Ethyl acrylate
√ [9] Acetonitrile
√ [10] Diisononyl phthalate (DINP)
√ [11] Diisodecyl phthalate
[12] Diisotridecyl phthalate
√ [13] Polybrominated diphenylether

[1] 1,1,1-Trichloroethane (CAS RN: 71-55-6)



Chemical formula / molecular weight: $C_2H_3C\ell_3$ / 133.40

Specific weight: 1.3376 (20/4˚C), 1.345 (15/4˚C), 1.3 (15/4˚C), 1.3492 (20/4˚C)

Melting point: -30.4˚C, -32.5˚C, -30˚C, -32˚C, -32.96˚C

Boiling point: 74.1˚C (101 kPa), 74˚C

Water solubility (Sw): 4,400 mg/L (20˚C), Insoluble

n-Octanol/water partition coefficient (LogPow): 2.17

Solubility in organic solvents: Soluble in acetone, benzene, methanol, carbon tetrachloride and carbon disulfide. 10% soluble in ethanol, ethylether and chloroform.

Vapor pressure: 13 kPa (20˚C), 17 kPa (25˚C), 21 kPa (30˚C)

Use: Reagent, raw material for synthesis

Production / import amount:

Export: 16,970,373 kg in 2000

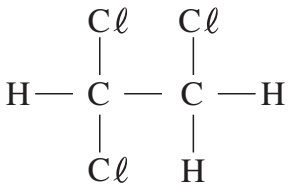
Survey results

In this survey, 1,1,1-trichloroethane was detected in 16 areas out of 16 (48 samples out of 48) and the range of detected values was 170 – 420 ng/m^3.

○Survey Results of 1,1,1-Trichloroethane

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	100% (48/48)	100% (16/16)	170 – 420 ng/m^3	12 ng/m^3

[2] 1,1,2- Trichloroethane (CAS RN: 79-00-5)



Chemical formula / molecular weight: $C_2H_3C\ell_3$ / 133.40

Specific weight: 1.4416 (20/4˚C), 1.4432 (20/4˚C), 1.44 (20/4˚C), 1.4, 1.433 (25/25˚C)

Melting point: -35˚C, -36.5˚C, -36˚C

Boiling point: 114˚C, 113.8˚C (101 kPa), 113.7˚C

Water solubility (Sw): 4,400 mg/ℓ (20˚C), 4,500 mg/ℓ (20˚C)

n-Octanol/water partition coefficient (Log Pow): 1.78, 1.6

Solubility in organic solvents: 10% soluble in chloroform, ethanol, ethylether. Soluble in esters, ketones, ethers. Soluble in various organic solvents.

Vapor pressure : 2.2 kPa (20˚C), 2.5 kPa (20˚C), 3.1 kPa (25˚C), 4.3 kPa (30˚C), 5.3 kPa (35.2˚C), 5.3 kPa (35˚C)

Use: Solvent for fats, oils, waxes, natural resins and alkaloids

Production / import amount: Unknown

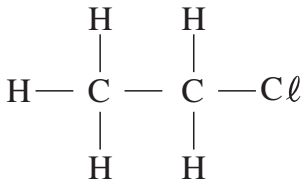
Survey results

In this survey, 1,1,2-trichloroethane was detected in 3 areas out of 16 (4 samples out of 48) and the range of detected values was 20 – 27 ng/m^3.

○Survey Results of 1,1,2-Trichloroethane

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	8% (4/48)	19% (3/16)	20 – 27 ng/m^3	20 ng/m^3

[3] Ethyl chloride (CAS RN: 75-00-3)



Chemical formula / molecular weight: $C_2H_5C\ell$ / 64.51

Specific weight: 0.9214 (0/0˚C), 0.9028 (10˚C), 0.917 (6/6˚C), 0.92 (0/4˚C), 0.918

Melting point: -138.7˚C, -136.4˚C, -138.3˚C, -142˚C

Boiling point: 12.5˚C (101.3 kPa), 12.3˚C (101 kPa), 12.4˚C

Water solubility (Sw): 5,740 mg/ℓ (20˚C), 3,330 mg/ℓ (0˚C)

n-Octanol/water partition coefficient (Log Pow): 1.43, 1.54, 1.39

Solubility in organic solvents: 48.3 g/100mℓ in alcohol, Easily miscible with alcohols and ethers.

Vapor pressure: 133 kPa (20˚C), 61 kPa (0˚C), 93 kPa (10˚C), 193 kPa (30˚C)

Use: Refrigerant, topical anesthetic, alkylation reagent and insecticide, and in the production of ethyl cellulose and Ziegler-type catalyst.

Production / import amount: Unknown

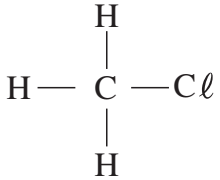
Survey results

In this survey, ethyl chloride was detected in 16 areas out of 16 (46 samples out of 48) and the range of detected values was 14 – 540 ng/m^3.

○Survey Results of Ethyl chloride

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	96% (46/48)	100% (16/16)	14 – 540 ng/m^3	6.0 ng/m^3

[4] Methyl chloride (CAS RN: 74-87-3)



Chemical formula / molecular weight: $CH_3C\ell$ / 50.49

Specific weight: 0.92 (20˚C), 0.918 (20/4˚C), 0.9159 (20˚C), 0.99 (25˚C)

Melting point: -97.7˚C, -97.6˚C, -97˚C

Boiling point: -23.7˚C, -24.2˚C, -24˚C

Water solubility (Sw): 3,030 mℓ/ℓ(20˚C), 4,000 mℓ/ℓ, 6,500 mg/ℓ (30˚C, 1,013hPa), 4,800 mg/ℓ (25˚C)

n-Octanol/water partition coefficient (Log Pow): 0.85, 0.91 (25˚C)

Solubility in organic solvents: Soluble in alcohol and chloroform. Soluble in benzene (4,723 mℓ/100mℓ), carbon tetrachloride (3,756 mℓ/100mℓ), glacial acetic acid (3,679 mℓ/100mℓ), ethanol (3,740 mℓ/100mℓ (20˚C)).

Vapor pressure: 475 kPa (20˚C), 507 kPa (20˚C)

Use: Medicine, pesticides, foaming agent, nonflammable film, organic synthesis (for manufacturing butyl rubber, silicon resin, methylcellulose), methylating agent for other organic synthesis, extractant or solvent at low temperature.

Production / import amount:

Production: 176,541 t in 2000

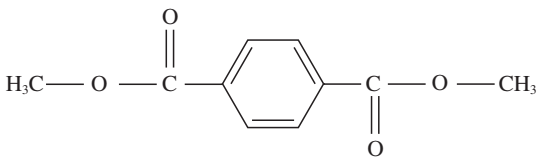
Survey results

In this survey, methyl chloride was detected in 16 areas out of 16 (48 samples out of 48) and the range of detected values was 750 – 16,000 ng/m^3.

○Survey Results of Methyl chloride

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	100% (48/48)	100% (16/16)	750 – 16,000 ng/m^3	12 ng/m^3

[5] Dimethyl terephthalate (CAS RN: 120-61-6)



Chemical formula / molecular weight: $C_{10}H_{10}O_4$ / 194.19

Specific weight: 1.065, 1.35

Melting point: 140.6˚C, 140˚C, 141 - 142˚C

Boiling point: 288˚C, 284˚C

Water solubility (Sw): Hardly soluble, insoluble, 3,300 mg/ℓ (in boiling water)

n-Octanol/water partition coefficient (Log Pow): Unknown

Solubility in organic solvents: Soluble in hot alcohol. Easily soluble in ethers. Slightly soluble in methanol.

Vapor pressure: 1.7 kPa (150˚C), 2.1 kPa (100˚C), 19 kPa (150˚C)

Use: Polyester type synthetic fiber and film (Currently high purity terephthalic acid is the preferred raw material for synthetic fiber.)

Production / import amount:

Production: 291,894 t in 2000

Export: 2,540 t

Import: 81,484 t

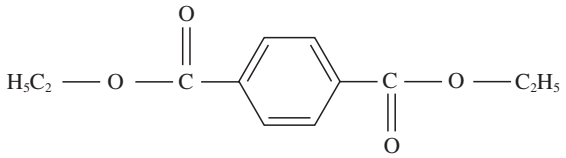
Survey results

In this survey, dimethyl terephthalate was detected in 1 area out of 13 (3 samples out of 38) and the range of detected values was 0.074 – 0.093 ng/m^3.

○Survey Results of Dimethyl terephthalate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	9% (3/38)	8% (1/13)	0.074 – 0.093 ng/m^3	0.030 ng/m^3

[6] Diethyl terephthalate (CAS RN: 636-09-9)



Chemical formula / molecular weight: $C_{12}H_{14}O_4$ / 222.24

Specific weight: 1.1

Melting point: 302.2˚C

Boiling point: 42 – 45˚C

Water solubility (Sw): Unknown

n-Octanol/water partition coefficient (Log Pow): Unknown

Solubility in organic solvents: Unknown

Vapor pressure: Unknown

Use: Unknown

Production / import amount: Unknown

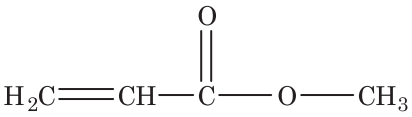
Survey results

In this survey, diethyl terephthalate was detected in 1 area out of 13 (3 samples out of 38) and the range of detected values was 0.16 – 0.22 ng/m^3.

○Survey Results of Diethyl terephthalate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	8% (3/38)	8% (1/13)	0.16 – 0.22 ng/m^3	0.042 ng/m^3

[7] Methyl acrylate (CAS RN: 96-33-3)



Chemical formula / molecular weight: $C_4H_6O_2$ / 86.09

Specific weight: 0.925 (25/25˚C), 0.95

Melting point: -77˚C

Boiling point: 80˚C (101.2 kPa)

Water solubility (Sw): 60 g/ℓ (20˚C)

n-Octanol/water partition coefficient (Log Pow): Unknown

Vapor pressure: 9.0 kPa (20˚C)

Use (as acrylic ester): Acrylic fiber, processing of textiles, paint, processing of paper, adhesive, processing of leather, acrylic rubber.

Production / import amount (as acrylic ester):

Production: 253,370 t in 2000

Export : 78,279 t

Import : 34,059 t

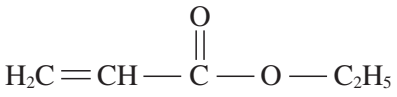
Survey results

In this survey, methyl acrylate was not detected in any air samples of air (5 areas, 15 samples).

○ Survey Results of Methyl acrylate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	0% (0/15)	0% (0/5)	ND	0.6 ng/m^3

[8] Ethyl acrylate (CAS RN: 140-88-5)



Chemical formula / molecular weight: $C_5H_8O_2$ / 100.12

Specific weight: 0.9405 (20/4˚C), 0.919 (25/25˚C), 0.923 (20/20˚C), 0.9234 (20˚C), 0.924 (20/4˚C)

Melting point: -71.2˚C, -71˚C, <-75˚C

Boiling point: 99.4˚C (101.3 kPa), 99.5˚C, 20˚C (5.2 kPa), 100˚C

Water solubility (Sw): 20 g/ℓ (20˚C), 15 g/ℓ (20˚C), 18 g/ℓ (25˚C)

n-Octanol/water partition coefficient(Log Pow): 1.32, 1.18

Solubility in organic solvents: Soluble in alcohols and ethers. 10% soluble in chloroform, alcohols and ethers.

Vapor pressure: 3.9 kPa (20˚C), 3.8 kPa (20˚C), 2.7 kPa (20˚C), 6.5 kPa (30˚C), 16.5 kPa (50˚C)

Use (as acrylic ester): Acrylic fiber, processing of textiles, paint, processing of paper, adhesive, processing of leather, acrylic rubber.

Production / import amount (as acrylic ester):

Production: 253,370 t in 2000

Export : 78,279 t

Import : 34,059 t

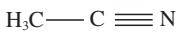
Survey results

In this survey, ethyl acrylate was detected in 1 area out of 5 (3 samples out of 15) and the range of detected values was 0.6 – 1.8 ng/m^3.

○ Survey Results of Ethyl acrylate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	20% (3/15)	20% (1/5)	0.6 – 1.8 ng/m^3	0.5 ng/m^3

[9] Acetonitrile (CAS RN: 75-05-8)



Chemical formula / molecular weight: C_2H_3N / 41.05

Specific weight: 0.78745 (15/4˚C), 0.77125 (30/4˚C), 0.7822 (20˚C), 0.783, 0.7868 (20/20˚C), 0.79 (20/4˚C)

Melting point: -45˚C, -44.9˚C, -41˚C, -48˚C

Boiling point: 81.6˚C (101 kPa), 82˚C

Water solubility (Sw): Miscible, easily miscible, soluble.

n-Octanol/water partition coefficient (Log Pow): -0.34

Solubility in organic solvents: Miscible with methanol, ethyl acetate, acetone, acetamide solution, chloroform, carbon tetrachloride and many unsaturated hydrocarbons. Not miscible with saturated hydrocarbons.

Vapor pressure: 9.7 kPa (20˚C), 9.9 kPa (20˚C), 12 kPa (24˚C), 13 kPa (27˚C)

Use : Raw material for vitamin B_1 and sulfa drug, extraction solvent for butylene-butane, synthetic fiber, solvent for other use, raw material for organic synthesis, flavor, extract, denaturant.

Production / import amount:

Production: 5,000 t in 2000

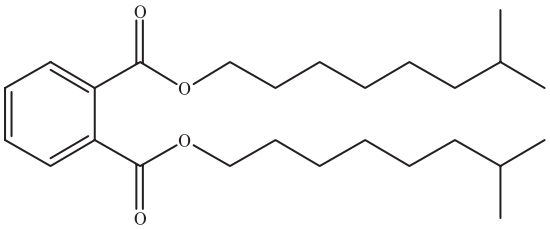
Survey results

In this survey, acetonitrile was detected in 7 areas out of 7 (17 samples out of 17) and the range of detected values was 93 – 1,200 ng/m^3.

○Survey Results of Acetonitrile

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	100% (17/17)	100% (7/7)	93 – 1,200 ng/m^3	76 ng/m^3

[10] Diisononyl phthalate (DINP) (CAS RN: 28553-12-0)



Chemical formula / molecular weight: $C_{26}H_{42}O_4$ / 418.62

Specific weight: 0.972 (20/20˚C), 0.976

Melting point: -48˚C

Boiling point: 252˚C (667 Pa), 403˚C

Water solubility (Sw): 0.0006 mg/ℓ , 0.2 mg/ℓ

n-Octanol/water partition coefficient (Log Pow): Unknown

Vapor pressure: 5.4×10^{-7} mmHg (25˚C), 0.2 Pa (100˚C), 66 Pa (200˚C), 80 Pa (200˚C), 5.3 kPa (300˚C)

Use: High- grade leather, film, sheet, electric cable, high- grade wallpaper, paste sol, etc.

Production / import amount:

Production: 108,358 t in 2000

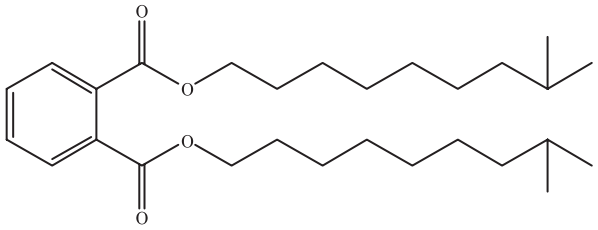
Survey results

In this survey, diisononyl phthalate was detected in 7 areas out of 7 (20 samples out of 21) and the range of detected values was 0.42 – 22 ng/m^3.

○Survey Results of Diisononyl phthalate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	95% (20/21)	100% (7/7)	0.42 – 22 ng/m^3	0.40 ng/m^3

[11] Diisodecyl phthalate (CAS RN: 26761-40-0)



Chemical formula / molecular weight: $C_{28}H_{46}O_4$ / 446.67

Specific weight: 0.968 (20˚C), 0.966 (20˚C), 0.96, 0.969 (20˚C)

Melting point: -50˚C

Boiling point: 420˚C (101 kPa), 250 – 257˚C (533 Pa), 250 - 257˚C (0.5 kPa), 200˚C (40 Pa)

Water solubility (Sw): Insoluble, 0.28 mg/ℓ , 1.19 mg/ℓ

n-Octanol/water partition coefficient (Log Pow): 3 – 4

Solubility in organic solvents: Insoluble in glycerol, glycol and several amines. Soluble in most organic solvent. Easily soluble in ethanol, benzene and ethers.

Vapor pressure: 40 Pa (200˚C), 147 Pa (200˚C), 1.1 kPa (250˚C), 3.7×10^{-8} mmHg (25˚C)

Use: Heat resistant power cable, agricultural vinyl film, (leather, sheet, paste)

Production / import amount:

Production: 7,855 t in 1996

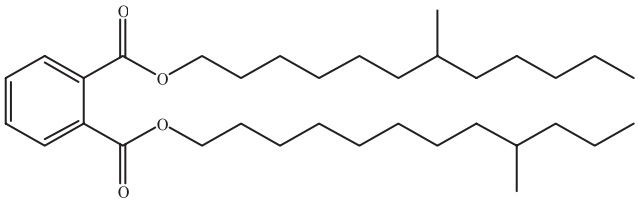
Survey results

In this survey, diisodecyl phthalate was detected in 6 areas out of 7 (12 samples out of 21) and the range of detected values was 0.30 – 1.3 ng/m^3.

○Survey Results of Diisotridecyl phthalate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	57% (12/21)	86% (6/7)	0.30 – 1.3 ng/m^3	0.30 ng/m^3

[12] Diisotridecyl phthalate (CAS RN: 27253-26-5)



Chemical formula / molecular weight: $C_{34}H_{58}O_4$ / 530.83

Specific weight: 0.969

Boiling point: 249 – 256˚C (533 Pa)

Water solubility (Sw): Insoluble, 0.34 mg/ℓ

n-Octanol/water partition coefficient (Log Pow): Unknown

Solubility in organic solvents: Easily soluble in benzene and ethers

Vapor pressure: 147 Pa (200˚C), 5.0×10^{-7} mmHg (25˚C)

Use: Plasticizer for polyvinyl chloride resin

Production / import amount: Unknown

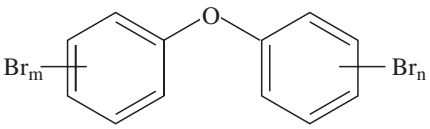
Survey results

In this survey, diisotridecyl phthalate was not detected in any air samples of air (7 areas, 21 samples).

○Survey Results of Diisotridecyl phthalate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	0% (0/21)	0% (0/7)	ND	0.1 ng/m^3

[13] Polybrominated diphenylether (PBDE, 1 - 7 brominated compounds) (CAS RN: –)



Chemical formula / molecular weight : $C_{12}H_{10-(m+n)}OBr_{m+n}$ / 249.11 – 722.48

	Mono-BDEs	Di-BDEs	Tri-BDEs	Tetra-BDEs	Penta-BDEs	Hexa-BDEs	Hepta-BDEs
Chemical formula:	$C_{12}H_9OBr$	$C_{12}H_8OBr_2$	$C_{12}H_7OBr_3$	$C_{12}H_6OBr_4$	$C_{12}H_5OBr_5$	$C_{12}H_4OBr_6$	$C_{12}H_3OBr_7$
Specific weight:	1.42						
Melting point:	18˚C	58.5˚C			-7 - -3˚C		
Boiling Point:	304˚C, 305 - 310˚C	338˚C, 340˚C			>200˚C		
Sw:	48 mg/ℓ						
Log Pow:	4 - 5				>6		
Vapor Pressure:	0.2 Pa (20˚C)				>933 – 1,333 Pa		

Use: Mono-BDEs: Synthetic intermediate, heating medium

Di-BDEs: Synthetic intermediate, flame retardant

Tri-BDEs: Solvent, detergent, flame retardant

Tetra-BDEs: Flame retardant

Penta-BDEs: Additive for epoxy resin, phenol resin, polyester, polyurethane, textiles

Hexa-BDEs: Flame retardant

Hepta-BDEs: Unknown

Production amount: Approximately 1,000 t (tri-BDEs) in 1987

Survey results

In this survey, total polybrominated diphenylether (1 - 7 brominated compounds) was detected in 12 areas out of 12 (36 samples out of 36) and the range of detected values was 0.00007 – 0.067 ng/m^3 (0.07 - 67 pg/m^3).

○Survey Results of Total Polybrominated diphenylether (1 - 7 brominated compounds)

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2001	100% (36/36)	100% (12/12)	0.00007 – 0.067 ng/m^3 (0.07 – 67 pg/m^3)	Determined individually

Figure 2-1 Locations of the Environmental Survey for the Aquatic System (FY2001)

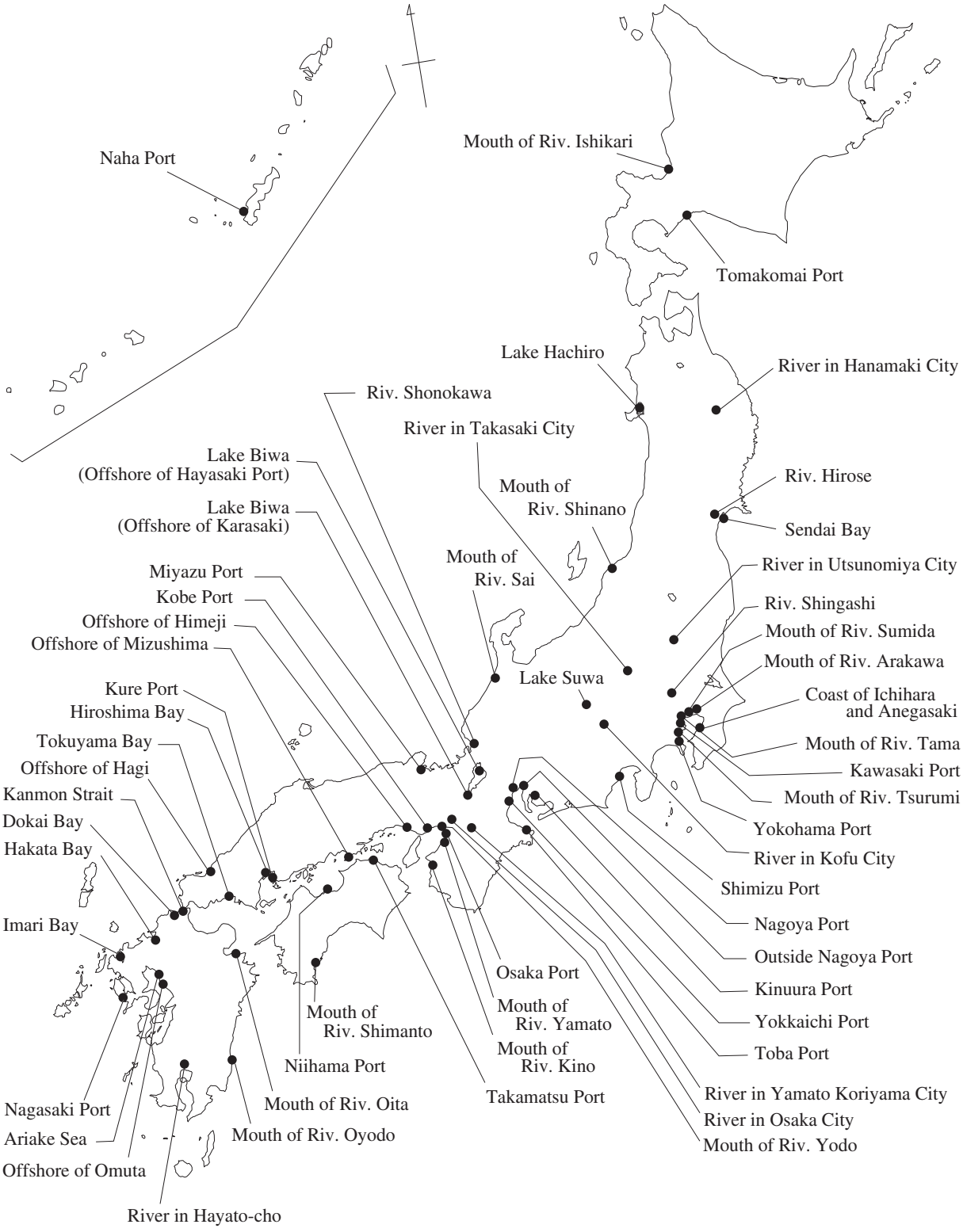


Table 2-1 Outline of the Environmental Survey for Surface Water (FY2001)
(A/B: Detected samples/Total samples, C/D: Detected areas/Total areas)

Chemical substance		A/B	C/D	Range(μg/ℓ)	Detection limit (μg/ℓ)
1	Nitrobenzene	5/147	2/49	0.046 - 0.51	0.037
2	*p*-Chloronitrobenzene	0/150	0/50		0.087
3	Chlorothalonil	0/51	0/17		0.010
4	Pyridaphenthion	0/51	0/17		0.11
5	Butachlor	0/51	0/17		0.11
6	Ethylene oxide	0/27	0/9		0.098
7	2,6-Di-*tert*-butylphenol	0/159	0/53		0.17
8	2,6-Di-*tert*-butyl-4-methylphenol	26/156	10/52	0.06 - 1.6	0.050
9	2,4,6-Tri-*tert*-butylphenol	0/153	0/51		0.020
10	2,6-Di-*tert*-butyl-4-ethylphenol	5/153	2/51	0.063 - 0.21	0.055
11	Polychlorinated naphthalene (PCN)	12/24	5/8	5.2 - 94 pg/ℓ	
11-1	Mono-PCNs	7/24	3/8	4.2 - 12 pg/ℓ	4.0 pg/ℓ
11-2	Di-PCNs	3/24	1/8	5.9 - 7.6 pg/ℓ	5.0 pg/ℓ
11-3	Tri-PCNs	10/24	4/8	5.0 - 43 pg/ℓ	5.0 pg/ℓ
11-4	Tetra-PCNs	5/24	2/8	8.7 - 39 pg/ℓ	8.0 pg/ℓ
11-5	Penta-PCNs	1/24	1/8	13pg/ℓ	8.0 pg/ℓ
11-6	Hexa-PCNs	0/24	0/8		19 pg/ℓ
11-7	Hepta-PCNs	0/24	0/8		8.0 pg/ℓ
11-8	Octa-PCN	0/24	0/8		20 pg/ℓ
12	Long-chain polychlorinated paraffins				
12-1	chlorination rate: 40%	2/21	1/7	0.49 - 0.77	0.28
12-2	chlorination rate: 70%	2/21	1/7	0.46 - 0.83	0.14

Table 2-2 Outline of the Environmental Survey for Bottom Sediment (FY2001)
(A/B: Detected samples/Total samples, C/D: Detected areas/Total areas)

Chemical substance		A/B	C/D	Range (ng/g-dry)	Detection limit (ng/g-dry)
1	Nitrobenzene	6/144	3/48	1.4 – 2.3	1.4
2	*p*-Chloronitrobenzene	0/144	0/48		2.2
4	Pyridaphenthion	0/51	0/17		11
5	Butachlor	0/51	0/17		1.6
6	Ethylene oxide	0/27	0/9		2.1
7	2,6-Di-*tert*-butylphenol	12/153	4/51	2.4 – 14	1.9
8	2,6-Di-*tert*-butyl-4-methylphenol	36/159	15/53	6.8 – 77	6.4
9	2,4,6-Tri-*tert*-butylphenol	2/159	1/53	9.3 – 14	7.0
10	2,6-Di-*tert*-butyl-4-ethylphenol	8/159	4/53	3.5 – 74	3.3
11	Polychlorinated naphthalene (PCN)	24/24	8/8	0.020 – 4.1	
11-1	Mono-PCNs	11/21	6/8	0.0012 – 0.075	0.0008
11-2	Di-PCNs	15/24	6/8	0.0021 – 1.3	0.0009
11-3	Tri-PCNs	24/24	8/8	0.0037 – 0.73	0.0005
11-4	Tetra-PCNs	24/24	8/8	0.014 – 1.7	0.0010
11-5	Penta-PCNs	22/24	8/8	0.0020 – 1.1	0.0020
11-6	Hexa-PCNs	18/24	6/8	0.005 – 0.18	0.004
11-7	Hepta-PCNs	12/24	4/8	0.005 – 0.066	0.005
11-8	Octa-PCN	6/24	3/8	0.006 – 0.075	0.005
12	Long-chain polychlorinated paraffins				
12-1	chlorination rate: 40%	17/21	6/7	42 – 2000	38
12-2	chlorination rate: 70%	16/21	6/7	11 – 390	11

Table 2-3 Outline of the Environmental Survey for Fish (FY2001)
(A/B: Detected samples/Total samples, C/D: Detected areas/Total areas)

Chemical substance		A/B	C/D	Range (ng/g-wet)	Detection limit (ng/g-wet)
4	Pyridaphenthion	0/48	0/16		6.9
5	Butachlor	0/48	0/16		1.5
6	Ethylene oxide	0/24	0/8		1.9
12	Long-chain polychlorinated paraffins				
12-1	chlorination rate: 40%	0/21	0/7		8.0
12-2	chlorination rate: 70%	0/21	0/7		3.7

Figure 2-2 Locations of the Environmental Survey for Air (FY2001)

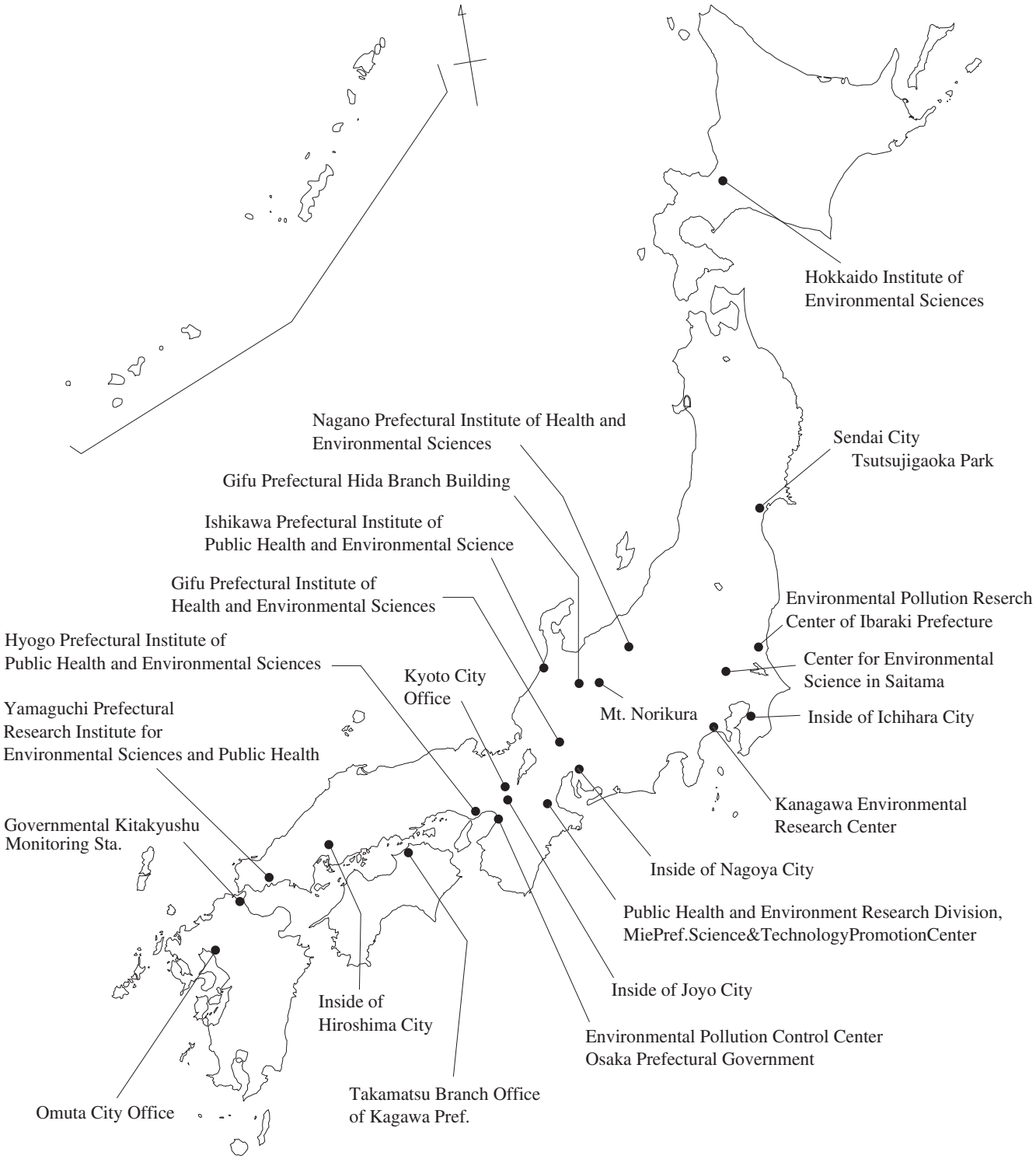


Table 2-4 Outline of the Environmental Survey for Air (FY2001)
(A/B: Detected samples/Total samples, C/D: Detected areas/Total areas)

Chemical substance		A/B	C/D	Range (ng/m^3)	Detection limit (ng/m^3)
1	1,1,1-Trichloroethane	48/48	16/16	170 – 420	12
2	1,1,2-Trichloroethane	4/48	3/16	20 – 27	20
3	Ethyl chloride	46/48	16/16	14 – 540	6.0
4	Methyl chloride	48/48	16/16	750 – 16000	12
5	Dimethyl terephthalate	3/38	1/13	0.074 – 0.093	0.030
6	Diethyl terephthalate	3/38	1/13	0.16 – 0.22	0.042
7	Methyl acrylate	0/15	0/5		0.6
8	Ethyl acrylate	3/15	1/5	0.6 – 1.8	0.5
9	Acetonitrile	17/17	7/7	93 – 1200	76
10	Diisononyl phthalate	20/21	7/7	0.42 – 22	0.40
11	Diisodecyl phthalate	12/21	6/7	0.30 – 1.3	0.30
12	Diisotridecyl phthalate	0/21	0/7		0.1
13	Polybrominated diphenylether (PBDE)	36/36	12/12	0.00007 – 0.067	
13-1	Mono-BDEs	7/36	3/12	0.0004 – 0.0020	0.0004
13-2	Di-BDEs	29/36	12/12	0.0002 – 0.012	0.0002
13-3	Tri-BDEs	36/36	12/12	0.00007 – 0.0079	0.00005
13-4	Tetra-BDEs	27/36	10/12	0.0005 – 0.010	0.0005
13-5	Penta-BDEs	32/36	12/12	0.00010 – 0.0093	0.00009
13-6	Hexa-BDEs	27/36	12/12	0.00011 – 0.011	0.00010
13-7	Hepta-BDEs	20/36	9/12	0.00021 – 0.038	0.00020

Chapter 3 Monitoring of Major Chemical Substances

1. Purpose of the survey

The purpose of this survey is to monitor the extent of environmental pollution on an annual basis, by grasping the long-term variation in persistence of chemical substances (the persistence of which is identified or suspected) in bottom sediment, wildlife and air (including indoor air), and to obtain data that can be utilized in cases of problems related to human health or the ecosystem.

2. Summary of the survey

(1) Surveyed substances and media

Bottom sediment: The following 23 substances (mainly Class 1 Specified Chemical Substances based on the Chemical Substances Control Law) were surveyed:

[1] Hexachlorobenzene (HCB), [2] Dieldrin,

[3] DDTs and their derivatives (*p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD),

[4] Chlordanes (*trans*-chlordane, *cis*-chlordane, *trans*-nonachlor, *cis*-nonachlor),

[5] Hexachlorocyclohexanes (HCH): (α-HCH, β-HCH),

[6] Dichlorobenzenes (*o*-dichlorobenzene, *m*-dichlorobenzene, *p*-dichlorobenzene),

[7] 2,6-Di-*tert*-butyl-4-methylphenol (BHT),

[8] terphenyls(*o*-terphenyl, *m*-terphenyl, *p*-terphenyl),

[9] Tibutyl phosphate, [10] Benzo[*a*]pyrene, [11] 1,4-Dioxane,

[12] Tibutyltin (TBT) compounds, [13] Tiphenyltin (TPT) compounds

Wildlife: The following 18 substances (mainly Class 1 Specified Chemical Substances) were surveyed:

[1] PCBs, [2] HCB, [3] Dieldrin,

[4] DDTs and derivatives (*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] HCHs (α-HCH, β-HCH), [7] TBTs, [8] TPTs

The species and characteristics of wildlife subject to the monitoring are shown in Table 3-1.

Air: The following 6 substances were selected from the Designated Chemical Substances and Class 2 Specified Chemical Substances based on the same law for the survey:

[1] Tichloroethylene (TCE), [2] Tetrachloroethylene (PERC), [3] Carbon tetrachloride,

[4] Chloroform, [5] 1,2-Dichloroethane (DCE), [6] 1,2-Dichloropropane (DCP)

(2) Surveyed areas

The FY2001 survey covered 39 areas for bottom sediment (Figure 3-A/3-C), 21 areas for wildlife (Figure 3-B), 31 areas for atmospheric air (Figure 3-D) and 7 areas (3 homes each, Figure 3-D) for the exposure route (indoor air and diet).

(3) Analytical method

Chlorinated organic compounds were analyzed using GC/ECD or GC/MS and organotin compounds were analyzed using GC/FPD or GC/MS.

3. Survey results

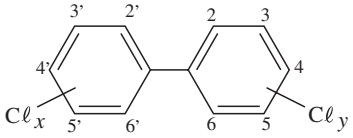
Survey results are as follows. Detailed results are also available on the supplement CD-ROM ; Table 3-2 (Bottom sediment), Table 3-3 (Wildlife), Table 3-4 (Designated Chemical Substances – Persistence in the Environment), Table 3-5 (Designated Chemical Substances – Exposure Route), and Table 3-6 (Organotin compounds).

Target Chemical Substances and Media for Monitoring

		Media				
	Chemical substance	Surface water	Bottom sediment	Wildlife	Air	Indoor air and diet
1	PCBs			B		
2	HCB		A	B		
3	Dieldrin			B		
4	DDTs and their derivatives		A	B		
5	Chlordanes		A	B		
6	HCHs		A	B		
7	Dichlorobenzenes		A	B		
8	BHT		A			
9	Terphenyls		A			
10	Tributyl phosphate		A			
11	Benzo[*a*]pyrene		A			
12	TBTs	C	C	B		
13	TPTs	C	C	B		
14	1,4-Dioxane	C	C			
15	TCE, PERC				D	D
16	Carbon tetrachloride				D	D
17	Chloroform				D	D
18	1,2-DCE				D	D
19	1,2-DCP				D	D

Indication	Name of Investigation
A	Monitoring of Bottom Sediment
B	Wildlife Monitoring
C	Investigation and Survey of Designated Chemical Substances – Survey of the Persistence in the Environment
D	Same as the above – Survey of the Exposure Route

[1] PCBs



PCBs (polychlorinated biphenyls) were designated as a Class 1 Specified Chemical Substance based on the Chemical Substances Control Law in June 1974, since it is not readily biodegradable, is highly bioaccumulative in wildlife and chronically toxic. Its production and use were in principle prohibited by the same law. It is therefore important from various aspects to follow its concentration level in the environment. In FY1978, PCBs were selected as a substance subject to the survey and has been monitored since that time.

Survey results

<Wildlife>

PCBs were detected in fish, shellfish and birds. The range of detected values of total PCB for fish was 0.01 to 0.40 μg/g-wet, the detection frequency was 49% (35 samples out of 72), and that in terms of area was 47% (7 areas out of 15). The range of detected values for shellfish was 0.04 to 0.07 μg/g-wet, the detection frequency was 33% (10 samples out of 30), and that in terms of area was 33% (2 areas out of 6). The range of detected values for birds was 0.03 to 0.17 μg/g-wet, the detection frequency was 50% (5 samples out of 10), and that in terms of area was 50% (1 area out of 2).

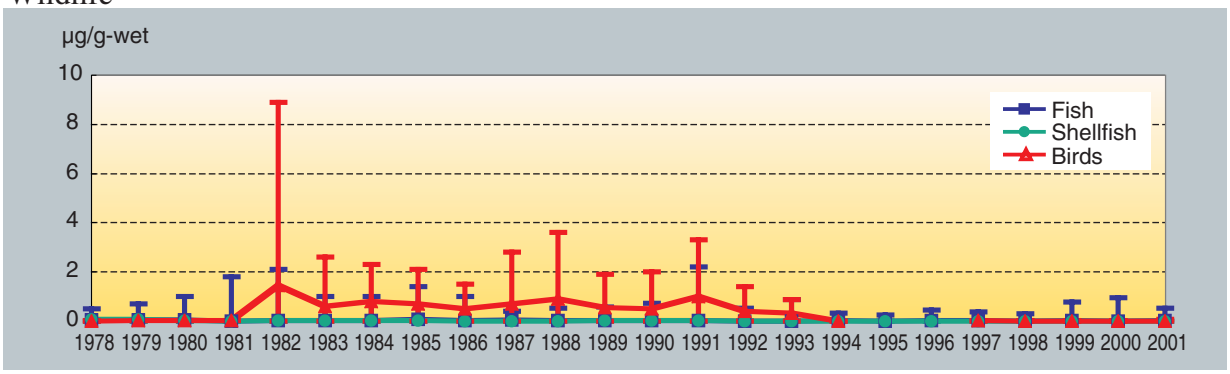
PCBs are substances covered by the POPs Treaty (Stockholm POPs Convention, May 2001), and from the standpoint of global pollution monitoring, it is necessary to continue to monitor and trace the change in concentration of PCBs.

○ Survey Results of Total PCB in Wildlife (FY2001)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		sample	area		
Total PCB	Fish	49% (35/72)	47% (7/15)	0.01 – 0.40	0.01
	Shellfish	33% (10/30)	33% (2/6)	0.04 – 0.07	0.01
	Birds	50% (5/10)	50% (1/2)	0.03 – 0.17	0.01

Figure 3-1 Detection Frequency and Range of Total PCB

Wildlife



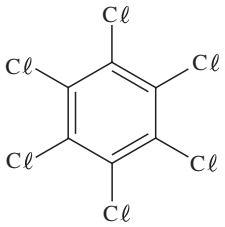
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	25/ 30	35/ 40	33/ 50	24/ 45	27/ 50	28/ 50	35/ 60	35/ 60	39/ 55	52/ 65	47/ 65	41/ 65	46/ 70	41/ 70	37/ 70	39/ 70	39/ 70	34/ 70	65/ 105	71/ 108	39/ 70	40/ 70	73/ 107	70/ 107
SF	15/ 15	15/ 15	15/ 15	5/ 15	11/ 20	10/ 20	10/ 20	10/ 20	10/ 20	10/ 20	10/ 20	11/ 21	15/ 25	20/ 30	15/ 30	18/ 30	16/ 30	15/ 30	15/ 30	15/ 30	10/ 30	13/ 30	10/ 30	11/ 31
B	6/ 7	6/ 6	8/ 8	7/ 7	5/ 8	5/ 10	9/ 10	5/ 10	6/ 10	10/ 10	7/ 10	9/ 10	5/ 10	5/ 10	5/ 10	5/ 10	0/ 5			5/ 10	5/ 10	7/ 10	5/ 10	5/ 10

Detection Limit: Fish (0.02 µg/g-wet - 0.01 µg/g-wet), Shellfish (0.01 µg/g-wet), Birds (0.01 µg/g-wet)

Remarks for charts in Chapter 3 :

- Symbols (■, ●, ▲) show the median values of all measured values.
- The vertical lines show the detected ranges.

[2] Hexachlorobenzene (HCB)



Since HCB is not readily biodegradable and is bioaccumulative and chronically toxic, it was designated as a Class 1 Specified Chemical Substance based on the Chemical Substances Control Law in June 1979. Its production and use were substantially terminated.

Survey results

< Bottom sediment>

HCB was detected in bottom sediment with a range of detected values from 0.51 to 2.4 ng/g-dry, the detection frequency was 15% (3 samples out of 20).

○ Survey Results of HCB in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range (ng/g-dry)
		Sample	
HCB	Bottom sediment	15% (3/20)	0.51 − 2.4

< Wildlife>

HCB was detected in fish and birds. The range of detected values for fish was 0.001 to 0.002 μg/g-wet, the detection frequencie was 3% (2 samples out of 72) and that in terms of area was 13% (2 areas out of 15). The range of detected values for birds was 0.002 to 0.006 μg/g-wet; the detection frequency was 50% (5 samples out of 10) and that in terms of area was 50% (1 area out of 2).

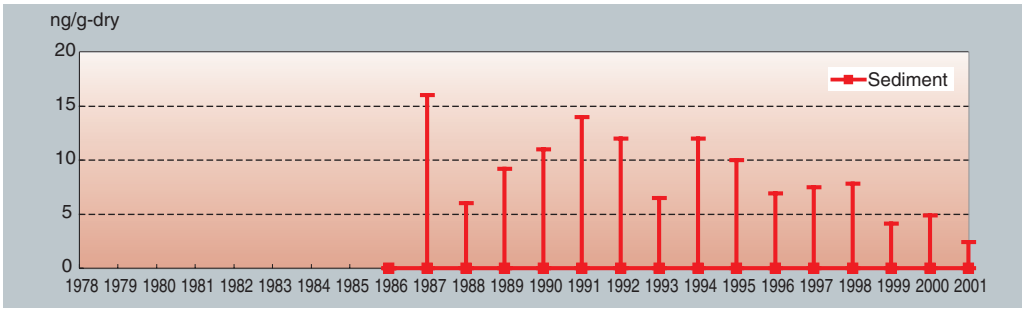
○Survey Results of HCB in Wildlife (FY2001)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		Sample	Area		
HCB	Fish	3% (2/72)	13% (2/15)	0.001 − 0.002	0.001
	Shellfish	0% (0/30)	0% (0/6)	ND	0.001
	Birds	50% (5/10)	50% (1/2)	0.002 − 0.006	0.001

HCB is a substance covered by the POPs Treaty, and from the standpoint of global pollution monitoring, it is necessary to continue to monitor and trace the change in concentration of HCB.

Figure 3-2 Detection Frequency and Range of HCB

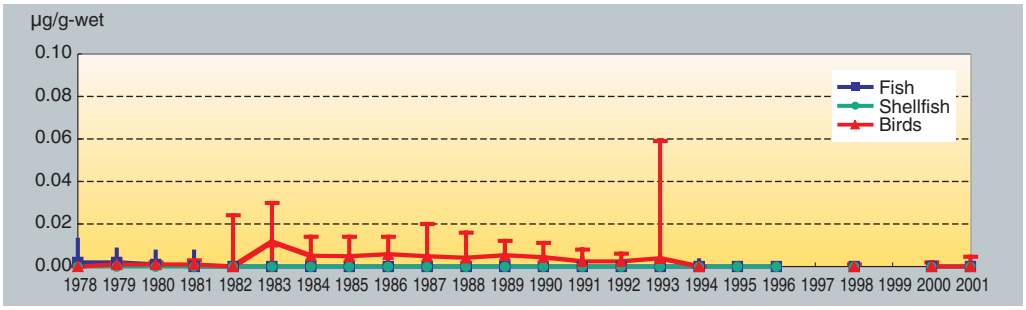
(A) Bottom sediment



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S									0/ 17	5/ 19	3/ 22	5/ 17	3/ 18	8/ 18	9/ 18	11/ 19	9/ 17	6/ 18	2/ 18	2/ 17	3/ 18	3/ 18	4/ 17	3/ 20

Detection Limit: 1 ng/g-dry

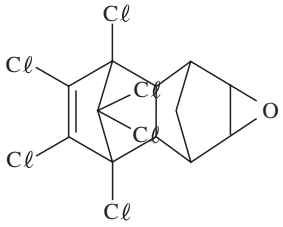
(B) Wildlife



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	104/ 105	37/ 40	29/ 50	21/ 46	24/ 50	7/ 50	13/ 60	8/ 60	13/ 55	7/ 65	8/ 65	19/ 65	14/ 70	13/ 70	7/ 70	10/ 70	9/ 70	9/ 70	5/ 70		8/ 70		7/ 69	2/ 72
SF	0/ 10	0/ 15	0/ 15	0/ 20	0/ 20	0/ 20	0/ 20	0/ 20	0/ 20	0/ 20	0/ 20	0/ 21	0/ 25	0/ 30	0/ 30	0/ 30	0/ 30	0/ 30	0/ 30		0/ 30		0/ 30	0/ 30
B	0/ 7	4/ 6	4/ 8	6/ 7	4/ 9	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	0/ 5				3/ 10		5/ 10	5/ 10

Detection Limit: 0.001 µg/g-wet

[3] Dieldrin



Dieldrin was primarily used as a pesticide, with its peak use period as an agricultural chemical from 1955 to 1965. Although its manufacture and use have been substantially discontinued since 1971, dieldrin was still used as an anti-termite agent in the treatment of housing. However, in October 1981, together with aldrin and endrin, it was designated as a Class 1 Specified Chemical Substance based on the Chemical Substances Control Law, whereby its production and use were in principle prohibited. In addition, registration of dieldrin as an agricultural chemical had already been cancelled in 1975. Thus, the use of dieldrin was almost completely terminated in 1981.

Survey results

<Bottom sediment>

Dieldrin was detected in one sample of bottom sediment with the detected value of 0.67 ng/g-dry, and the detection frequency was 5% (1 sample out of 20).

○ Survey Results of Dieldrin in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range (ng/g-dry)
		Sample	
Dieldrin	Bottom sediment	5% (1/20)	0.67

<Wildlife>

Dieldrin was detected in fish, shellfish and birds. The detected concentrations were 0.001 to 0.003 μg/g-wet, 0.002 to 0.071 μg/g-wet and 0.001 to 0.005 μg/g-wet, respectively, in the FY2001 survey. The detection frequency was 11% (8 samples out of 72) for fish, 33% (10 samples out of 30) for shellfish, and 80% (8 samples out of 10) for birds. Detection frequency in terms of area was 33% (5 areas out of 15) for fish, 33% (2 areas out of 6) for shellfish, and 100% (2 areas out of 2) for birds.

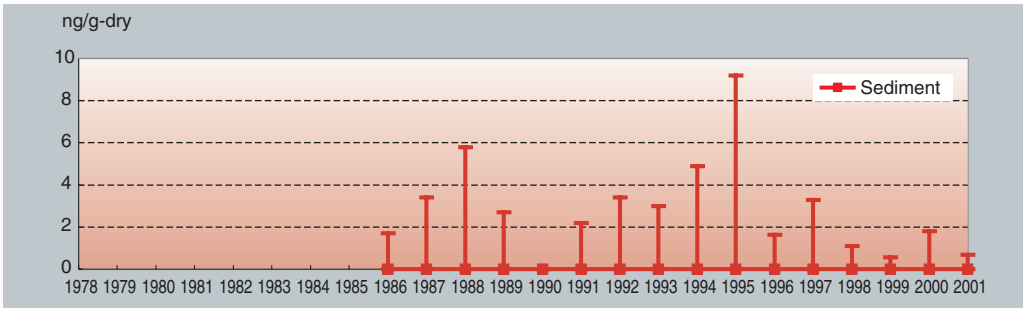
○ Survey Results of Dieldrin in Wildlife (FY2001)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		Sample	Area		
Dieldrin	Fish	11% (8/72)	33% (5/15)	0.001 – 0.003	0.001
	Shellfish	33% (10/30)	33% (2/6)	0.002 – 0.071	0.001
	Birds	80% (8/10)	100% (2/2)	0.001 – 0.005	0.001

Dieldrin is a substance covered by the POPs Treaty, and from the standpoint of global pollution monitoring, it is necessary to continue to monitor and trace the change in concentration of dieldrin.

Figure 3-3 Detection Frequency and Range of Dieldrin

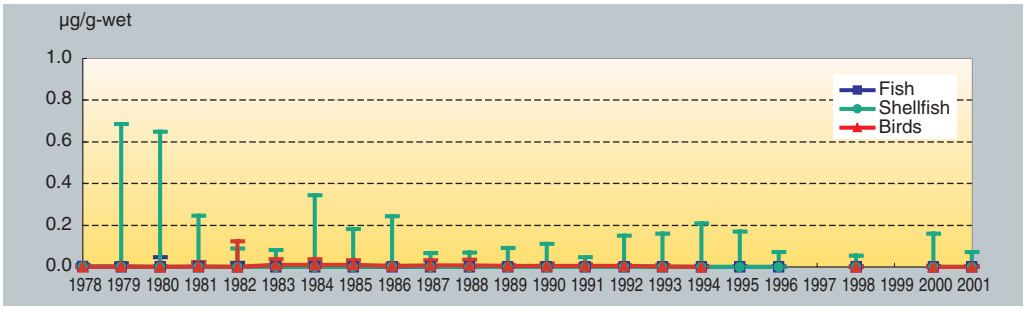
(A) Bottom sediment



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S									1/ 17	1/ 19	1/ 22	1/ 17	0/ 18	2/ 18	4/ 18	3/ 19	1/ 17	2/ 18	2/ 18	1/ 17	1/ 18	1/ 18	1/ 17	1/ 20

Detection Limit: 1 ng/g-dry

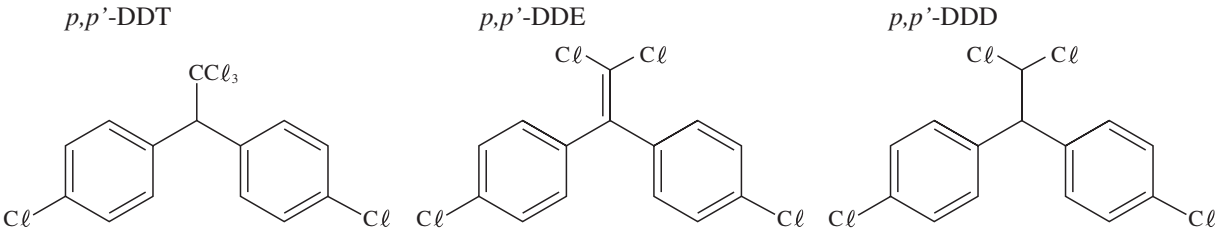
(B) Wildlife



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	22/ 30	30/ 40	30/ 50	12/ 46	20/ 50	27/ 50	30/ 60	27/ 60	20/ 55	23/ 65	19/ 65	35/ 65	23/ 70	26/ 70	16/ 70	25/ 70	12/ 70	10/ 70	9/ 70		6/ 70		10/ 70	8/ 72
SF	5/ 10	10/ 15	9/ 15	10/ 20	10/ 20	10/ 20	10/ 20	11/ 20	10/ 20	12/ 20	8/ 20	10/ 21	12/ 25	15/ 30	10/ 30	10/ 30	10/ 30	5/ 30	10/ 30		8/ 30		5/ 30	10/ 30
B	1/ 7	6/ 6	5/ 8	7/ 7	4/ 9	10/ 10	5/ 10	5/ 10	8/ 10	5/ 10	6/ 10	7/ 10	5/ 10	9/ 10	7/ 10	7/ 10	0/ 5				5/ 10		2/ 10	8/ 10

Detection Limit (FY1983-): 0.001 µg/g-wet

[4] DDTs and their derivatives



DDT is a type of pesticide that was widely used together with HCH and Drins. However, its use as an agricultural chemical was terminated in 1971 and it was designated as a Class 1 Specified Chemical Substance in based on the Chemical Substances Control Law in 1981, whereby its production and use were in principle prohibited. DDT has several isomers and, in addition to *p,p'*-DDT (active component of DDT as a pesticide), *p,p'*-DDE and *p,p'*-DDD (degradation products of DDT in the environment) in the case of bottom sediment, and *p,p'*-DDE, *p,p'*-DDD, *o,p'*-DDT, *o,p'*-DDE, *o,p'*-DDD in the case of wildlife, were selected as substances subject to the survey.

Survey results

<Bottom sediment>

In the FY2001 survey, *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD were detected in bottom sediment. The range of detected values was 0.17 to 3.2 ng/g-dry, 0.20 to 13 ng/g-dry, and 0.32 to 7.2 ng/g-dry, respectively. The detection frequency was 15% (3 samples out of 20), 40% (8 samples out of 20), and 35% (7 samples out of 20), respectively.

○Survey Results of DDTs in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range
		Sample	(ng/g-dry)
p,p'-DDT	Bottom sediment	15% (3/20)	0.17 – 3.2
p,p'-DDE		40% (8/20)	0.20 – 13
p,p'-DDD		35% (7/20)	0.32 – 7.2

<Wildlife>

p,p'-DDT was detected in fish, shellfish and birds. The range of detected values for fish was 0.001 to 0.036 μg/g-wet, the detection frequency was 32% (23 samples out of 72) and that in terms of area was 40% (6 areas out of 15). The detected value for shellfish was 0.001 μg/g-wet, the detection frequency was 17% (5 samples out of 30) and that in terms of area was 17% (1 area out of 6). The detected values for birds was 0.001 to 0.002 μg/g-wet, the detection frequency was 30% (3 samples out of 10) and that in terms of area was 100% (2 area out of 2).

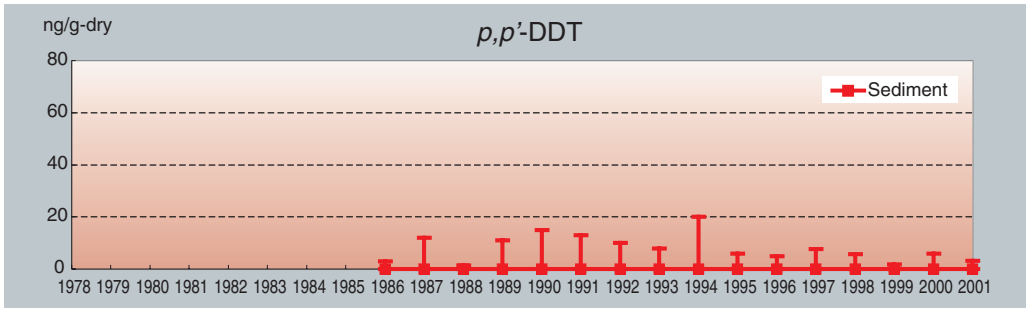
○Survey Results of DDTs in Wildlife (FY2001)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		Sample	Area		
p,p'-DDT	Fish	32% (23/72)	40% (6/15)	0.001 – 0.036	0.001
	Shellfish	17% (5/30)	17% (1/6)	0.001	0.001
	Birds	30% (3/10)	100% (2/2)	0.001 – 0.002	0.001
p,p'-DDE	Fish	69% (50/72)	87% (13/15)	0.001 – 0.031	0.001
	Shellfish	33% (10/30)	33% (2/6)	0.003 – 0.007	0.001
	Birds	100% (10/10)	100% (2/2)	0.019 – 0.20	0.001
p,p'-DDD	Fish	40% (29/72)	40% (6/15)	0.001 – 0.007	0.001
	Shellfish	50% (15/30)	50% (3/6)	0.001 – 0.003	0.001
	Birds	50% (5/10)	50% (1/2)	0.001 – 0.003	0.001
o,p'-DDT	Fish	14% (10/72)	27% (4/15)	0.001 – 0.003	0.001
	Shellfish	0% (0/30)	0% (0/6)	ND	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001
o,p'-DDE	Fish	8% (6/72)	13% (2/15)	0.001 – 0.009	0.001
	Shellfish	0% (0/30)	0% (0/6)	ND	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001
o,p'-DDD	Fish	1% (1/72)	7% (1/15)	0.001	0.001
	Shellfish	17% (5/30)	17% (1/6)	0.001	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001

p,p'-DDT is a substance covered by the POPs Treaty, and from the standpoint of global pollution monitoring, it is necessary to continue to monitor and trace the change in concentration of DDTs and their derivatives.

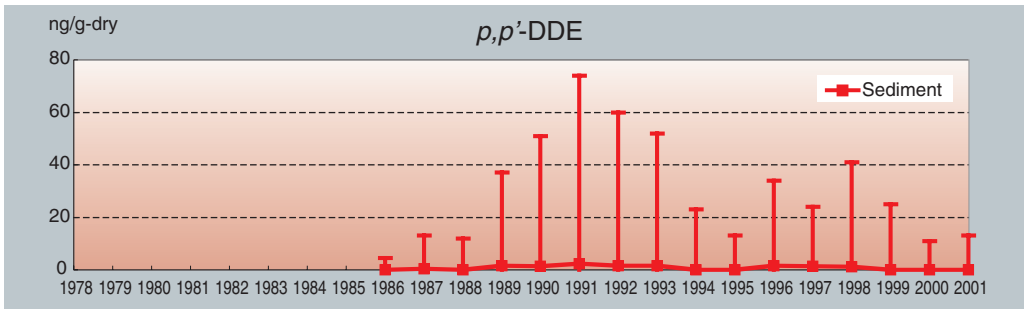
Figure 3-4 Detection Frequency and Range of *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD

(A) Bottom sediment



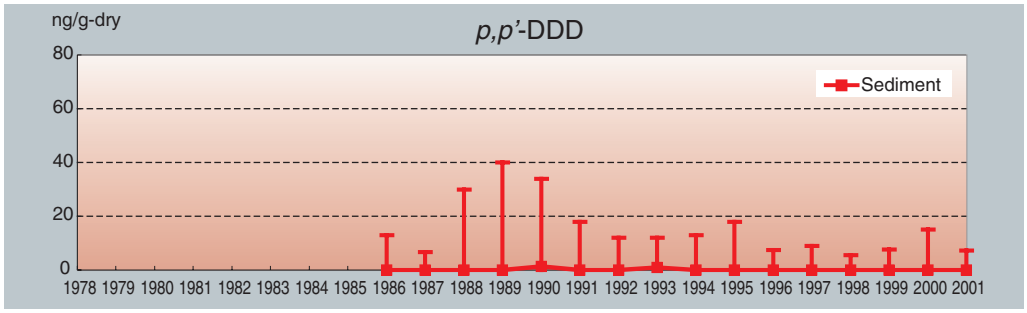
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S									4/ 17	3/ 19	3/ 22	3/ 17	5/ 18	4/ 17	6/ 18	8/ 19	5/ 16	3/ 18	6/ 17	4/ 17	5/ 18	2/ 18	4/ 17	3/ 20

Detection Limit: 1 ng/g-dry



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S									6/ 17	8/ 19	9/ 22	10/ 17	8/ 18	10/ 18	10/ 18	13/ 19	10/ 17	8/ 18	10/ 18	11/ 17	11/ 18	9/ 18	10/ 17	8/ 20

Detection Limit: 1 ng/g-dry

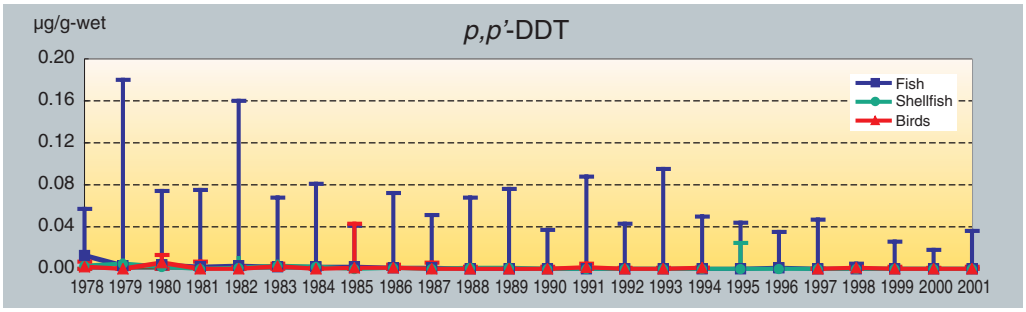


	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S									5/ 17	2/ 19	5/ 22	4/ 17	7/ 18	7/ 18	8/ 18	9/ 19	9/ 17	10/ 18	9/ 18	8/ 17	8/ 18	7/ 18	8/ 17	7/ 20

Detection Limit: 1 ng/g-dry

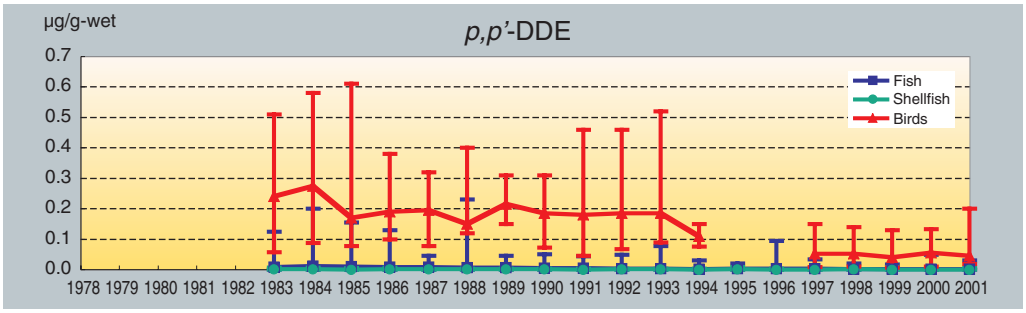
Figure 3-4 Detection Frequency and Range of *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD (continued)

(B) Wildlife



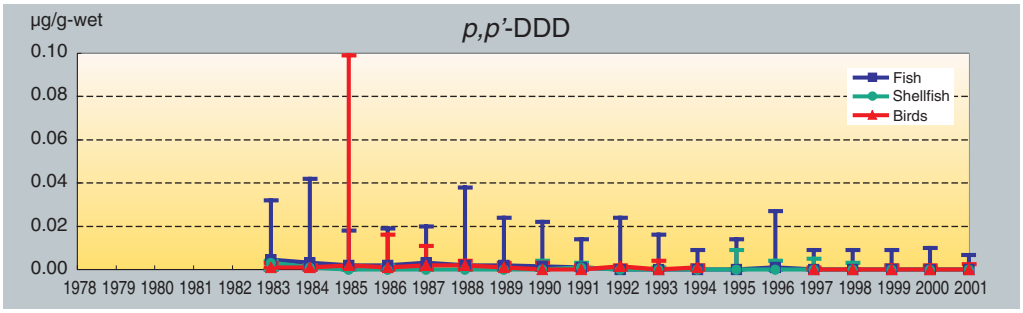
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	25/ 30	34/ 40	37/ 50	26/ 46	40/ 50	35/ 50	45/ 60	40/ 60	34/ 55	38/ 65	30/ 65	32/ 65	28/ 70	29/ 70	24/ 70	27/ 70	17/ 70	33/ 70	38/ 70	26/ 70	35/ 70	15/ 70	16/ 69	23/ 72
SF	10/ 10	15/ 15	15/ 15	9/ 20	20/ 20	20/ 20	19/ 20	10/ 20	15/ 20	10/ 20	16/ 20	14/ 21	7/ 25	11/ 30	0/ 30	0/ 30	0/ 30	5/ 30	0/ 30	0/ 30	0/ 30	0/ 30	4/ 30	5/ 30
B	6/ 7	0/ 6	8/ 8	1/ 7	4/ 9	6/ 10	2/ 10	7/ 10	6/ 10	5/ 10	5/ 10	0/ 10	2/ 10	6/ 10	1/ 10	5/ 10	5/ 5			0/ 10	6/ 10	5/ 10	2/ 10	3/ 10

Detection Limit (FY1983-): 0.001 μg/g-wet



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F						45/ 50	50/ 60	51/ 60	51/ 55	55/ 65	55/ 65	52/ 65	64/ 70	61/ 70	58/ 70	59/ 70	60/ 70	63/ 70	59/ 70	50/ 70	59/ 70	46/ 70	50/ 69	50/ 72
SF						11/ 20	15/ 20	10/ 20	15/ 20	15/ 20	15/ 20	11/ 21	15/ 25	14/ 30	19/ 30	18/ 30	13/ 30	15/ 30	10/ 30	15/ 30	20/ 30	15/ 30	14/ 30	10/ 30
B						10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	5/ 5			10/ 10	10/ 10	10/ 10	10/ 10	10/ 10

Detection Limit: 0.001 μg/g-wet

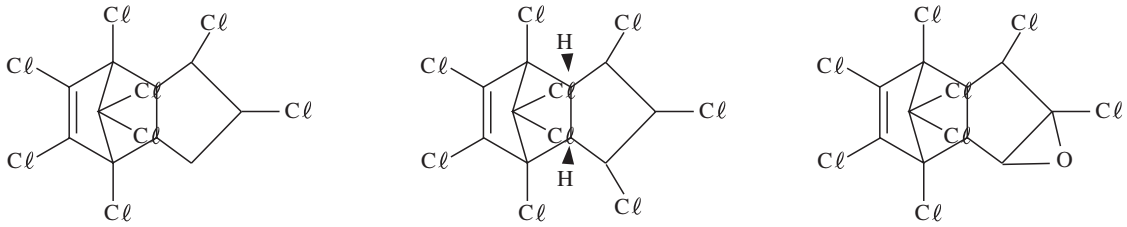


	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F						40/ 50	35/ 60	35/ 60	37/ 55	43/ 65	36/ 65	41/ 65	40/ 70	39/ 70	32/ 70	31/ 70	31/ 70	31/ 70	35/ 70	35/ 70	29/ 70	26/ 70	32/ 69	29/ 72
SF						13/ 20	13/ 20	5/ 20	10/ 20	5/ 20	7/ 20	6/ 21	12/ 25	17/ 30	6/ 30	5/ 30	10/ 30	5/ 30	10/ 30	10/ 30	10/ 30	5/ 30	3/ 30	5/ 30
B						10/ 10	5/ 10	10/ 10	7/ 10	6/ 10	6/ 10	5/ 10	5/ 10	5/ 10	6/ 10	5/ 10	4/ 5			1/ 10	0/ 10	1/ 10	5/ 10	5/ 10

Detection Limit: 0.001 μg/g-wet

[5] Chlordanes (*trans*-chlordane, *cis*-chlordane, *trans*-nonachlor, *cis*-nonachlor, oxychlordane)

chlordane　　nonachlor　　oxychlordane



In the Detailed Environmental Survey conducted in FY1982, chlordanes were detected widely in the environment in bottom sediment and fish. It was thereby added to the substances subject to the survey since FY1983. In Japan, chlordane has been used for primary processing of lumber, plywood and anti-termite agents, but since it is not readily biodegradable, it was designated as a Class 1 Specified Chemical Substance based on the Chemical Substances Control Law in September 1986, whereby its production and use were in principle prohibited. The compositions of chlordanes manufactured for industrial purposes are varied, but in this survey, the 5 types of chlordanes that were selected are the ones with high detection frequencies in the results of the FY1982 Detailed Environmental Survey for 8 types of chlordanes (*trans*-chlordane, *cis*-chlordane, *trans*-nonachlor, *cis*-nonachlor, oxychlordane, heptachlor, γ-chlordene and heptachlor epoxide).

<Bottom sediment>

trans-Chlordane, *cis*-chlordane, *trans*-nonachlor and *cis*-nonachlor were detected in bottom sediment. The range of detected values was 0.59 to 4.7 ng/g-dry, 1.0 to 4.7 ng/g-dry, 0.31 to 4.8 ng/g-dry and 1.3 to 1.6 ng/g-dry, respectively. The detection frequency was 30% (6 samples out of 20), 20% (4 samples out of 20), 25% (5 samples out of 20) and 15% (3 samples out of 20), respectively.

○Survey Results of Chlordanes in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range
		Sample	(ng/g-dry)
trans-Chlordane	Bottom sediment	30% (6/20)	0.59 – 4.7
cis-Chlordane		20% (4/20)	1.0 – 4.7
trans-Nonachlor		25% (5/20)	0.31 – 4.8
cis-Nonachlor		15% (3/20)	1.3 – 1.6

<Wildlife>

trans-Chlordane was detected in fish and shellfish and *cis*-chlordane, *cis*-nonachlor and oxychlordane were detected in fish and shellfish and birds. For fish, the range of detected values of each chlordane was 0.001 to 0.013 μg/g-wet and that of total chlordane was 0.001 to 0.036 μg/g-wet. For shellfish, the range of detected values of each chlordane was 0.001 to 0.016 μg/g-wet and that of total chlordane was 0.008 to 0.021 μg/g-wet. For birds, the range of detected values of each chlordane was

0.001 to 0.016 μg/g-wet and that of total chlordanes was 0.001 to 0.025 μg/g-wet. The detection frequency of total chlordanes in fish was 58% (42 samples out of 72) and that in terms of area was 67% (10 areas out of 15). The detection frequency of total chlordanes in shellfish was 50% (15 samples out of 30) and that in terms of area was also 50% (3 areas out of 6). The detection frequency of total chlordanes in birds was 80% (8 samples out of 10) and that in terms of area was 100% (2 area out of 2).

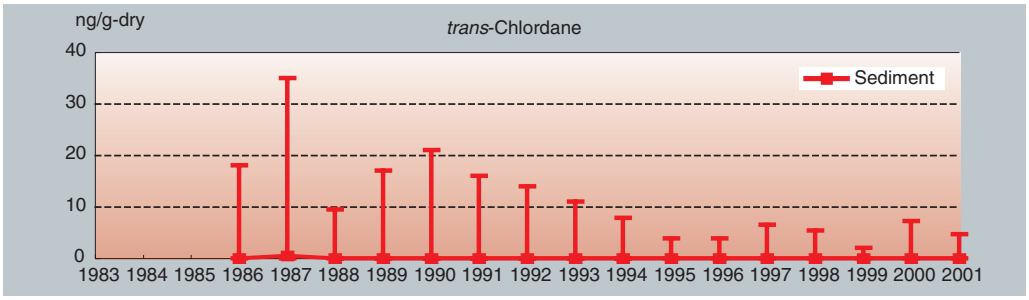
○Survey Results of Chlordanes in Wildlife (FY2001)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		Sample	Area		
trans-Chlordane	Fish	24% (17/72)	33% (5/15)	0.001 – 0.004	0.001
	Shellfish	50% (15/30)	50% (3/6)	0.001 – 0.003	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001
cis-Chlordane	Fish	43% (31/72)	47% (7/15)	0.001 – 0.011	0.001
	Shellfish	50% (15/30)	50% (3/6)	0.002 – 0.016	0.001
	Birds	10% (1/10)	50% (1/2)	0.001	0.001
trans-Nonachlor	Fish	53% (38/72)	60% (9/15)	0.001 – 0.013	0.001
	Shellfish	37% (11/30)	50% (3/6)	0.001 – 0.004	0.001
	Birds	50% (5/10)	50% (1/2)	0.002 – 0.016	0.001
cis-Nonachlor	Fish	38% (27/72)	53% (8/15)	0.001 – 0.007	0.001
	Shellfish	33% (10/30)	33% (2/6)	0.001 – 0.002	0.001
	Birds	30% (3/10)	50% (1/2)	0.001 – 0.003	0.001
Oxychlordane	Fish	10% (7/72)	33% (5/15)	0.001 – 0.007	0.001
	Shellfish	17% (5/30)	17% (1/6)	0.001 – 0.003	0.001
	Birds	70% (7/10)	100% (2/2)	0.001 – 0.005	0.001
Total chlordanes	Fish	58% (42/72)	67% (10/15)	0.001 – 0.036	0.001
	Shellfish	50% (15/30)	50% (3/6)	0.008 – 0.021	0.001
	Birds	80% (8/10)	100% (2/2)	0.001 – 0.025	0.001

trans-Chlordane and *cis*-chlordane are substances covered by the POPs Treaty, and from the standpoint of global pollution monitoring, it is necessary to continue to monitor and trace the change in concentration of chlordanes.

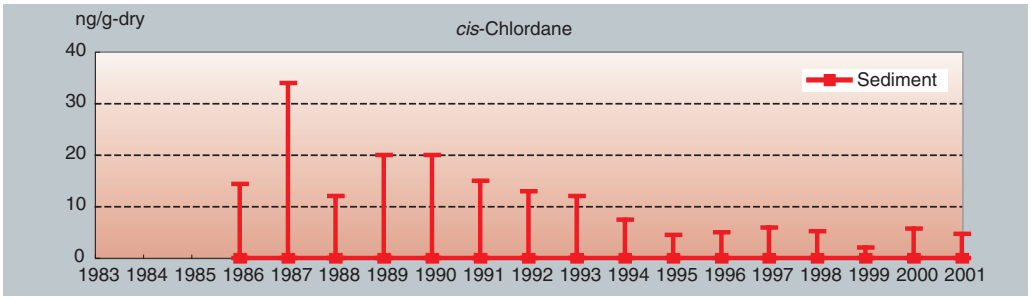
Figure 3-5 Detection Frequency and Range of *trans*- and *cis*-Chlordane

(A) Bottom sediment



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S				6/ 17	9/ 19	6/ 22	5/ 17	8/ 18	8/ 18	8/ 18	7/ 19	5/ 17	6/ 18	2/ 18	4/ 17	4/ 18	4/ 18	6/ 17	6/ 20

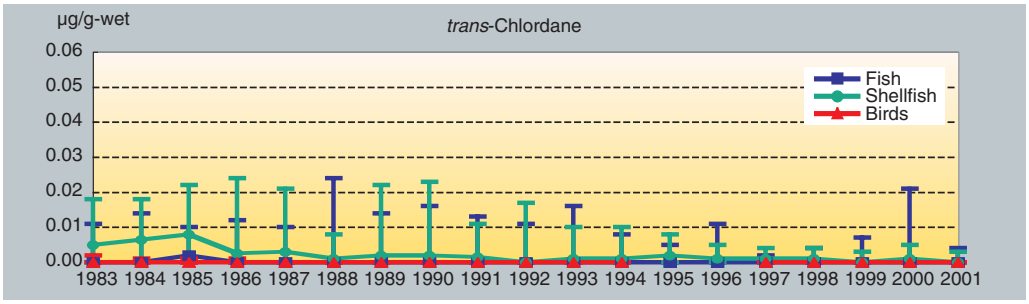
Detection Limit (FY1986-): 1 ng/g-dry



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S				6/ 17	8/ 19	7/ 22	6/ 17	6/ 18	6/ 18	7/ 18	5/ 19	4/ 17	3/ 18	2/ 18	3/ 17	3/ 18	2/ 18	5/ 17	4/ 20

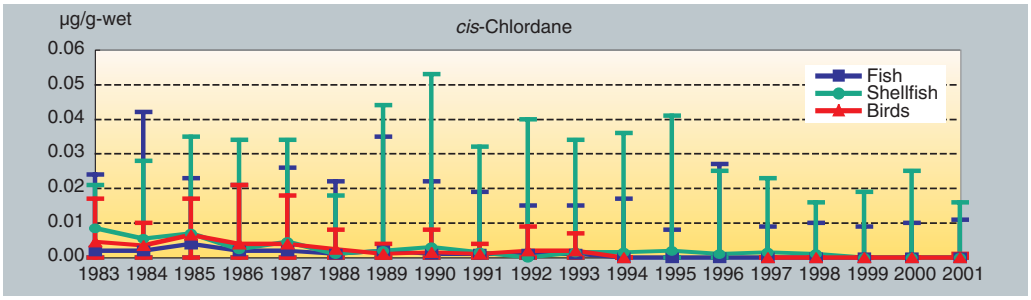
Detection Limit: 1 ng/g-dry

(B) Wildlife



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	24/ 50	26/ 60	33/ 60	23/ 55	32/ 65	25/ 65	26/ 65	22/ 70	17/ 70	23/ 70	23/ 70	17/ 70	14/ 70	20/ 70	11/ 70	15/ 70	14/ 70	14/ 69	18/ 72
SF	10/ 20	11/ 20	13/ 20	16/ 20	11/ 20	12/ 20	11/ 21	15/ 25	20/ 30	15/ 30	20/ 30	20/ 30	20/ 30	20/ 30	20/ 30	20/ 30	10/ 30	20/ 30	15/ 30
B	5/ 10	5/ 10	5/ 10	5/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 5			0/ 10	0/ 10	0/ 10	0/ 10	0/ 10

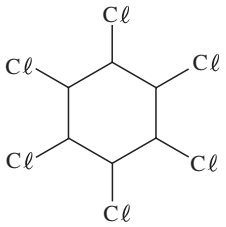
Detection Limit (FY1983-): 0.001 µg/g-wet



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	31/ 50	41/ 60	35/ 60	34/ 55	44/ 65	37/ 65	45/ 65	42/ 70	43/ 70	37/ 70	37/ 70	33/ 70	33/ 70	24/ 70	27/ 70	25/ 70	20/ 70	26/ 69	31/ 72
SF	14/ 20	15/ 20	15/ 20	16/ 20	15/ 20	13/ 20	16/ 21	18/ 25	20/ 30	15/ 30	19/ 30	20/ 30	20/ 30	15/ 30	20/ 30	20/ 30	15/ 30	15/ 30	15/ 30
B	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	5/ 10	0/ 5			0/ 10	0/ 10	0/ 10	0/ 10	1/ 10

Detection Limit: 0.001 µg/g-wet

[6] Hexachlorocyclohexanes (HCHs)



HCHs were used as agricultural chemicals in the past, but their use has been discontinued since 1971. Although HCHs include several isomers, α and β isomers were selected as substances subject to the survey in FY2001.

Survey results

<Bottom sediment>

The detected value of α-HCH was 0.21 ng/g-dry and the detection frequency was 5% (1 sample out of 20). The range of detected values of β-HCH was 0.48 to 6.8 ng/g-dry and the detection frequency was 15% (3 samples out of 20).

○Survey Results of HCHs in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range
		Sample	(ng/g-dry)
α-HCH	Bottom sediment	5% (1/20)	0.21
β-HCH		15% (3/20)	0.48 − 6.8

<Wildlife>

α-HCH was detected only in fish, and β-HCH was detected in fish and birds. The range of detected values of α-HCH in fish was 0.001 to 0.002 μg/g-wet, the detection frequency was 7% (5 samples out of 72) and that in terms of area was 13% (2 areas out of 15). The range of detected values of β-HCH in fish, shellfish and birds was 0.001 to 0.002 μg/g-wet, 0.002 μg/g-wet and 0.002 to 0.010 μg/g-wet, respectively. The detection frequency was 29% (11 samples out of 72), 17% (5 samples out of 30) and 100% (10 samples out of 10), respectively. The detection frequency in terms of area was 20% (3 areas out of 15), 16% (1 area out of 6) and 100% (2 areas out of 2), respectively.

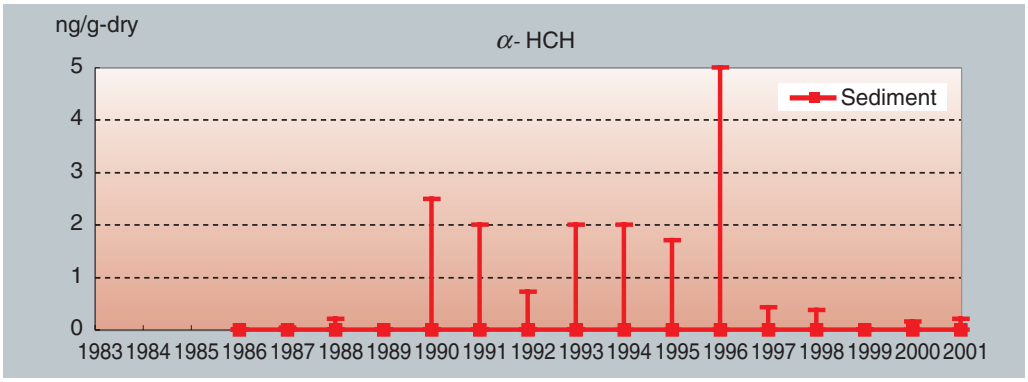
○Survey Results of HCHs in Wildlife (FY2001)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		Sample	Area		
α-HCH	Fish	7% (5/72)	13% (2/15)	0.001 – 0.002	0.001
	Shellfish	0% (0/30)	0% (0/6)	ND	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001
β-HCH	Fish	29% (11/72)	20% (3/15)	0.001 – 0.002	0.001
	Shellfish	17% (5/30)	16% (1/6)	0.002	0.001
	Birds	100% (10/10)	100% (2/2)	0.002 – 0.010	0.001

HCHs may be adopted as substances covered by the POPs Treaty, and from the standpoint of global pollution monitoring, it is necessary to continue to monitor and trace the change in concentration of HCHs.

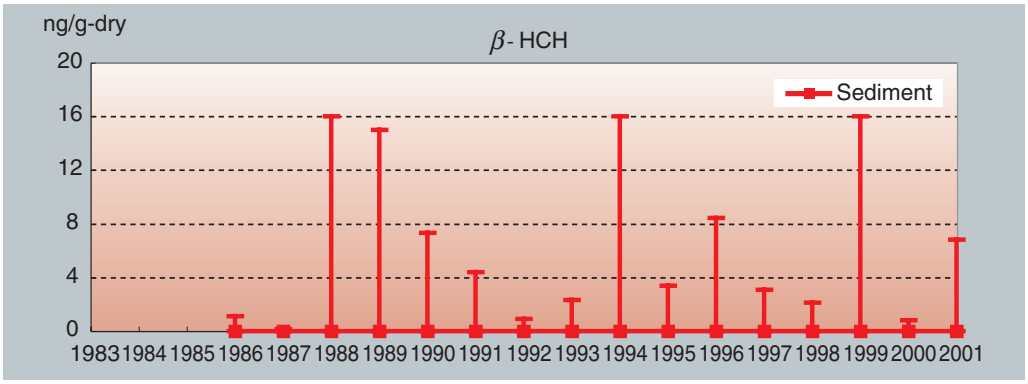
Figure 3-6 Detection Frequency and Range of α- and β-HCH

(A) Bottom Sediment



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S				0/17	0/19	0/22	0/17	1/18	2/18	1/18	2/19	2/17	1/18	2/18	1/17	2/18	0/18	1/17	1/20

Detection Limit: 1 ng/g-dry

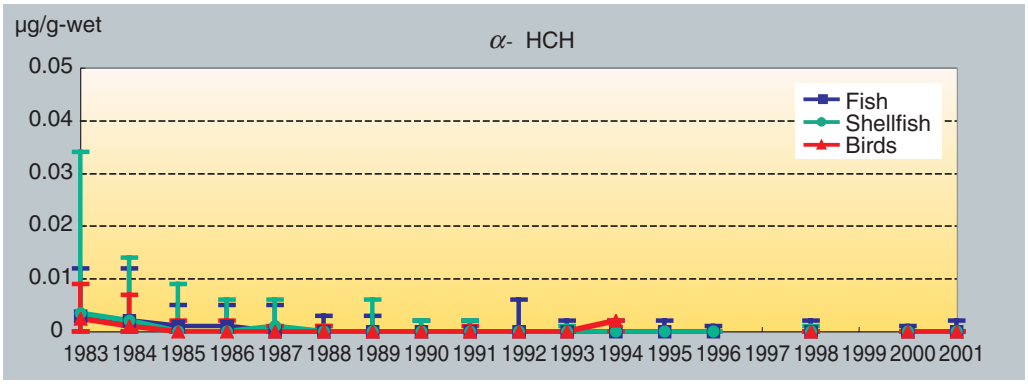


	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S				2/17	1/19	2/22	2/17	4/18	2/18	2/18	1/19	1/17	3/18	5/18	3/17	1/18	1/18	2/17	3/20

Detection Limit: 1 ng/g-dry

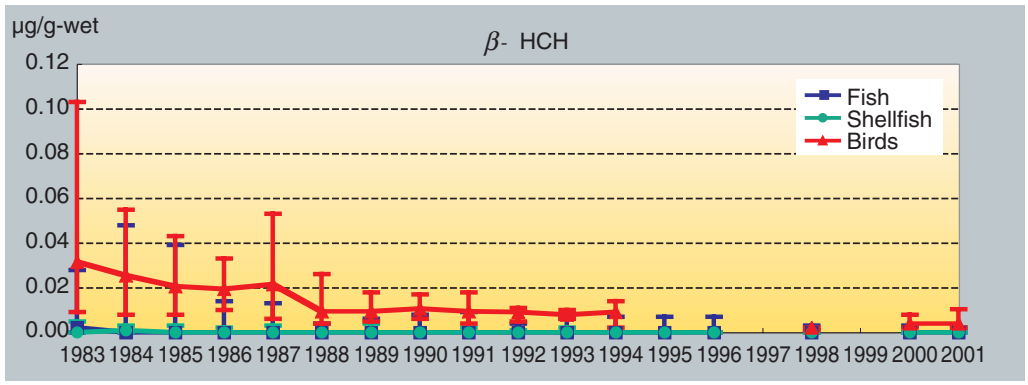
Figure 3-6 Detection Frequency and Range of α- and β-HCH (continued)

(B) Wildlife



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	39/ 50	42/ 60	40/ 60	33/ 55	32/ 65	22/ 65	14/ 65	18/ 70	14/ 70	16/ 70	10/ 70	6/ 70	8/ 70	4/ 70		8/ 70		1/ 69	11/ 72
SF	15/ 20	20/ 20	7/ 20	10/ 20	11/ 20	5/ 20	6/ 21	10/ 25	6/ 30	0/ 30	1/ 30	0/ 30	0/ 30	0/ 30		3/ 30		0/ 30	0/ 30
B	5/ 10	5/ 10	5/ 10	4/ 10	2/ 10	3/ 10	0/ 10	0/ 9	2/ 10	0/ 10	0/ 10	3/ 5				0/ 10		0/ 10	0/ 10

Detection Limit: 0.001 μg/g-wet

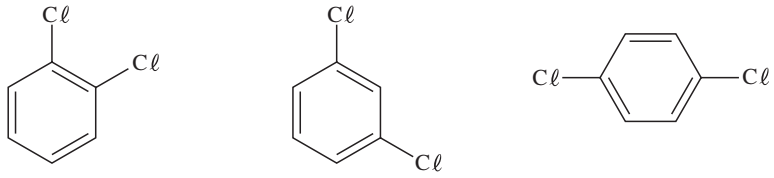


	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	33/ 50	29/ 60	25/ 60	20/ 55	19/ 65	15/ 65	17/ 65	20/ 70	13/ 70	25/ 70	11/ 70	14/ 70	10/ 70	12/ 70		10/ 70		7/ 69	11/ 72
SF	10/ 20	10/ 20	5/ 20	4/ 20	5/ 20	0/ 20	4/ 21	0/ 25	4/ 30	2/ 30	2/ 30	0/ 30	0/ 30	0/ 30		0/ 30		0/ 30	5/ 30
B	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	10/ 10	5/ 5				10/ 10		10/ 10	10/ 10

Detection Limit: 0.001 μg/g-wet

[7] Dichlorobenzenes

o-Dichlorobenzene *m*-Dichlorobenzene *p*-Dichlorobenzene



Dichlorobenzenes are widely used for various purposes such as organic solvents, pesticides and dye intermediates, etc.

Survey results

The range of detected values of *o*-dichlorobenzene, *m*-dichlorobenzene and *p*-dichlorobenzene in FY2001 was 0.33 to 72 ng/g-dry, 0.11 to 14 ng/g-dry and 0.31 to 180 ng/g-dry, respectively. The detection frequency was 55% (11 samples out of 20), 30% (6 samples out of 20) and 80% (16 samples out of 20), respectively.

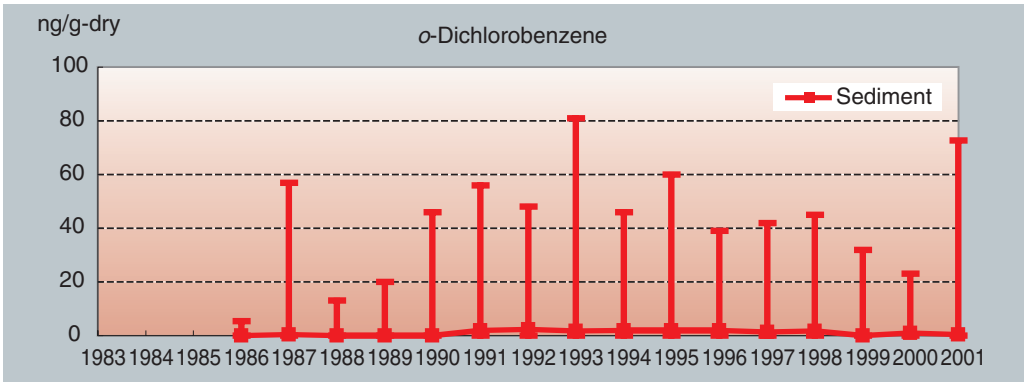
○Survey Results of Dichlorobenzenes in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range
		Sample	(ng/g-dry)
o-Dichlorobenzene	Bottom sediment	55% (11/20)	0.33 − 72
m-Dichlorobenzene		30% (6/20)	0.11 − 14
p-Dichlorobenzene		80% (16/20)	0.31 − 180

The concentration level of dichlorobenzenes has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals.

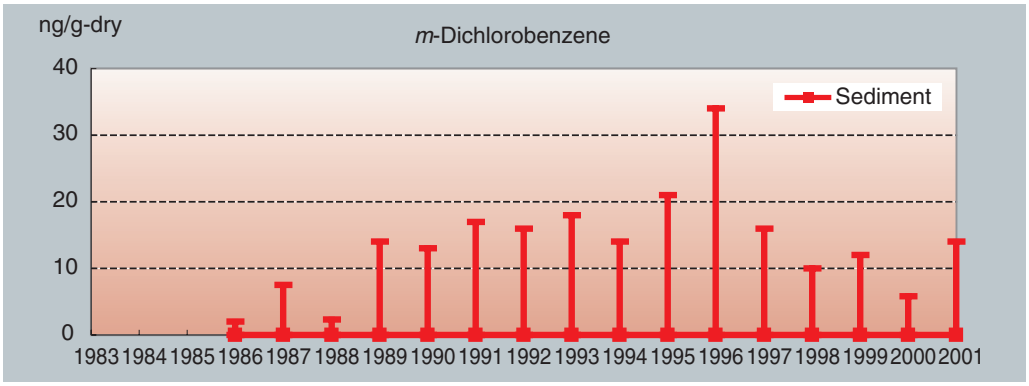
Figure 3-7 Detection Frequency and Range of *o*-, *m*- and *p*-Dichlorobenzene

Bottom sediment



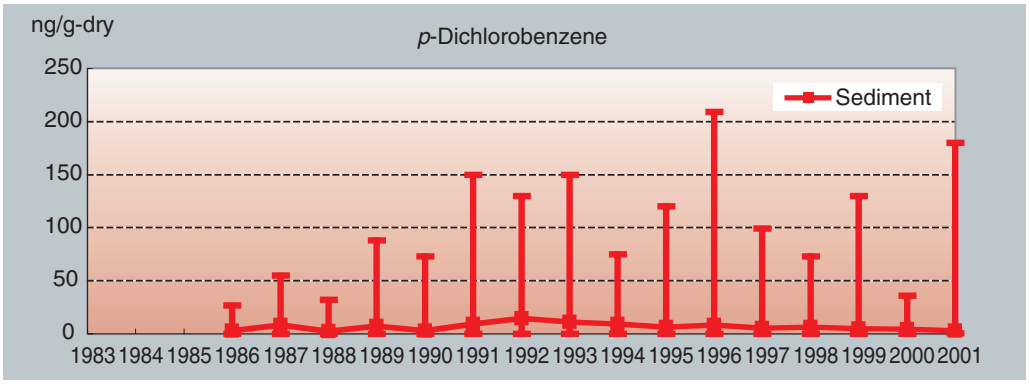
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S				6/ 17	9/ 19	7/ 22	12/ 17	7/ 18	13/ 18	13/ 18	16/ 19	14/ 17	15/ 18	12/ 18	11/ 17	11/ 18	14/ 18	9/ 17	11/ 20

Detection Limit: 1 ng/g-dry



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S				2/ 17	6/ 19	4/ 22	4/ 17	4/ 18	8/ 18	11/ 18	13/ 19	10/ 17	12/ 18	9/ 18	8/ 17	7/ 18	5/ 18	6/ 17	6/ 14

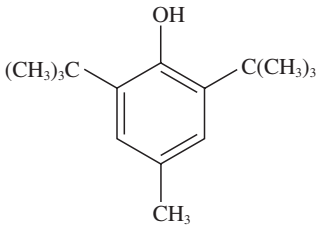
Detection Limit: 1 ng/g-dry



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S				11/ 17	13/ 19	16/ 22	13/ 16	9/ 18	16/ 18	16/ 18	18/ 19	16/ 17	17/ 18	16/ 18	16/ 17	16/ 18	15/ 18	15/ 17	16/ 20

Detection Limit: 1 ng/g-dry

[8] 2,6-Di-*tert*-butyl-4-methylphenol (BHT)



BHT is used as an anti-oxidant, anti-degradation agent for plastics, etc.

Survey results

<Bottom sediment>

The range of detected values of BHT in the FY2001 survey was 1.8 to 30 ng/g-dry and the detection frequency was 35% (7 samples out of 20).

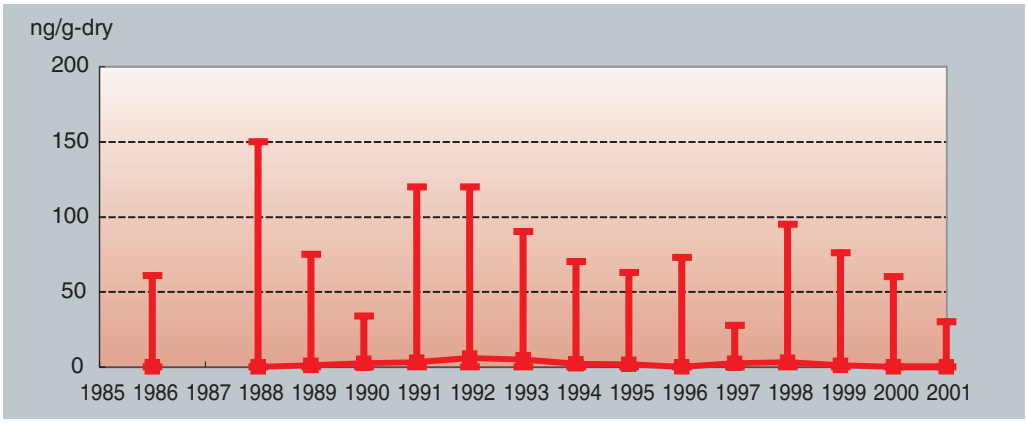
○Survey Results of BHT in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range
		Sample	(ng/g-dry)
BHT	Bottom sediment	35% (7/20)	1.8 – 30

The concentration level of BHT has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals.

Figure 3-8 Detection Frequency and Range of 2,6-Di-*tert*-butyl-4-methylphenol (BHT)

Bottom sediment

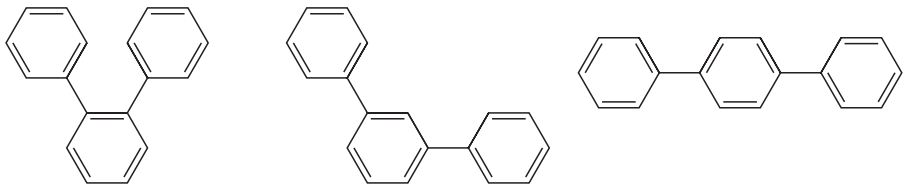


	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S		5/ 17		9/ 22	5/ 16	9/ 18	10/ 18	12/ 18	14/ 19	9/ 16	12/ 18	11/ 51	12/ 17	14/ 18	7/ 18	7/ 17	7/ 20

Detection Limit: 1 ng/g-dry

[9] Terphenyls

o-Terphenyl *m*-Terphenyl *p*-Terphenyl



Terphenyls are used as heat transfer media and/or for its raw material.

Survey results

<Bottom sediment>

The range of detected values of *o*-terphenyl, *m*-terphenyl and *p*-terphenyl in the FY2001 survey was 0.51 to 5.1 ng/g-dry, 2.3 to 67 ng/g-dry and 1.2 to 38 ng/g-dry, respectively. The detection frequency was 15% (3 samples out of 20), 35% (7 samples out of 20) and 40% (8 samples out of 20), respectively.

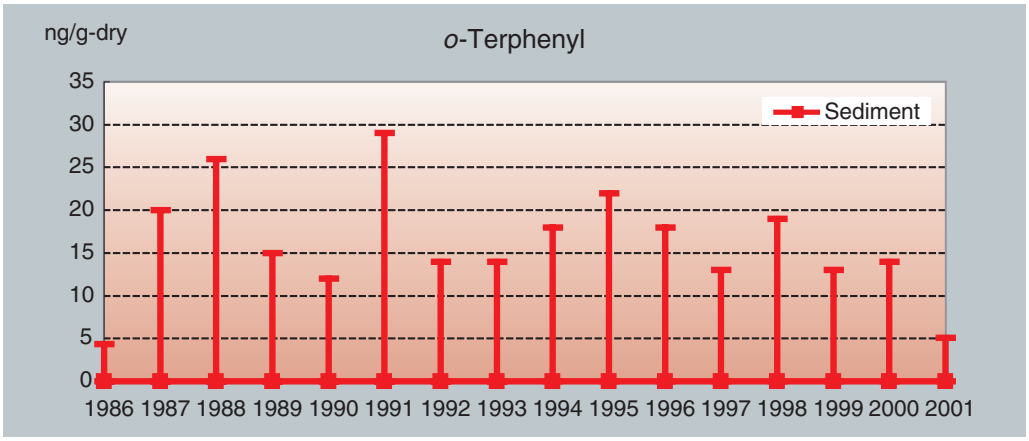
○Survey Results of Terphenyls in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range (ng/g-dry)
		Sample	
o-Terphenyl	Bottom sediment	15% (3/20)	0.51 – 5.1
m-Terphenyl		35% (7/20)	2.3 – 67
p-Terphenyl		40% (8/20)	1.2 – 38

The concentration level of terphenyls has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals.

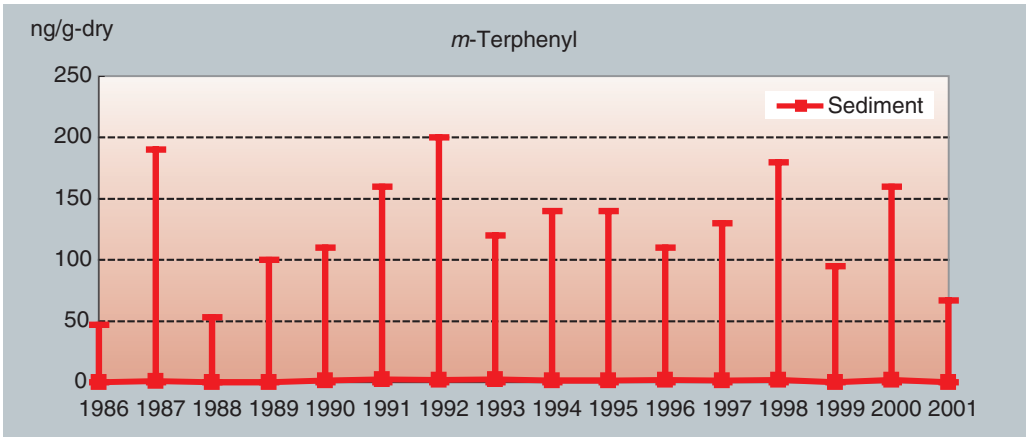
Figure 3-9 Detection Frequency and Range of *o*-, *m*- and *p*-Terphenyl

Bottom sediment



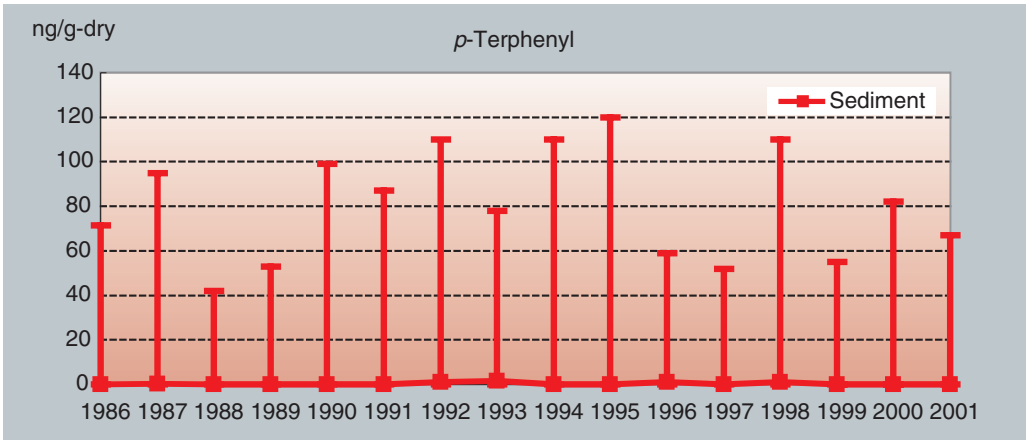
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S	3/17	4/19	1/22	4/17	6/18	4/18	6/18	8/19	4/17	4/18	1/18	4/17	3/18	3/18	5/17	3/20

Detection Limit: 1 ng/g-dry



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S	5/17	10/19	6/22	10/17	12/18	14/18	15/18	15/19	12/17	14/18	14/18	13/17	14/18	11/18	11/17	7/20

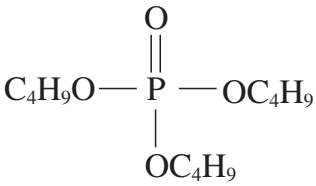
Detection Limit: 1 ng/g-dry



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S	4/17	6/19	7/22	9/17	11/18	14/18	15/18	15/19	12/17	12/18	9/18	11/17	12/18	5/18	10/17	8/20

Detection Limit: 1 ng/g-dry

[10] Tributyl phosphate (TBP)



TBP is used as a plasticizer for synthetic rubber, extraction solvent of metals, and antifoaming agent for paper and fiber processing.

Survey results

<Bottom sediment>

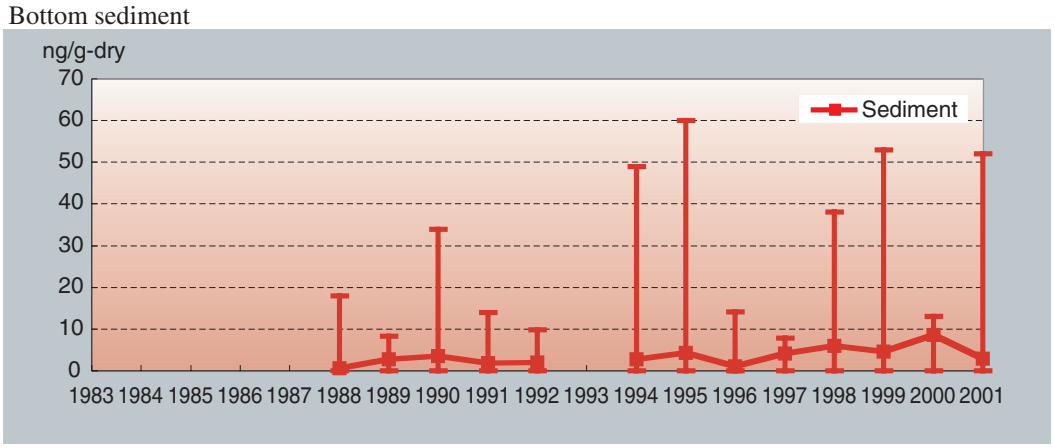
The range of detected values in the FY2001 survey was 2.1 to 52 ng/g-dry and the detection frequency was 60% (12 samples out of 20).

○Survey Results of TBP in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range
		Sample	(ng/g-dry)
TBP	Bottom sediment	60% (12/20)	2.1 – 52

The concentration level of TBP has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals.

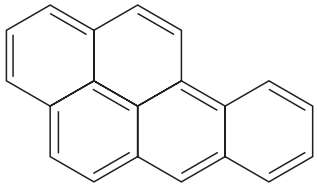
Figure 3-10 Detection Frequency and Range of Tributyl phosphate (TBP)



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S						8/22	6/15	9/17	8/17	7/15		10/17	10/18	9/18	8/18	10/18	10/18	9/17	12/20

Detection Limit: 1 ng/g-dry

[11] Benzo[*a*]pyrene



Benzo[*a*]pyrene is unintentionally formed as a result of incomplete combustion of organic materials such as oil, coal, wood, etc., as well as being produced by the carbonization of coal and other materials.

Survey results

<Bottom sediment>

The range of detected values in the FY2001 survey was 2.4 to 1,700 ng/g-dry and the detection frequency was 80% (16 samples out of 20).

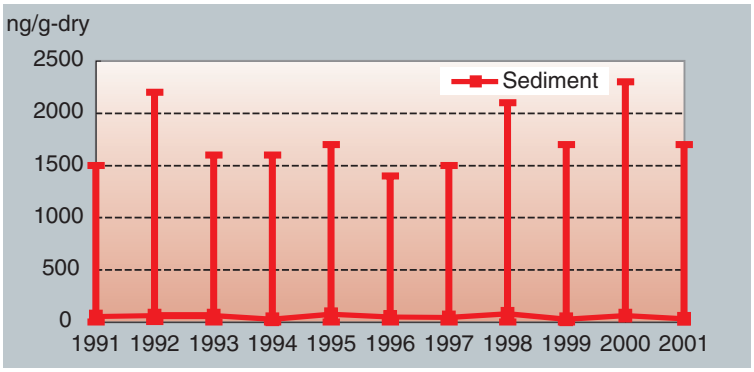
○Survey Results of Benzo[*a*]pyrene in Bottom sediment (FY2001)

Substance	Media	Detection frequency	Range
		Sample	(ng/g-dry)
Benzo[*a*]pyrene	Bottom sediment	80% (16/20)	2.4 – 1,700

The concentration level of Benzo[*a*]pyrene has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals.

Figure 3-11 Detection Frequency and Range of Benzo[*a*]pyrene

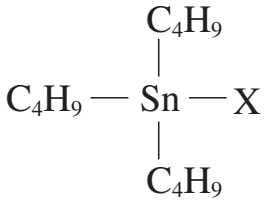
Bottom sediment



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S	16/18	18/18	18/19	14/17	16/18	17/18	15/17	16/17	15/18	12/17	16/20

Detection Limit: 1 - 5 ng/g-dry

[12] Tributyltin (TBT) **compounds**



X: anion

As a result of the General Inspection Survey of Chemical Substances on Environmental Safety, environmental pollution caused by organotin compounds became apparent throughout Japan, so environmental pollution has been monitored in wildlife since FY1985 for tributyltin (TBT) compounds and since FY1989 for triphenyltin (TPT) compounds. Based on the survey results, 13 TBTs and 7 TPTs were specified as Designated Chemical Substances based on the Chemical Substances Control Law in the late 1980s. Accordingly, surveys for bottom sediment and surface water have been successively conducted since FY1988.

In 1990, bis(tributyltin) oxide (TBTO), which is a TBT among organotin compounds, was designated as a Class 1 Specified Chemical Substance based on the Chemical Substances Control Law. In addition, the former Designated Chemical Substances of 13 TBTs, excluding TBTO, and 7 TPTs were designated as Class 2 Specified Chemical Substances based on the same law.

Survey results

TBTs were detected in surface water, bottom sediment, fish and shellfish. The range of detected values of TBTs* in surface water, bottom sediment, fish and sellfish was 0.003 to 0.023 μg/ℓ , 0.8 to 210 ng/g-dry, 0.01 to 0.10 μg/g-wet and 0.01 to 0.05 μg/g-wet, respectively. The detection frequency in surface water, bottom sediment, fish and sellfish was 14% (13 samples out of 96) and that in terms of area was 22% (7 areas out of 32), 81% (83 samples out of 102) and that in terms of area was 88% (30 areas out of 34), 43% (31 samples out of 72) and that in terms of area was 53% (8 areas out of 15) and 100% (30 samples out of 30) and that in terms of area was 100% (6 areas out of 6), respectively.

* Values are the equivalent value to TBTO (bis-tributyltin oxide).

○Survey Results of TBTs in the Aquatic system and Wildlife (FY2001)

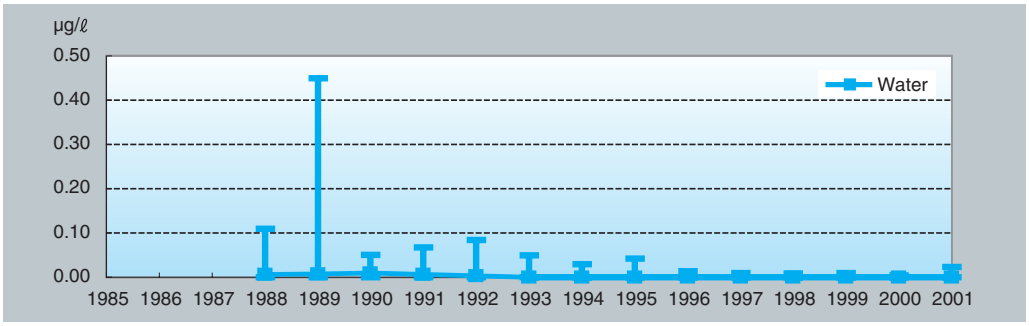
Substance	Media	Detection frequency		Range	Detection limit
		Sample	Area		
TBT	Surface water	14% (13/96)	22% (7/32)	0.003 − 0.023 μg/ℓ	0.003 μg/ℓ
	Bottom sediment	81% (83/102)	88% (30/34)	0.8 − 210 ng/g-dry	0.8 ng/g-dry
	Fish	43% (31/72)	53% (8/15)	0.01 − 0.10 μg/g-wet	0.01 μg/g-wet
	Shellfish	100% (30/30)	100% (6/6)	0.01 − 0.05 μg/g-wet	0.01 μg/g-wet
	Birds	0% (0/10)	0% (0/2)	ND	0.01 μg/g-wet

TBTs persist widely in the environment and their pollution levels generally remain at the same level in bottom sediment.

The situation of pollution by TBTs is expected to improve further, considering that their production and use in open systems has been substantially terminated in Japan. However, there is some anxiety about pollution by non-regulated countries for using TBTs, it is necessary to continue to promote measures against environmental pollution and to monitor the status of environmental pollution. Furthermore, since the substances are suspected of having endocrine disrupting effects, it is also necessary to collect toxicological and other related information.

Figure 3-12 Detection Frequency and Range of Tributyl tin (TBT) compounds

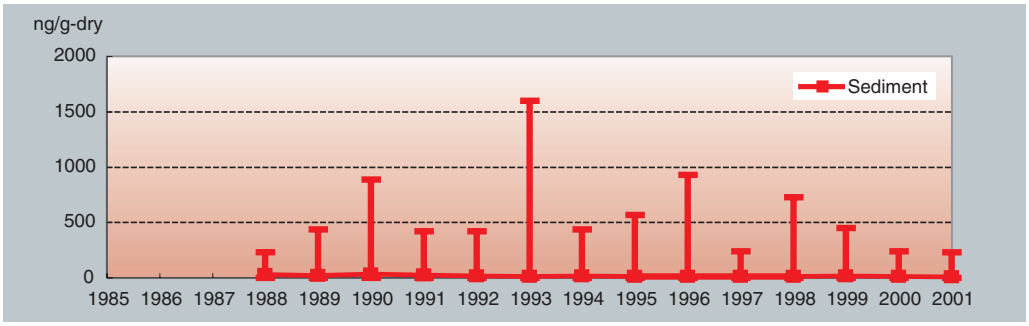
(A) Surface water



	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
W				34/ 51	46/ 78	60/ 77	60/ 93	52/ 99	42/ 99	35/ 96	31/ 105	27/ 105	21/ 107	20/ 76	16/ 105	9/ 102	13/ 96

Detection Limit: 0.003 - 0.1 μg/ℓ

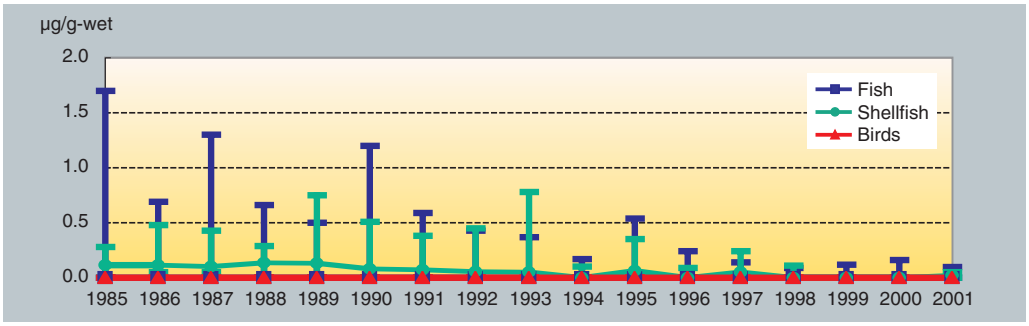
(B) Bottom sediment



	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S				51/ 51	63/ 78	76/ 90	85/ 95	87/ 102	83/ 102	87/ 102	87/ 104	94/ 108	85/ 105	86/ 105	85/ 103	81/ 99	83/ 102

Detection Limit: 0.1 - 1 ng/g-dry

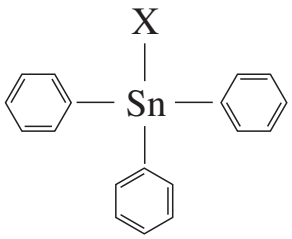
(C) Wildlife



	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	23/ 60	22/ 55	17/ 65	27/ 65	23/ 65	26/ 70	21/ 70	22/ 70	23/ 70	15/ 70	13/ 70	23/ 70	13/ 70	17/ 70	9/ 70	10/ 70	31/ 72
SF	15/ 20	20/ 20	20/ 20	12/ 20	16/ 21	24/ 25	18/ 30	17/ 30	15/ 30	6/ 30	20/ 30	15/ 30	18/ 30	10/ 30	0/ 30	0/ 30	30/ 30
B	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 5	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10

Detection Limit: [-FY2000]Fish(0.05 - 3 μg/g-wet), Shellfish(0.05 μg/g-wet), Birds(0.05 μg/g-wet); [FY2001] 0.01 μg/g-wet

[13] Triphenyltin (TPT) **compounds**



X: anion

Triphenyltin (TPT) compounds persist widely in the environment and their pollution levels generally remain at the same level in bottom sediment. However, in surface water the pollution level has improved in recent years and in wildlife the pollution levels remain largely at the same level or tend to be improved. The pollution by TPTs is expected to improve further, considering that the production and usage of them for open systems has been substantially terminated in Japan.

Survey results

TPTs were detected in surface water, bottom sediment and wildlife (fish/shellfish). The range of detected values of TPTs* in surface water was 0.001 to 0.002 μg/ℓ , the detection frequency was 3% (3 samples out of 96) and that in terms of area was 3% (1 area out of 32). The range of detected values of TPTs* in bottom sediment was 1.0 to 29 ng/g-dry, the detection frequency was 48% (49 samples out of 102), and that in terms of area was 62% (21 areas out of 34). The range of detected values of TPTs* in fish was 0.02 to 0.05 μg/g-wet, the detection frequency was 8% (6 samples out of 72), and that in terms of area was 20% (3 areas out of 15). The detected value of TPTs in shellfish was 0.02 μg/g-wet, the detection frequency was 17% (5 sample out of 30), and that in terms of area was 17% (1 area out of 6).

* Values are the equivalent value to TPTCl (triphenyltin chloride).

○Survey Results of TPTs in the Aquatic system and Wildlife (FY2001)

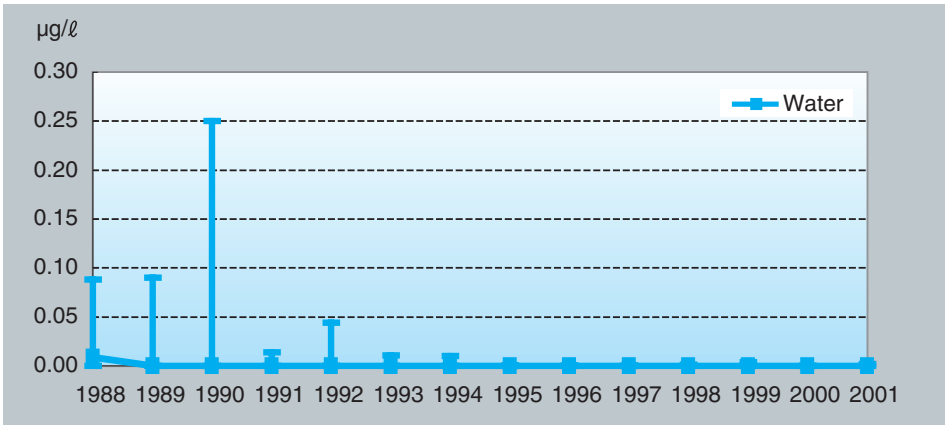
Substance	Media	Detection frequency		Range	Detection limit
		Sample	Area		
TPT	Surface water	3% (3/96)	3% (1/32)	0.001 – 0.002 μg/ℓ	0.001 μg/ℓ
	Bottom sediment	48% (49/102)	62% (21/34)	1.0 – 29 ng/g-dry	1.0 ng/g-dry
	Fish	8% (6/72)	20% (3/15)	0.02 – 0.05 μg/g-wet	0.02 μg/g-wet
	Shellfish	17% (5/30)	17% (1/6)	0.02 μg/g-wet	0.02 μg/g-wet
	Birds	0% (0/10)	0% (0/2)	ND	0.02 μg/g-wet

TPTs persist widely in the environment and their pollution levels generally remain at the same level in bottom sediment.

The situation of pollution by TPTs is expected to improve further, considering that their production and use in open systems has been substantially terminated in Japan. However, there is some anxiety about pollution by non-regulated countries for using TPTs, it is necessary to continue to promote measures against environmental pollution and to monitor the status of environmental pollution. Furthermore, since the substances are suspected of having endocrine disrupting effects, it is also necessary to collect toxicological and other related information.

Figure 3-13 Detection Frequency and Range of Triphenyl tin (TPT) compounds

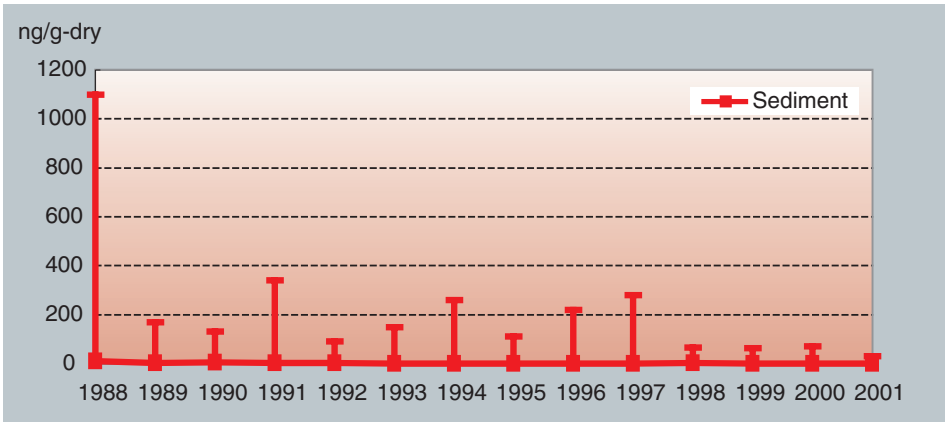
(A) Surface water



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
W	73/ 119	39/ 78	19/ 72	5/ 90	10/ 90	2/ 90	4/ 92	0/ 87	0/ 108	0/ 108	4/ 102	3/ 105	0/ 102	3/ 96

Detection Limit: 0.001 - 0.01µg/ℓ

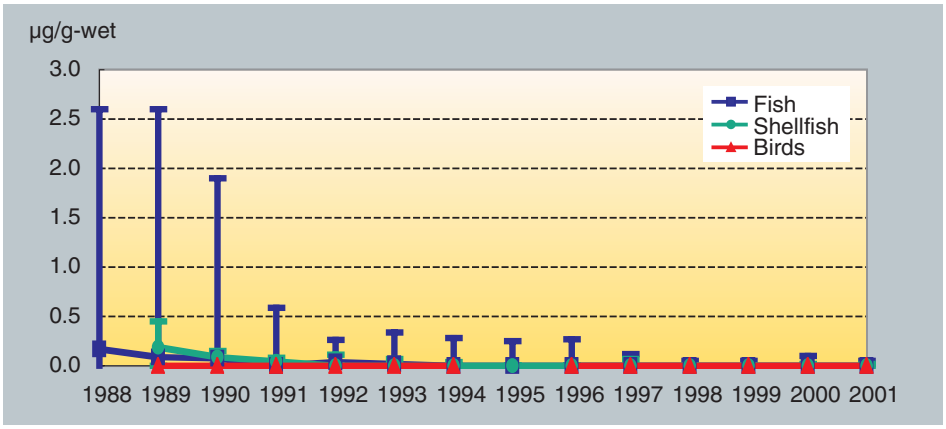
(B) Bottom sediment



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S	99/ 129	50/ 78	51/ 77	55/ 89	60/ 95	55/ 96	47/ 88	48/ 93	41/ 99	36/ 91	54/ 94	45/ 99	52/ 96	49/ 102

Detection Limit: 0.3 - 1 ng/g-dry

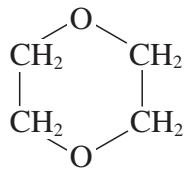
(C) Wildlife



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
F	118/ 144	40/ 65	50/ 70	33/ 70	40/ 70	38/ 70	28/ 70	21/ 70	20/ 70	19/ 70	14/ 70	10/ 70	13/ 70	6/ 72
SF		17/ 21	20/ 25	22/ 30	10/ 30	5/ 30	5/ 30	0/ 30	0/ 30	5/ 30	0/ 30	0/ 30	1/ 30	5/ 30
B		5/ 10	5/ 10	0/ 10	0/ 10	0/ 10	0/ 5		0/ 10	0/ 10	0/ 10	0/ 10	0/ 10	0/ 10

Detection Limit: 0.02 µg/g-wet

[14] 1,4-Dioxane



1,4-Dioxane is used as an industrial solvent in a wide range of organic products. It was designated as a Designated Chemical Substance based on the Chemical Substances Control Law in October 1987 and has been subject to the survey since FY1989, in which surface water and bottom sediment are surveyed.

Survey results

The range of detected values in surface water was 0.09 to 8.0 μg/ℓ in FY2001 and the geometric mean was 0.12 μg/ℓ. The detection frequency was 45% (45 samples out of 99), and that in terms of area was 48% (16 areas out of 33).

The detected value in bottom sediment was 14 to 30 ng/g-dry, and the geometric mean was 1.6 ng/g-dry. The detection frequency was 3% (3 sample out of 99), and that in terms of area was 3% (1 area out of 33).

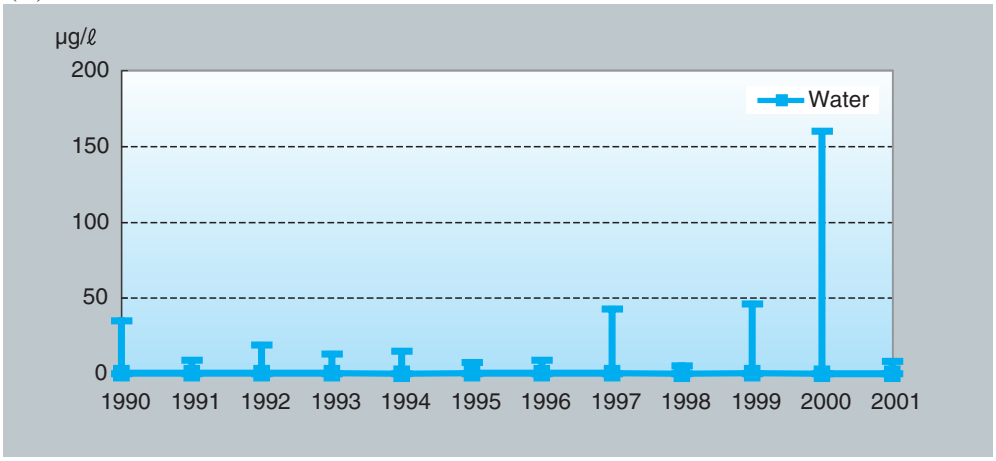
Compared with past survey results for surface water and bottom sediment, there was no apparent difference in the pollution status. Since 1,4-Dioxane persists widely in the environment, it is necessary to continue surveys to monitor the pollution status. However, its concentration level has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals.

○Survey Results of 1,4-Dioxane in the Aquatic System (FY2001)

Substance	Media	Detection frequency		Geometric mean	Range	Detection limit
		Sample	Area			
1,4-Dioxane	Surface water	45% (45/99)	48% (16/33)	0.12 μg/ℓ	0.09 – 8.0 μg/ℓ	0.08 μg/ℓ
	Bottom sediment	3% (3/99)	3% (1/33)	1.6 ng/g-dry	14 – 30 ng/g-dry	10 ng/g-dry

Figure 3-14 Detection Frequency and Range of 1,4-Dioxane

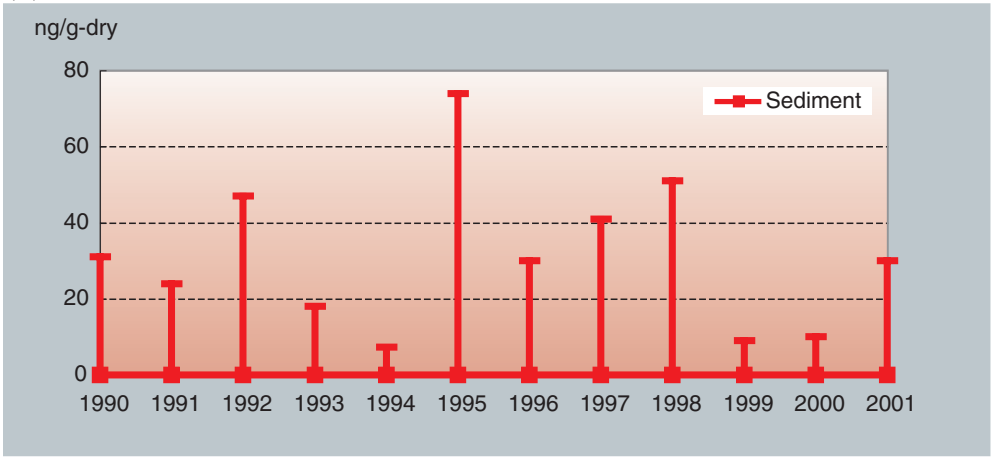
(A) Surface water



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
W	62/ 96	66/ 96	64/ 99	67/ 102	60/ 96	64/ 105	68/ 105	70/ 102	63/ 103	71/ 105	60/ 98	45/ 99

Detection Limit: 0.08 - 0.1 μg/ℓ

(B) Bottom sediment

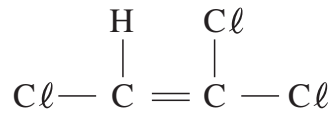


	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
S	29/ 94	12/ 96	6/ 102	15/ 93	13/ 90	9/ 102	5/ 108	3/ 105	5/ 108	1/ 99	1/ 93	3/ 99

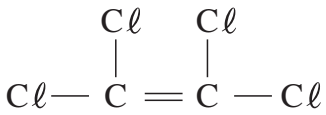
Detection Limit: 5 -10 ng/g-dry

[15] Trichloroethylene (TCE) **/ Tetrachloroethylene** (PERC)

TCE



PERC



Trichloroethylene (TCE) is used as a metal degreasing detergent and tetrachloroethylene (PERC) is used as a dry-cleaning solvent and a metal degreasing detergent. These two substances were designated as Designated Chemical Substances based on the Chemical Substances Control Law in May 1987, and were later designated as Class 2 Specified Chemical Substance based on the same law in April 1989. As of October 1989, the two substances have been subject to waste water regulation and ground water regulation based on the Water Pollution Control Law, and in March 1993, they were added to the items in the Environmental Quality Standard for water pollution. Concerning air, the Guidelines on Environmental Atmosphere (provisional figure) was established in April 1993, and the Environmental Quality Standard was established in February 1997.

These two substances have been subject to the survey since FY1988 for surface water, bottom sediment and air, but since FY1989 surface water and bottom sediment were excluded due to their low detection frequencies and concentration levels in the FY1988 survey. Since FY1997, air has been excluded from the survey because these substances were added to the items in the Environmental Quality Standard under which the pollution status of the substances are observed full time. Since FY1990, the Study of the Exposure Route has also been conducted.

Survey results

(TCE)

In FY2001, the Survey of the Persistence in the Environment (Table 3-3, available on the CD-ROM) and the Study of the Exposure Route (Table 3-4, available on the CD-ROM) were conducted.

The range of detected values in air was 0.02 to 3.8 μg/m^3, the detection frequency was 95% (38 samples out of 40), the geometric mean was 0.25 μg/m^3, and the exposure range was 1.2 to 29 μg/person.day. The range of detected values in indoor air was 0.02 to 6.9 μg/m^3, the detection frequency was 95% (60 samples out of 63), the geometric mean was 0.30 μg/m^3, and the exposure range was 0.75 to 43 μg/person.day.

In the FY2001 survey, TCE was detected in many points as in the past surveys.

(PERC)

The range of detected values in air was 0.04 to 1.7 μg/m^3, the detection frequency was 100% (40 samples out of 40), the geometric mean was 0.49 μg/m^3, and the exposure range via air was 5.5 to 17 μg/person.day. The range of detected values in indoor air was 0.07 to 9.9 μg/m^3, the detection frequency was 100% (63 samples out of 63), the geometric mean was 0.44 μg/m^3, and the exposure range via indoor air was 1.8 to 44 μg/person.day.

Compared with the past survey results, there was no apparent difference in the status of persistence and exposure.

Since TCE and PERC persist widely in the environment, it is necessary to continue surveys in order to monitor the pollution status. However, their concentration levels have not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals while paying attention to the change of product amount.

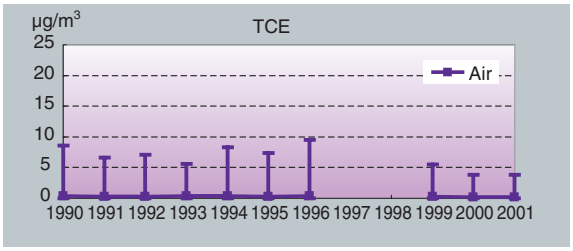
○Survey Results of TCE and PERC (FY2001)

Substance	Media	Detection frequency	Concentration ($\mu g/m^3$)			Exposure amount (μg/person.day)	
		Sample	Geometric mean	Range	Detection limit	Range	Geometric mean
TCE	Air	95% (38/40)	0.25	0.02 – 3.8	0.02	1.2 – 29	3.7
	Indoor air	95% (60/63)	0.30	0.02 – 6.9	0.02	0.75 – 43	4.9
PERC	Air	100% (40/40)	0.49	0.04 – 1.7	0.01	5.5 – 17	8.6
	Indoor air	100% (63/63)	0.44	0.07 – 9.9	0.01	1.8 – 44	7.2

note: Geometric mean is calculated, assuming ND as a half of the detection limit.
Exposure range is calculated, assuming the amount of respiration by an adult as $15m^3$ per day.

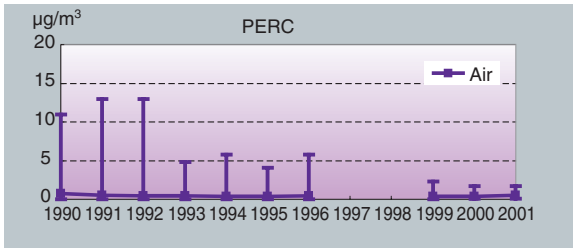
Figure 3-15 Detection Frequency and Range of Trichloroethylene (TCE) and Tetrachloroethylene (PERC)

(A) Air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
A	109/ 128	109/ 126	118/ 138	98/ 110	88/ 110	91/ 108	108/ 126			37/ 38	38/ 41	38/ 40

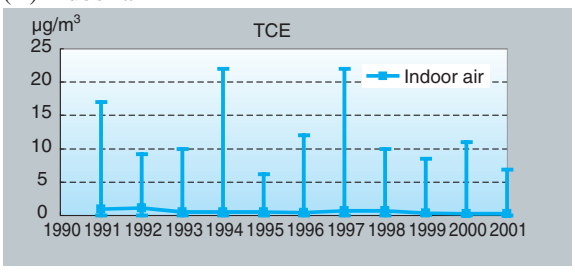
Detection Limit: 0.020 - 0.062 μg/m3



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
A	136/ 137	144/ 144	147/ 158	117/ 117	109/ 114	110/ 111	125/ 126			37/ 37	41/ 41	40/ 40

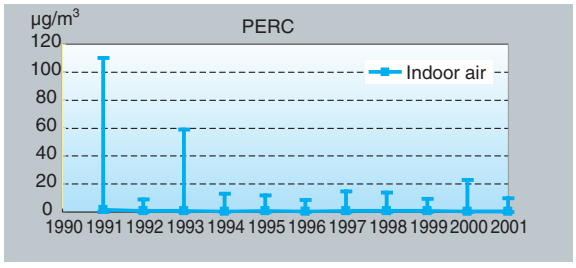
Detection Limit: 0.007 - 0.060 μg/m3

(B) Indoor air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I		79/ 80	76/ 78	77/ 77	71/ 72	73/ 76	64/ 84	75/ 76	75/ 79	71/ 71	68/ 72	60/ 63

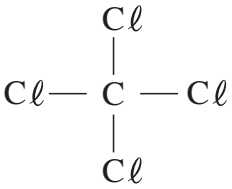
Detection Limit: 0.020 - 0.17 μg/m3



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I		81/ 81	78/ 81	81/ 81	74/ 81	75/ 81	74/ 84	79/ 79	80/ 80	72/ 72	72/ 72	63/ 63

Detection Limit: 0.010 - 0.10 μg/m3

[16] Carbon tetrachloride



Carbon tetrachloride is primarily used as a raw material in the chemical industry. It was designated as a Designated Chemical Substance based on the Chemical Substances Control Law in July 1987, and later designated as a Class 2 Specified Chemical Substance based on the same law in April 1989. It was added to the items in the Environmental Quality Standard for water pollution in March 1993. In Japan, manufacture of the substance was terminated at the end of FY1995 based on the Montreal Protocol, with the exception of its use for experiments, research and analytical purposes.

Carbon tetrachloride has been subject to the survey since FY1988 for surface water, bottom sediment and air, but since FY1989 surface water and bottom sediment have been excluded due to the low detection frequency and concentration level in the FY1988 survey, and only air has been surveyed. Since FY1990, the Study of the Exposure Route has also been conducted.

Survey results

The range of detected values in air was 0.13 to 2.3 μg/m^3, and the geometric mean was 0.71 μg/m^3. The detection frequency was 100% (115 samples out of 115), and the exposure range via air was 2.5 to 12 μg/person.day. In the Study of the Exposure Route, the range of detected values in indoor air was 0.19 to 1.7 μg/m^3, the geometric mean was 0.70 μg/m^3, the detection frequency was 100% (57 samples out of 57), and the exposure range via indoor air was 4.7 to 20 μg/person.day.

Compared with past survey results, there was no apparent difference in the status of persistence and exposure.

Although carbon tetrachloride persists widely with a comparatively high concentration level in the environment, its concentration level has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals.

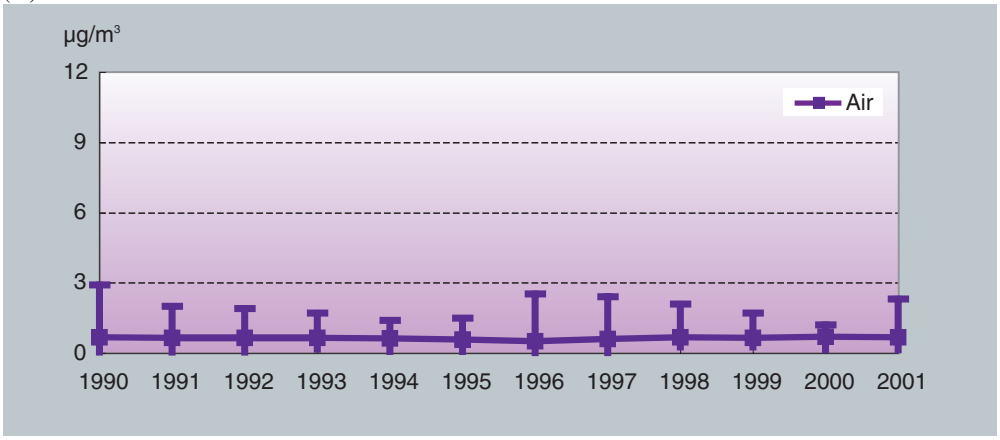
○Survey Results of Carbon tetrachloride (FY2001)

Substance	Media	Detection frequency	Concentration (μg/m^3)			Exposure amount (μg/person.day)	
		Sample	Geometric mean	Range	Detection limit	Range	Geometric mean
Carbon tetrachloride	Air	100% (115/115)	0.71	0.13 – 2.3	0.01	2.5 – 12	7.8
	Indoor air	100% (57/57)	0.70	0.19 – 1.7	0.01	4.7 – 20	10

note: Geometric mean is calculated, assuming ND as a half of the detection limit.
Exposure range is calculated, assuming the amount of respiration by an adult as 15m^3 per day.

Figure 3-16 Detection Frequency and Range of Carbon tetrachloride

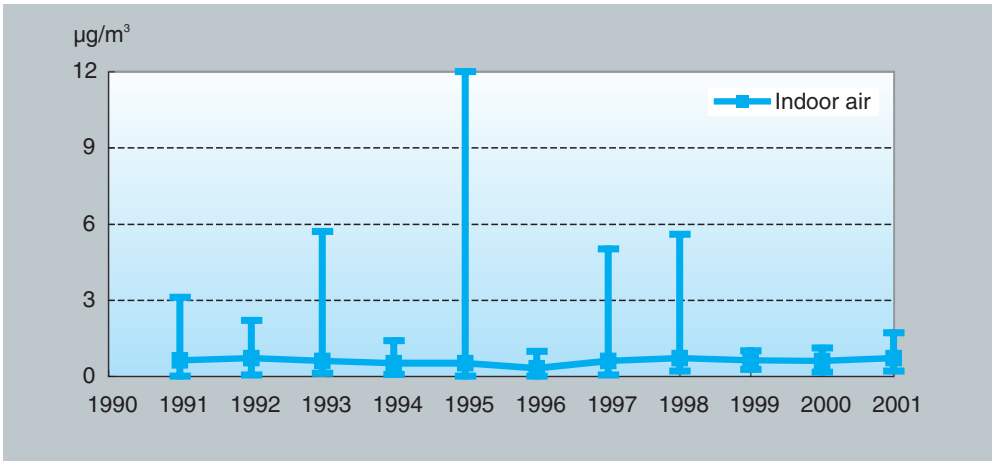
(A) Air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
A	137/ 137	144/ 144	157/ 158	115/ 115	111/ 111	111/ 111	124/ 130	128/ 128	130/ 130	119/ 119	117/ 117	115/ 115

Detection Limit: 0.001 - 0.025 μg/m³

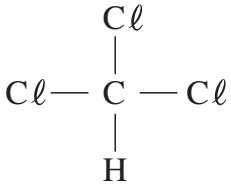
(B) Indoor air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I		80/ 81	81/ 81	81/ 81	77/ 77	79/ 81	62/ 84	79/ 79	81/ 81	72/ 72	72/ 72	57/ 57

Detection Limit: 0.005 - 0.10 μg/m³

[17] Chloroform



Chloroform is used as a raw material for synthetic resin, solvents and others. It was designated as a Designated Chemical Substance based on the Chemical Substances Control Law in July 1987. In March 1993, it was designated as a item for Monitoring of the Precautionary Monitoring Targets concerned with water pollution.

Chloroform has been subject to the survey since FY1988 for surface water, bottom sediment and air, but in FY1989 surface water and bottom sediment were excluded due to the low detection frequency and concentration level in the FY1988 survey, and only air has been surveyed. Since FY1991, the Study of the Exposure Route has also been conducted.

Survey results

The range of detected values in air was 0.03 to 6.5 μg/m^3, and the geometric mean was 0.29 μg/m^3. The detection frequency was 99% (118 samples out of 119), and the exposure range via air was 2.8 to 73 μg/person.day. In the Study of the Exposure Route, the range of detected values in indoor air was 0.02 to 12 μg/m^3, and the geometric mean was 0.93 μg/m^3. The detection frequency was 98% (62 samples out of 63), and the exposure range via indoor air was 3.9 to 73 μg/person.day. The range of detected values in diet was 1.5 to 16 ng/g-fresh weight and the geometric mean was 4.1 ng/g-fresh weight. The detection frequency was 87% (55 samples out of 63) and the exposure range via diet was 4.4 to 18 μg/person.day.

Compared with past survey results, there was no apparent difference in the status of persistence and exposure. Since chloroform persists widely with a comparatively high concentration level in the environment and its concentration in indoor air is higher than that in the open air, it is necessary to continue surveys to monitor the status of environmental pollution. However, its concentration level has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals while paying attention to the change of product amount.

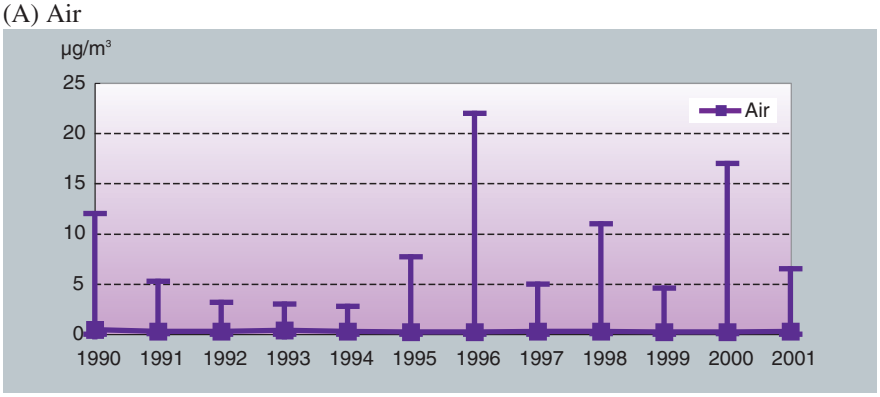
○Survey Results of Chloroform (FY2001)

Substance	Media	Detection frequency	Concentration (air:μg/m^3 diet:ng/g-fresh weight)			Exposure amount (μg/person.day)	
		Sample	Geometric mean	Range	Detection limit	Range	Geometric mean
Chloroform	Air	99% (118/119)	0.29	0.03 – 6.5	0.01	2.8 – 73	5.5
	Indoor air	98% (62/63)	0.93	0.02 – 12	0.01	3.9 – 73	15
	Diet	87% (55/63)	4.1	1.5 – 16	1.5	4.4 – 18	8.3

note: Geometric mean is calculated, assuming ND as a half of the detection limit.
Exposure range is calculated, assuming the amount of respiration by an adult as 15m^3 per day.

Figure 3-17 Detection Frequency and Range of Chloroform

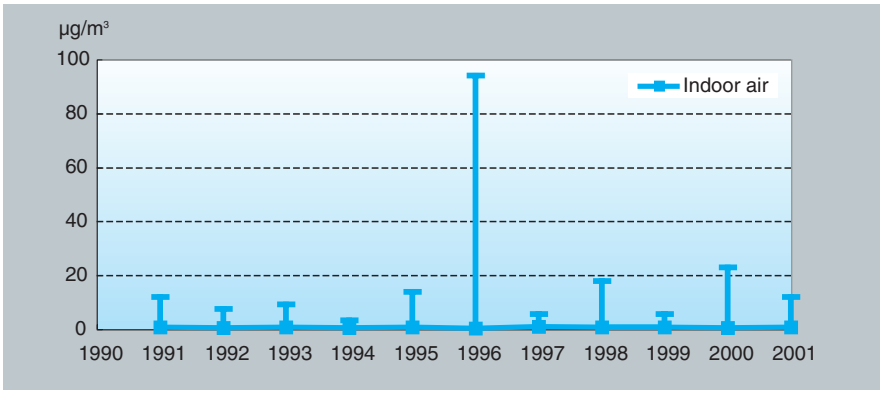
(A) Air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Air	128/ 128	136/ 136	124/ 148	107/ 108	104/ 113	98/ 113	118/ 130	122/ 134	126/ 126	121/ 121	116/ 116	118/ 119

Detection Limit: 0.01 μg/m³

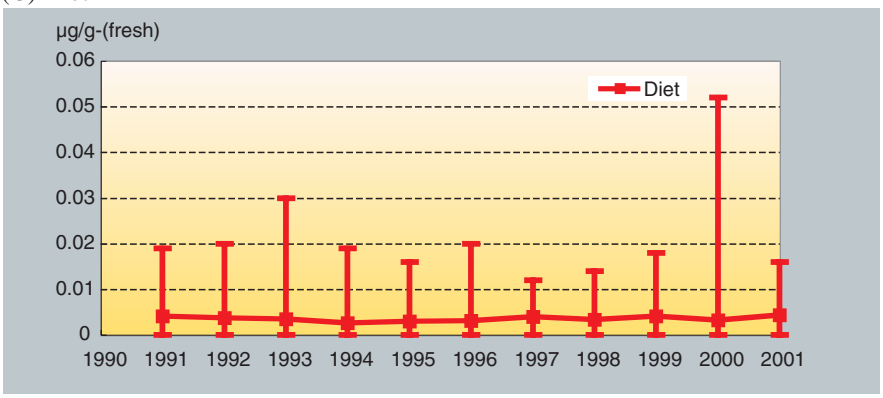
(B) Indoor air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I		79/ 81	78/ 81	81/ 81	75/ 81	80/ 81	72/ 84	79/ 79	81/ 81	72/ 72	71/ 72	62/ 63

Detection Limit: 0.01 μg/m³

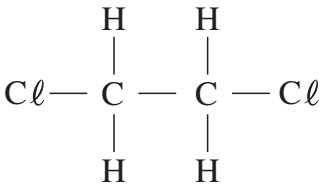
(C) Diet



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
D		68/ 81	58/ 81	73/ 74	55/ 81	63/ 81	60/ 81	67/ 81	65/ 81	62/ 72	58/ 72	55/ 63

Detection Limit: 0.0015 μg/g-fresh weight

[18] 1,2-Dichloroethane (DCE)



1,2-dichloroethane(DCE) is used as a raw material for vinylchloride monomers, etc. It was designated as a Designated Chemical Substance based on the Chemical Substances Control Law in July 1987. In March 1993, it was added to the items in the Environmental Quality Standard for water pollution.

1,2-DCE has been subject to the survey for surface water, bottom sediment and air since FY1989. Surface water and bottom sediment were later excluded from the survey for two reasons: first, because it was added to the items in the Environmental Quality Standard for water pollution in which water pollution was to be constantly monitored; secondly, it was detected with low frequency and concentration level in the FY1992 survey. Since FY1993, only air has been surveyed. The substance has been subject to the Study of the Exposure Route since FY1994 due to the tendency of high detection frequency in air.

Survey results

The range of detected values in air was 0.0023 to 0.62 μg/m^3, the geometric mean was 0.065 μg/m^3, and the detection frequency was 99% (97 samples out of 98), and the exposure range via air was 0.23 to 5.5 μg/person.day.

The range of detected values in indoor air was 0.0091 to 0.30 μg/m^3, the geometric mean was 0.071 μg/m^3, the detection frequency was 96% (52 samples out of 54), and the exposure range via indoor air was 0.45 to 2.3 μg/person.day.

Compared with past survey results, there was no apparent difference in the status of persistence and exposure.

Although 1,2-DCE persists widely in the environment, its concentration level has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals while paying attention to the change of product amount.

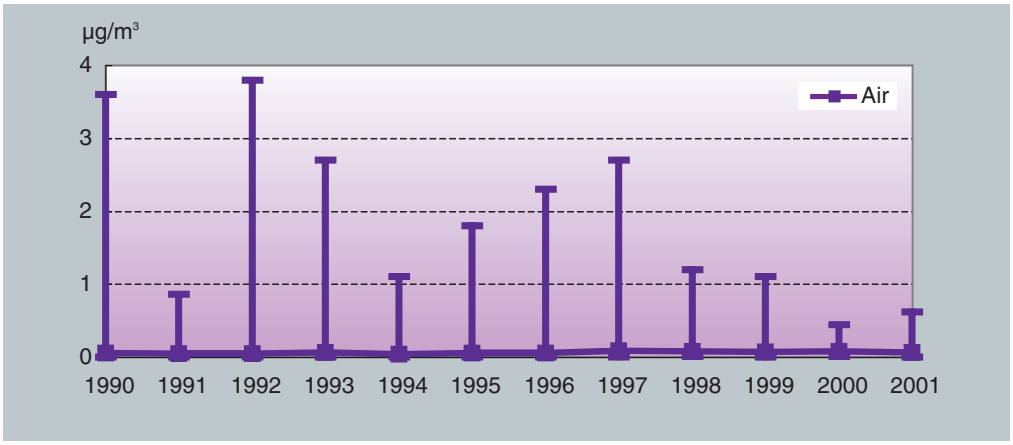
○Survey Results of 1,2-DCE (FY2001)

Substance	Media	Detection frequency	Concentration (μg/m^3)			Exposure amount (μg/person.day)	
		Sample	Geometric mean	Range	Detection limit	Range	Geometric mean
1,2-DCE	Air	99% (97/98)	0.065	0.0023 – 0.62	0.0009	0.23 – 5.5	0.85
	Indoor air	96% (52/54)	0.071	0.0091 – 0.30	0.0064	0.45 – 2.3	1.4

note: Geometric mean is calculated, assuming ND as a half of the detection limit.
Exposure range is calculated, assuming the amount of respiration by an adult as 15m^3 per day.

Figure 3-18 Detection Frequency and Range of 1,2-Dichloroethane (DCE)

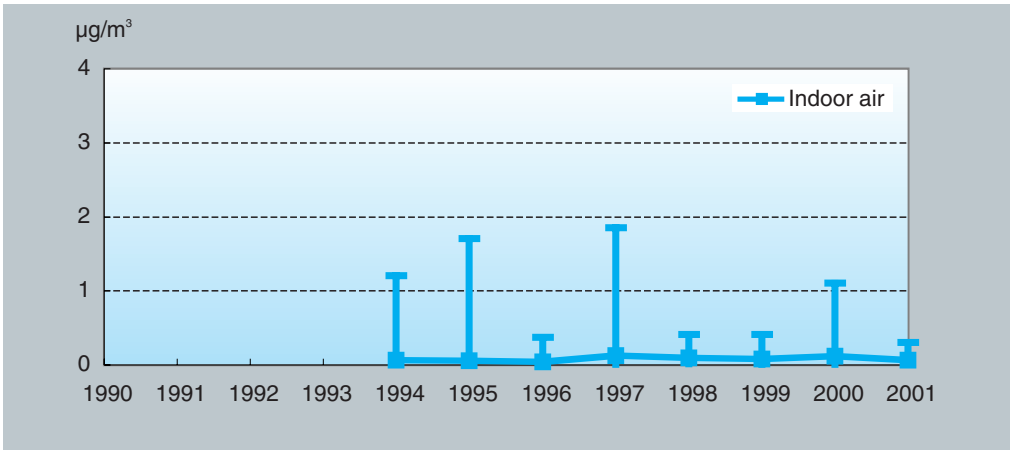
(A) Air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
A	48/ 58	52/ 60	55/ 62	72/ 80	73/ 80	66/ 79	80/ 92	96/ 97	102/ 102	101/ 101	96/ 96	97/ 98

Detection Limit: 0.0009 μg/m³

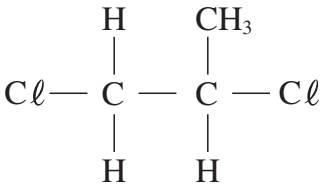
(B) Indoor air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I					71/ 71	70/ 70	73/ 78	73/ 79	73/ 73	71/ 72	70/ 70	52/ 54

Detection Limit: 0.0064 μg/m³

[19] 1,2-Dichloropropane (DCP)



1,2-Dichloropropane (DCP) is primarily used as a captive intermediate in the production of PERC and other chlorinated products. It is also used as an industrial solvent for oils, fats, resins, waxes, rubber, and so on. It was designated a Designated Chemical Substance based on the Chemical Substances Control Law in March 1988. In March 1993, it was designated as a item for Monitoring of the Precautionary Monitoring Targets concerned with water pollution.

1,2-DCP has been subject to the survey for surface water, bottom sediment and air since FY1989. Surface water and bottom sediment were later excluded from the survey, because of low detection frequency and concentration level in the FY1990 survey. Since FY1991, only air has been surveyed. The substance has been subject to the Study of the Exposure Route since FY1994 due to the tendency of high detection frequency in air.

Survey results

The range of detected values in air was 0.0020 to 9.0 μg/m^3, the geometric mean was 0.038 μg/m^3, the detection frequency was 100% (92 samples out of 92), and the exposure range via air was 0.18 to 1.5 μg/person.day.

The range of detected values in indoor air was 0.004 to 0.30 μg/m^3, the geometric mean was 0.044 μg/m^3, the detection frequency was 98% (51 samples out of 52), and the exposure range via indoor air was 0.35 to 2.0 μg/person.day.

Compared with past survey results, there was no apparent difference in the status of persistence and exposure.

Although 1,2-DCP persists widely in the environment, its concentration level has not changed in recent years, and it is considered possible to grasp the tendency by studies conducted at longer intervals while paying attention to the change of product amount.

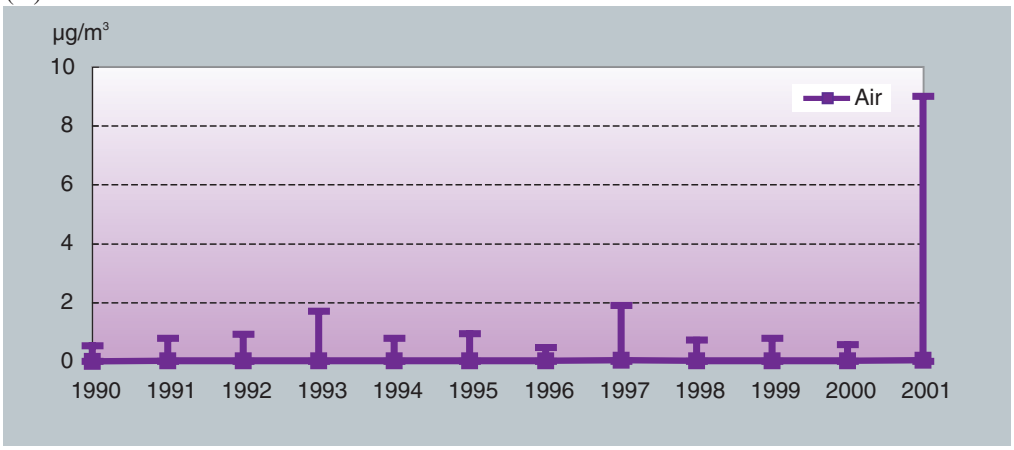
○Survey Results of 1,2-DCP (FY2001)

Substance	Media	Detection frequency	Concentration (μg/m^3)			Exposure amount (μg/person.day)	
		Sample	Geometric mean	Range	Detection limit	Range	Geometric mean
1,2-DCP	Air	100% (92/92)	0.038	0.0020 – 9.0	0.0009	0.18 – 1.5	0.50
	Indoor air	98% (51/52)	0.044	0.004 – 0.30	0.004	0.35 – 2.0	0.73

note: Geometric mean is calculated, assuming ND as a half of the detection limit.
Exposure range is calculated, assuming the amount of respiration by an adult as 15m^3 per day.

Figure 3-19 Detection Frequency and Range of 1,2-Dichloropropane (DCP)

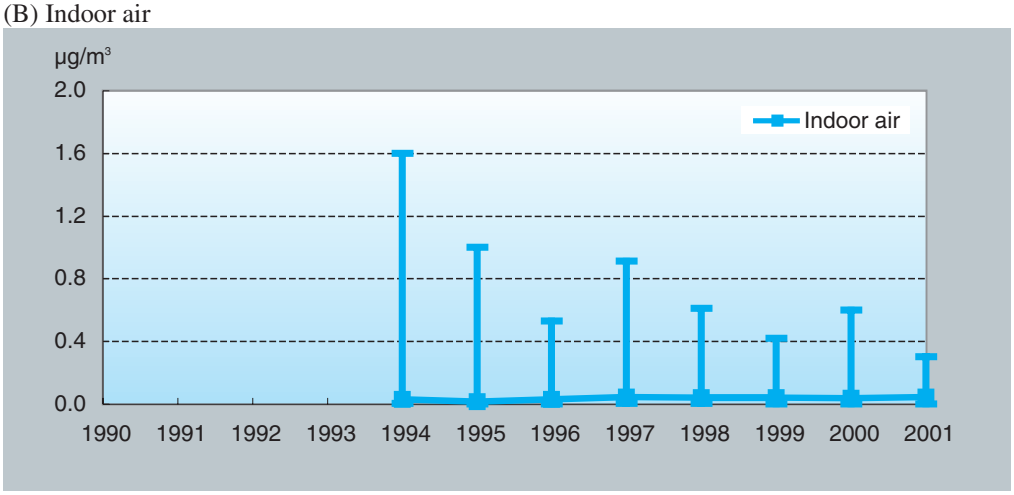
(A) Air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
A	23/ 58	23/ 61	44/ 62	47/ 68	56/ 76	59/ 77	72/ 87	93/ 97	82/ 86	77/ 79	83/ 86	92/ 92

Detection Limit: 0.0009 μg/m³

(B) Indoor air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I					63/ 63	66/ 72	63/ 81	73/ 73	56/ 56	54/ 55	66/ 67	51/ 52

Detection Limit: 0.004 μg/m³

Figure 3-A Locations for Monitoring of Bottom Sediment (FY2001)

Figure 3-B Surveyed Areas and Species for Wildlife Monitoring (FY2001)

Note: "( )":Fish, "[ ]":Shellfish, "{ }":Birds

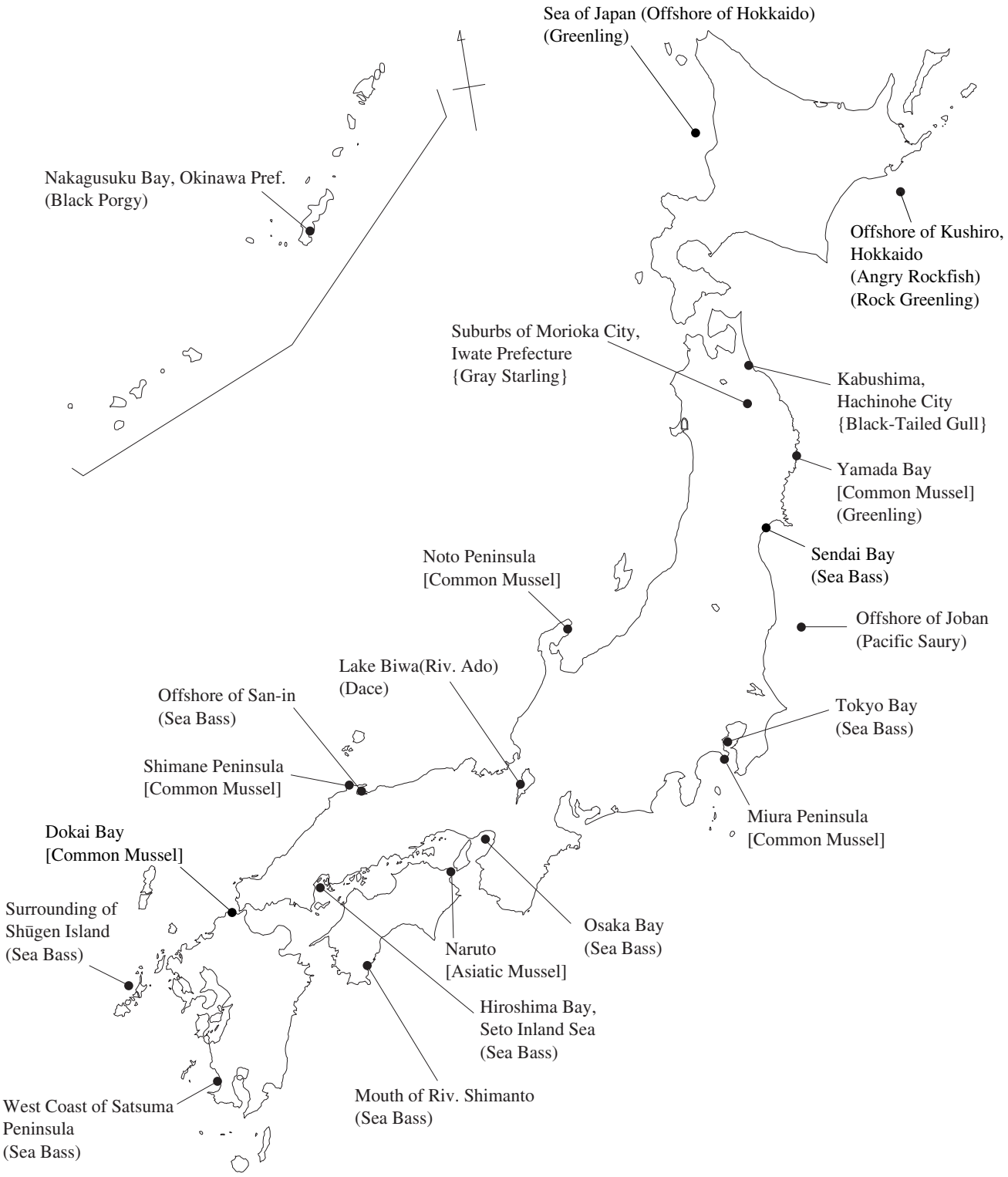


Figure 3-C Surveyed Areas for Persistence of Designated Chemical Substances (Surface Water/Bottom Sediment,FY2001)

Note: R, L and S in parentheses means rivers, lakes and sea, respectively

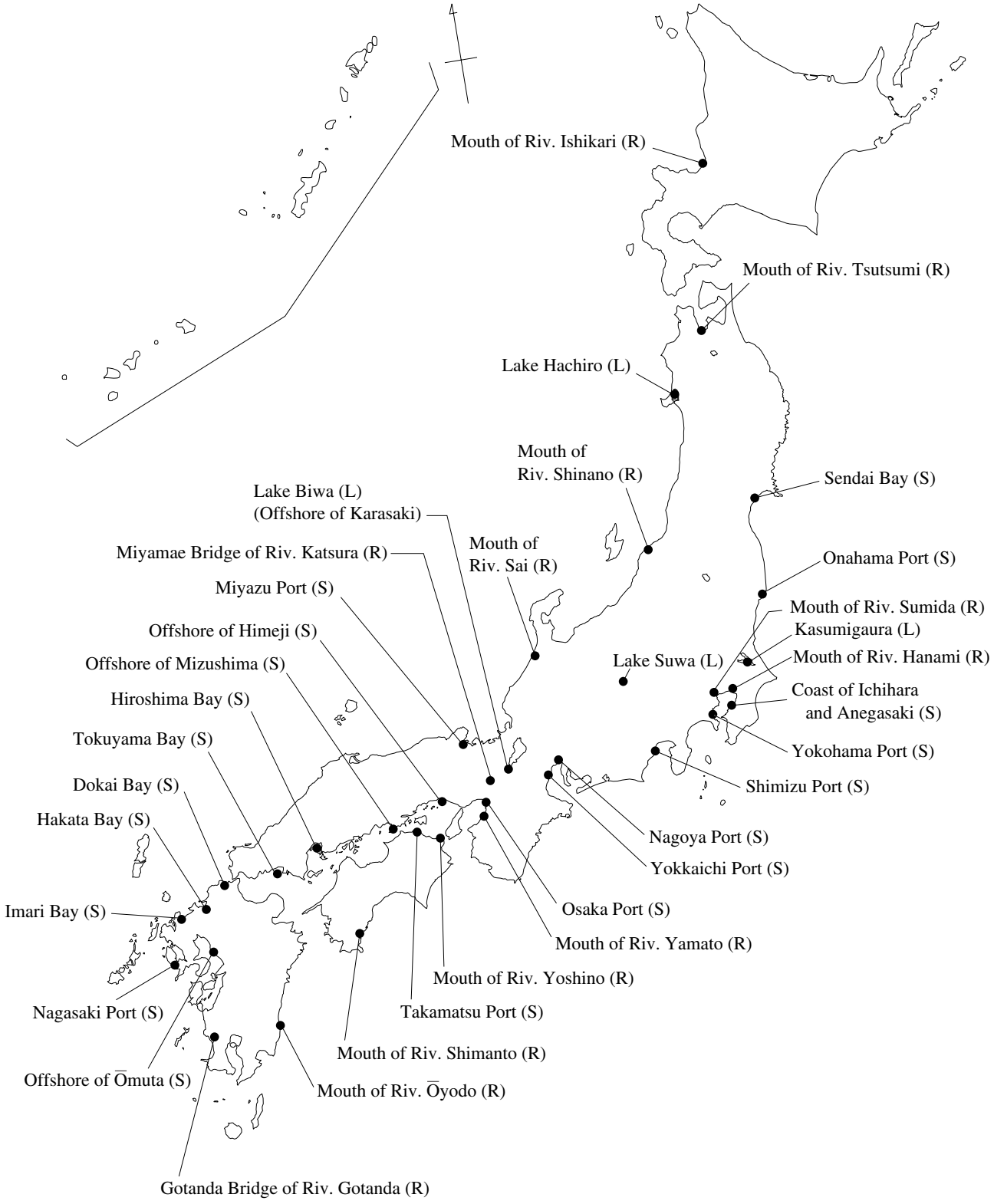


Figure 3-D Surveyed Areas for Air and Exposure Route of Designated Chemical Substances (FY2001)

Note: area name with underline means survey area of exposure route

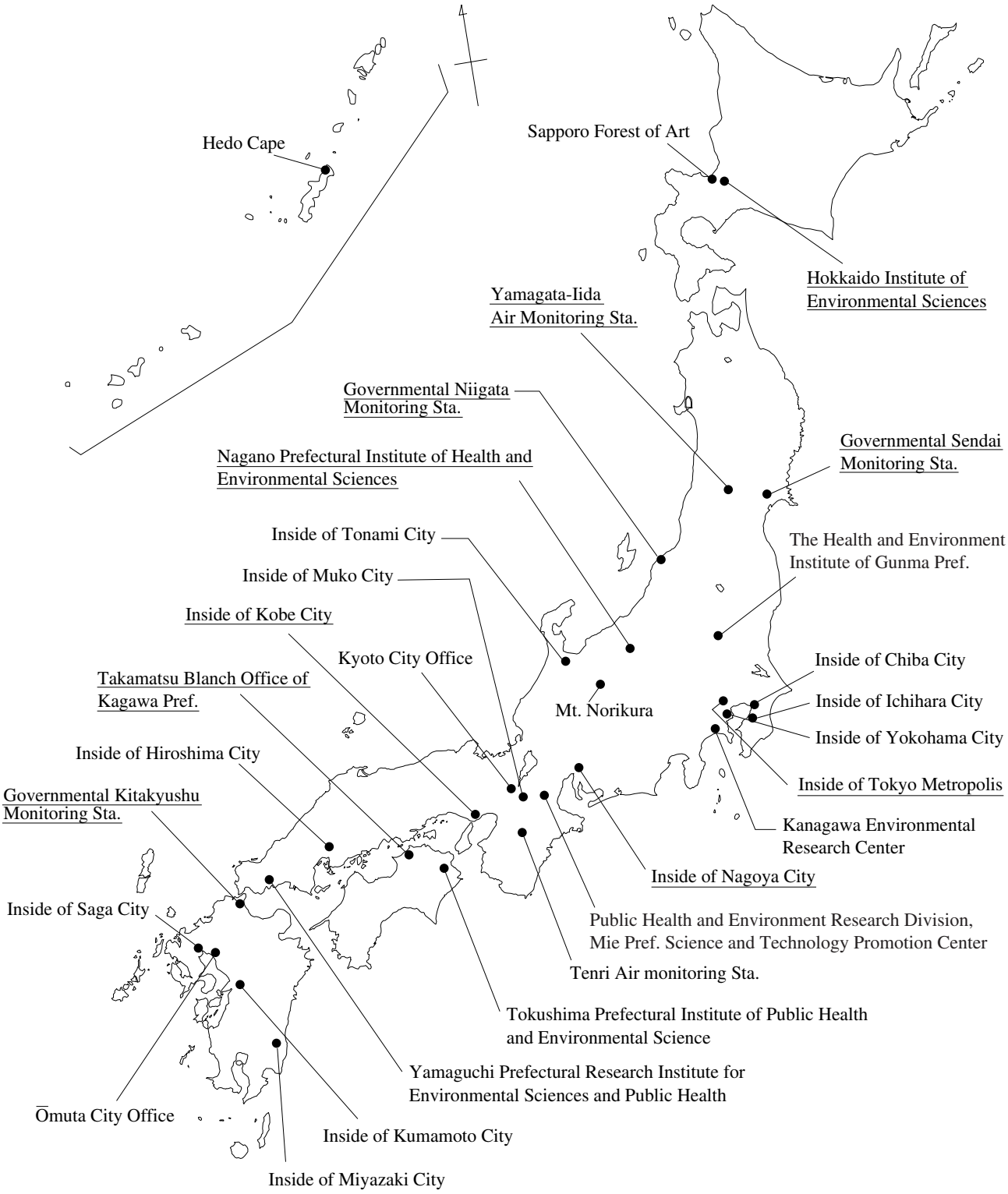


Table 3-1 Characteristics of Species Subject to Wildlife Monitoring

Species	Characteristics of species	Sampling areas	Object of investigation	Notes
Angry Rockfish *(Sebastes iracundus)*	1. Distributed in the deep seas of northern Japan 2. Bioaccumulation of chemical substances is high	Offshore of Kushiro in Hokkaido	To grasp the pollution level around the Japanese Archipelago	
Greenling *(Hexagrammos otakii)*	1. Distributed from Hokkaido to southern Japan, the Korean Peninsula, and China 2. Lives in shallow seas at a depth of 5−50 m	Sea of Japan (Offshore of Hokkaido), Yamada Bay in Iwate Prefecture	To grasp the pollution level of specific areas	
Rock Greenling *(Hexagrammos lagocephalus)*	1. Lives in cold current area east of Hidaka (Hokkaido) 2. Larger than greenling and lives in deeper sea; eats fish (smaller than its mouth size) in the sea bottom	Offshore of Kushiro in Hokkaido	To grasp the pollution level of specific areas	
Pacific Saury *(Cololabis saira)*	1. Distributed widely in the northern Pacific Ocean 2. Goes around the Japanese Archipelago; in the Kurils in autumn, and offshore Kyushu in winter 3. Bioaccumulation of chemical substances is medium	Offshore of Joban	To grasp the pollution level around the Japanese Archipelago	
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 water of sea and fresh water 3. Bioaccumulation of chemical substances is high	Sendai Bay, Tokyo Bay, Osaka Bay, Hiroshima Bay of Seto Inland Sea, Offshore of San-in, Mouth of the River Shimanto in Kochi Prefecture, West Coast of Satsuma Peninsula in Kagoshima Prefecture, Surrounding of Shugen Island in Nagasaki Prefecture	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 inside bays where rivers flow in	Nakagusuku Bay in Okinawa Prefecture	To grasp the pollution level in specific areas	
Dace *(Tribolodon hakonensis)*	1. Distributed widely in fresh water in Japan 2. Predator of mostly insects	Lake Biwa	To grasp the pollution level in specific areas	

Table 3-1 Characteristics of Species Subject to Wildlife Monitoring (Continued)

Species	Characteristics of species	Sampling areas	Object of investigation	Notes
Common Mussel *(Mytilus edulis galloprovincialis)*	1. Distributed world wide, excluding tropical zones 2. Sticks on the rocks of inner bays and bridge piers	Yamada Bay in Iwate Prefecture, Miura Peninsula in Kanagawa Prefecture, Noto Peninsula in Ishikawa Prefecture, Shimane Peninsula in Shimane Prefecture, Dokai Bay in Fukuoka Prefecture	To grasp the pollution level in specific areas	5 areas with different pollution levels were investigated
Asiatic Mussel *(Mytilus coruscus)*	1. Distributed in various areas south of southern Hokkaido 2. Sticks on rocks where the current is fast (1–10 m/s)	Naruto in Tokushima Prefecture	To grasp the pollution level in specific areas	
Gray Starling *(Strunus cineraceus)*	1. Distributed widely in the far east (The affinity is distributed world wide.) 2. Staple food is insects.	Suburbs of Morioka City in Iwate Prefecture	To grasp the pollution level in specific areas	
Black-tailed Gull *(Larus crassirostris)*	1. Breeds mainly in the sea off Japan 2. Breeds in a group at shore reef and fields of grass etc. or at islands off the coast	Kabushima in Hachinohe City, Aomori Prefecture	To grasp the pollution level in specific areas	

Chapter 4 Other Investigations – Summary of the Results of the "Follow-up Survey of the Status of Pollution by Unintentionally Formed Chemical Substances"

1. Purpose of the survey

As a result of the environmental pollution caused by chemical substances formed during the synthesis of chemical substances and in combustion processes, MOE has been conducting the Follow-up Survey of the Status of Pollution by Harmful Chemical Substances since FY1985, for the purpose of grasping the persistence of unintentionally formed chemical substances in the general environment.

Until FY1997 polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and coplanar PCBs were subject to the survey. In FY1998, the survey was interrupted to handle dioxins as the target substances in order to avoid duplication with the National Overall Urgent Survey for Dioxins, which was introduced for the purpose of grasping more detailed information on the status of environmental pollution during the year.

As compensation, in FY1998 the environmental survey was conducted on brominated dioxins (general name for polybrominated dibenzo-*p*-dioxins [PBDDs] and polybrominated dibenzofurans [PBDFs]). In FY2000, PCBs were chosen as additional target substances, and total PCBs, each PCB homolog and coplanar PCBs were surveyed on four media: surface water, bottom sediment, fish, and air. However, in FY2001, brominated dioxins were transferred to another brominated dioxins related study/investigation that has been conducted in MOE. Therefore, in the FY2001 survey, PCBs were selected as target substances, and total PCBs, each PCB homolog (10 species) and coplanar PCBs (14 species) were surveyed on four media: surface water, bottom sediment, wildlife (fish) and air.

2. PCBs

(1) Surveyed substances

PCB homolog	Number of isomers
Mono-CBs	3
Di-CBs	12
Tri-CBs	24
Tetra-CBs	42
Penta-CBs	46
Hexa-CBs	42
Hepta-CBs	24
Octa-CBs	12
Nona-CBs	3
Deca-CB	1
Total-PCBs	

Coplanar PCBs	IUPAC No.
3,3',4,4'-TetraCB	(#77)
3,4,4',5-TetraCB	(#81)
2,3,3',4,4'-PentaCB	(#105)
2,3,4,4',5-PentaCB	(#114)
2,3',4,4',5-PentaCB	(#118)
2',3,4,4',5-PentaCB	(#123)
3,3',4,4',5-PentaCB	(#126)
2,3,3',4,4',5-HexaCB	(#156)
2,3,3',4,4',5'-HexaCB	(#157)
2,3',4,4',5,5'-HexaCB	(#167)
3,3',4,4',5,5'-HexaCB	(#169)
2,2',3,3',4,4',5-HeptaCB	(#170)
2,2',3,4,4',5,5'-HeptaCB	(#180)
2,3,3',4,4',5,5'-HeptaCB	(#189)

(2) Surveyed media

Surface water, bottom sediment, wildlife (fish), air

(3) Surveyed areas

Aquatic system: 38 areas (See Fig. 4-1)

Surface water: 29 areas
Bottom sediment: 36 areas
Wildlife: 36 areas

Air: 15 areas (See Fig. 4-2)

(4) Analytical method

Quantitative analysis by high-resolution SIM method using gas chromatography/mass spectrometer (GC/MS)

(5) Survey results

The results are shown in Table 4-1 (Summary), Table 4-2 (Auatic system : surface water, bottm sediment and fish) and Table 4-3 (Air).

PCBs were detected in all four media (surface water, bottom sediment, wildlife and air) and in all surveyed areas. The range of detected values of total PCBs was 4 to 3,300 pg/ℓ in surface water, 63 to 510,000 pg/g-dry in bottom sediment, 3,200 to 530,000 pg/g-wet in wildlife, and 62 to 1,700 pg/m^3 in air.

(6) Evaluation of survey results

Production, import and use of PCBs in open systems was terminated by FY1972 and designated as Specially Controlled Industrial Waste based on the Law Concerning Disposal and Cleaning of Industrial Waste in July 1992. However, survey results of FY2001 indicate that PCBs still persist widely in the environment.

From the viewpoint of global pollution monitoring, it remains necessary to continue monitoring PCBs, and their chemical fate in the environment should be followed. It is also necessary to clarify pollution mechanisms, for example, the ratio of unintentional formation and behavior in the environment by investigating such as the composition of PCBs in the environment.

Figure 4-1 Locations of the Follow-up Survey of the Status of Pollution by Unintentionally Formed Chemical Substances (Aquatic System, FY2001)

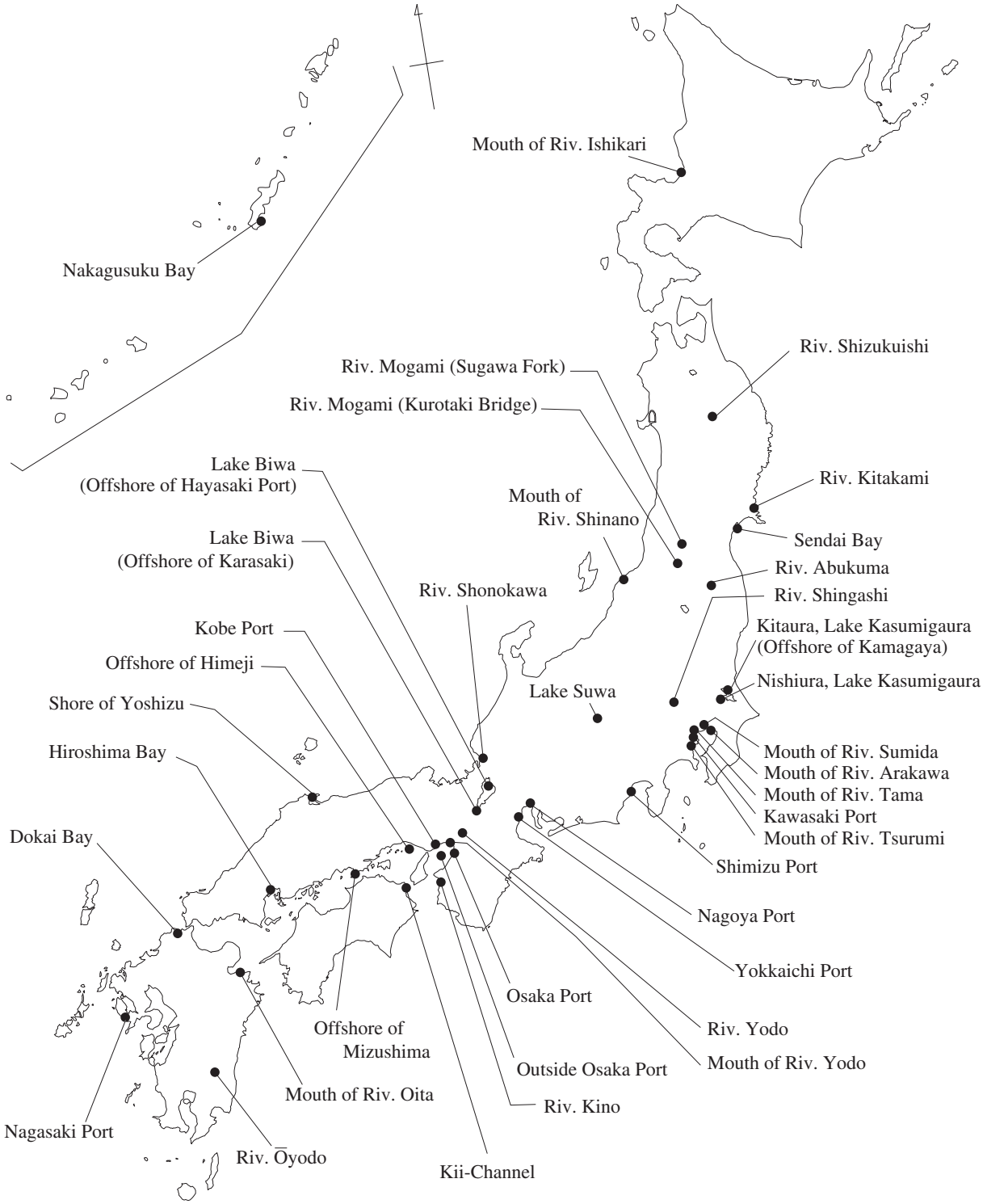


Figure 4-2 Locations of the Follow-up Survey of the Status of Pollution by Unintentionally Formed Chemical Substances (Air, FY2001)

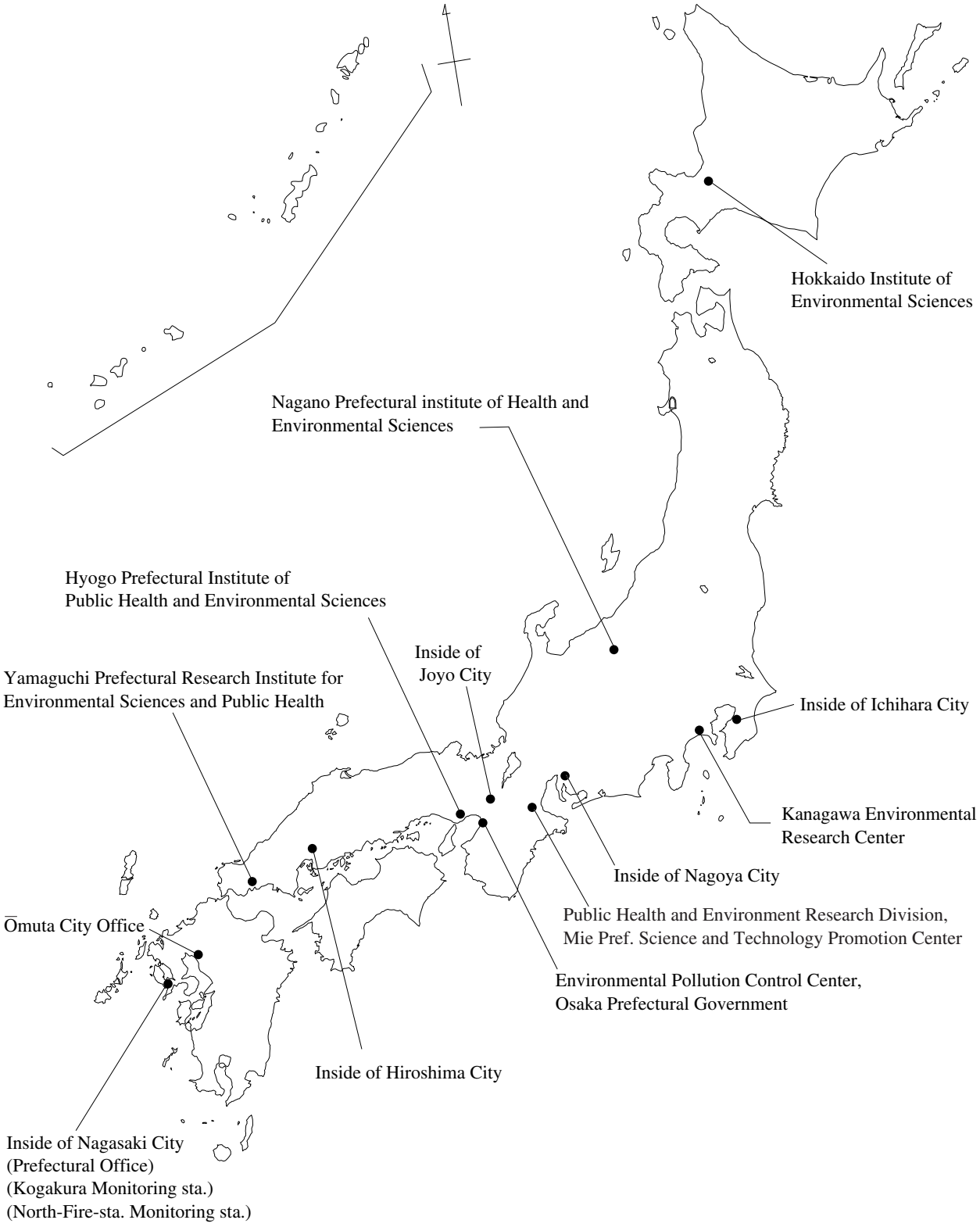


Table 4-1 Survey Results of PCBs (Summary, FY2001)

Substance		Surface water (pg/L)												Wildlife (pg/g-wet)						
		River 6 areas			Lake 3 areas			Estuary 8 areas			Sea 12 areas			Freshwater fish 14 areas			Saltwater fish 20 areas			Shellfish 1 area
		min.	med.	max.	min.	med.	max.	min.	med.	max.	min.	med.	max.	min.	med.	max.	min.	med.	max.	
3,3',4,4'-TetraCB	(#77)	ND	1.9	4.0	ND	0.9	2.6	2.7	7.0	10	0.7	3.4	32	6.8	32	200	3.8	87	450	5.9
3,4,4',5-TetraCB	(#81)	ND	ND	ND	ND	ND	ND	ND	ND	0.6	ND	ND	0.5	0.8	3.6	28	0.3	4.5	34	0.8
2,3,3',4,4'-PentaCB	(#105)	0.6	3.4	7.9	ND	ND	3.4	3.8	11	14	0.8	2.8	11	88	580	3100	38	750	8400	38
2,3,4,4',5-PentaCB	(#114)	ND	ND	1.1	ND	ND	ND	ND	0.8	1.7	ND	0.3	3.4	7.8	52	310	3.4	51	740	1.9
2,3',4,4',5-PentaCB	(#118)	ND	8.0	17	ND	ND	8.0	9.0	30	37	ND	7.0	33	210	1600	6700	160	2500	29000	130
2',3,4,4',5-PentaCB	(#123)	ND	ND	0.9	ND	ND	ND	ND	0.6	1.2	ND	ND	0.7	4.9	48	220	3.0	61	580	2.6
3,3',4,4',5-PentaCB	(#126)	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	3.7	1.7	7.1	31	0.9	9.0	99	1.2
2,3,3',4,4',5-HexaCB	(#156)	ND	0.8	2.0	ND	ND	1.2	0.6	2.0	4.7	ND	1.0	2.7	32	190	1000	14	250	3000	11
2,3,3',4,4',5'-HexaCB	(#157)	ND	ND	0.9	ND	ND	0.6	ND	0.8	2.2	ND	0.4	1.1	12	68	300	8.6	100	1100	6.5
2,3',4,4',5,5'-HexaCB	(#167)	ND	0.4	1.1	ND	ND	0.6	0.4	0.9	2.7	ND	0.5	1.3	16	97	430	11	170	1700	14
3,3',4,4',5,5'-HexaCB	(#169)	ND	ND	ND	ND	ND	ND	ND	ND	0.3	ND	ND	0.3	0.91	1.0	1.2	ND	ND	ND	ND
2,2',3,3',4,4',5-HeptaCB	(#170)	0.14	1.1	3.1	0.11	0.49	1.9	1.0	2.2	6.4	0.25	1.9	4.3	33	220	1300	33	480	3200	11
2,2',3,4,4',5,5'-HeptaCB	(#180)	ND	2.6	7.4	ND	ND	4.0	2.6	6.1	12	1.4	5.8	11	91	580	3100	110	1400	10000	51
2,3,3',4,4',5,5'-HeptaCB	(#189)	ND	ND	ND	ND	ND	ND	ND	ND	0.6	ND	ND	0.54	2.3	12	87	1.2	18	190	2.1
Mono-CBs		ND	ND	18	ND	ND	ND	ND	20	120	ND	6	180	0.76	1.6	21	0.76	4.2	26	2.6
Di-CBs		0.96	53	200	ND	2.6	2.7	6.0	180	540	3.2	56	640	19	42	630	12	190	1700	81
Tri-CBs		0.77	12	480	ND	0.86	8.3	20	480	1200	0.96	190	1500	140	840	11000	92	4300	28000	270
Tetra-CBs		7.0	120	750	ND	0.90	64	140	490	1100	3.7	260	760	470	4900	54000	370	12000	140000	620
Penta-CBs		0.6	88	180	ND	3.1	69	120	220	440	1.3	82	320	960	8800	47000	870	14000	190000	900
Hexa-CBs		1.6	37	77	0.80	7.6	51	46	98	240	5.6	52	120	1200	9000	44000	1400	21000	140000	1900
Hepta-CBs		0.14	8.5	24	0.11	0.49	13	9.4	20	43	2.0	16	33	320	2000	13000	540	6700	41000	710
Octa-CBs		ND	1.2	5.7	ND	ND	1.3	ND	3.2	9.8	ND	2.2	6.8	48	260	1600	57	690	4900	19
Nona-CBs		ND	ND	1.3	ND	ND	ND	ND	ND	1.6	ND	ND	3.9	7.7	32	220	4.4	52	380	ND
Deca-CB		ND	ND	3.0	ND	ND	1.0	ND	0.7	4.0	ND	0.2	1.5	5.3	22	73	4.0	27	280	ND
Total PCB		11	340	1500	3.6	16	210	550	1800	3100	17	830	3300	3200	26000	150000	3500	55000	530000	4400

Table 4-1 Survey Results of PCBs (Summary, FY2001,continued)

Substance		Bottom sediment (pg/g-dry)												Air (pg/m^3)		
		River 9 areas			Lake 5 areas			Estuary 9 areas			Sea 16 areas			15 areas		
		min.	med.	max.	min.	med.	max.	min.	med.	max.	min.	med.	max.	min.	med.	max.
3,3',4,4'-TetraCB	(#77)	0.6	7.6	110	65	170	190	3.1	520	3600	0.8	180	970	0.11	0.53	2.3
3,4,4',5-TetraCB	(#81)	ND	0.4	5.3	2.5	5.2	10	ND	15	100	ND	8.3	43	ND	0.05	0.91
2,3,3',4,4'-PentaCB	(#105)	1.9	36	390	81	310	500	4.3	810	6200	1.1	320	4800	ND	0.76	6.0
2,3,4,4',5-PentaCB	(#114)	ND	2.9	25	4.8	24	58	0.4	52	500	ND	19	330	0.02	0.10	0.57
2,3',4,4',5-PentaCB	(#118)	5.0	69	950	140	780	1000	9.0	2700	17000	3.0	110	13000	0.41	2.8	24
2',3,4,4',5-PentaCB	(#123)	ND	2.1	22	4.2	14	24	ND	53	360	ND	23	230	ND	0.070	0.50
3,3',4,4',5-PentaCB	(#126)	ND	0.8	6.6	5.7	12	16	ND	15	92	ND	8.3	58	ND	0.017	1.1
2,3,3',4,4',5-HexaCB	(#156)	0.7	6.3	140	29	130	260	1.2	310	2000	0.6	140	2000	0.02	0.15	1.3
2,3,3',4,4',5'-HexaCB	(#157)	ND	2.3	50	9.6	41	73	ND	95	750	0.5	59	2000	ND	0.060	0.60
2,3',4,4',5,5'-HexaCB	(#167)	0.3	2.8	64	11	50	89	0.4	130	890	0.3	72	1400	0.01	0.08	0.60
3,3',4,4',5,5'-HexaCB	(#169)	ND	ND	0.9	2.0	5.1	6.6	ND	ND	14	ND	ND	7.5	ND	0.008	0.62
2,2',3,3',4,4',5-HeptaCB	(#170)	ND	7.0	160	48	140	270	ND	350	3300	2.0	220	17000	0.02	0.11	1.6
2,2',3,4,4',5,5'-HeptaCB	(#180)	ND	19	330	150	200	1200	ND	770	8900	8.0	540	36000	0.06	0.37	5.5
2,3,3',4,4',5,5'-HeptaCB	(#189)	ND	0.6	12	4.3	9.9	14	ND	24	160	ND	12	500	ND	0.013	0.94
Mono-CBs		0.8	6.7	34	52	64	100	2.2	310	1400	6.9	91	890	1.5	3.6	24
Di-CBs		1.8	74	1600	180	410	830	18	3100	27000	23	1400	11000	16	48	230
Tri-CBs		0.11	390	3300	520	1800	2400	70	15000	79000	81	4600	36000	23	110	620
Tetra-CBs		0.60	820	4500	970	3300	4400	78	27000	160000	73	7500	56000	14	63	290
Penta-CBs		34	740	5600	1100	4300	5800	62	19000	120000	23	6200	74000	5.7	40	360
Hexa-CBs		25	230	5200	1100	3900	6700	35	12000	93000	32	6500	150000	1.9	17	190
Hepta-CBs		ND	61	1300	430	810	3200	2.9	2800	31000	29	2000	160000	0.3	2.1	43
Octa-CBs		ND	12	280	96	150	660	0.4	430	7200	5.8	430	55000	0.048	0.21	4.5
Nona-CBs		ND	2.0	28	18	32	45	ND	50	660	0.7	54	3200	0.019	0.057	4.8
Deca-CB		ND	2.5	14	16	27	42	ND	39	330	ND	41	460	0.01	0.04	2.0
Total PCB		63	4500	22000	4600	16000	21000	270	83000	510000	290	34000	420000	62	300	1700

Table 4-2 Survey Results of Total PCB (Aquatic system, FY2001)

Surveyed area	Surface water (pg/ℓ)	Bottom sediment (pg/g-dry)	Wildlife	
			Species	pg/g-wet
Mouth of River Ishikari Hokkaido	840	4,100	Dace	13,000
River Shizukuishi Iwate Prefecture	11	63	Dace	9,600
Sendai Bay Miyagi Prefecture	–	4,800	Sea bass	3,500
River Kitakami Miyagi Prefecture	–	630	Dace	7,000
River Mogami (Kurotaki Bridge) Yamagata Prefecture	350	4,500	Crusian carp	63,000
River Mogami (Sugawa Fork) Yamagata Prefecture	240	6,000	Dace	32,000
River Abukuma Fukushima Prefecture	340	1,300	Dace	21,000
Nishiura Lake Kasumigaura Ibaraki Prefecture	–	13,000	–	–
Kitaura (Offshore of Kamagaya) Lake Kasumigaura Ibaraki Prefecture	–	4,600	–	–
River Shingashi Saitama Prefecture	1,100	5,200	Carp	53,000
Mouth of River Arakawa Tokyo Metropolis	2,000	83,000	Sea bass	180,000
Mouth of River Sumida Tokyo Metropolis	3,100	280,000	Gray mullet	170,000
Mouth of River Shinano Niigata Prefecture	550	270	Carp	67,000
River Shonokawa Fukui Prefecture	1,500	4,800	Dace	3,200
Lake Suwa Nagano Prefecture	210	21,000	Crusian carp	110,000
Shimizu Port Shizuoka Prefecture	–	22,000	Sea bass	78,000
Nagoya Port Aichi Prefecture	1,300	26,000	Gray mullet	22,000
Yokkaichi Port Mie Prefecture	630	42,000	Sea bass	33,000
Lake Biwa (Offshoe of Karasaki) Shiga Prefecture	16	20,000	–	–
Lake Biwa (Offshore of Hayasaki Port) Shiga Prefecture	4	16,000	Crusian carp	150,000
River Yodo Osaka Prefecture	–	22,000	Fresh waterminnow	47,000
Offshore of Himeji Hyougo Prefecture	930	14,000	Sea bass	55,000
River Kino Wakayama Prefecture	2,500	18,000	Crusian carp	7,400
Shore of Yoshizu Tottori Prefecture	–	44,000	Sea bass	19,000
Offshore of Mizushima Okayama Prefecture	130	5,600	Nibe croaker	33,000

note: "–" means no investigations.

Table 4-2 Survey Results of Total PCB (Aquatic system, FY2001, continued)

Surveyed area	Surface water (pg/ℓ)	Bottom sediment (pg/g-dry)	Wildlife	
			Species	pg/g-wet
Hiroshima Bay Hiroshima Prefecture	180	16,000	Gray mullet	19,000
Kii Channel Tokushima Prefecture	730	590	Common mussel	4,400
Nagasaki Port Nagasaki Prefecture	380	420,000	Gray mullet	22,000
Mouth of River Oita Oita Prefecture	–	220,000	Sea bass	47,000
River Oyodo Miyazaki Prefecture	–	400	Crusian carp	10,000
Nakagusuku Bay Okinawa Prefecture	17	290	Black porgy	6,900
Mouth of River Tama Kawasaki City	1,800	510,000	Sea bass	130,000
Kawasaki Port Kawasaki City	1,400	240,000	Sea bass	530,000
Mouth of River Tsurumi Yokohama City	890	100,000	Sea bass	280,000
Osaka Port Osaka City	3,300	57,000	Sea bass	180,000
Mouth of River Yodo Osaka City	1,800	80,000	Sea bass	240,000
Outside Osaka Port Osaka City	1,100	200,000	Sea bass	170,000
Kobe Port Kobe City	1,000	410,000	Sea bass	120,000
Dokai Bay Kitakyushu City	–	100,000	Sea bream	24,000

note: "–" means no investigations.

Table 4-3 Survey Results of Total PCB (Air, FY2001)

Surveyed area	Air (pg/m^3)
Hokkaido Institute of Environmental Science Hokkaido	1,700
Inside of Ichihara City Chiba Prefecture	120
Kanagawa Environmental Research Center Kanagawa Prefecture	320
Nagano Prefectural Institute of Health and Environmental Sciences Nagano Prefecture	410
Public Health and Environment Research Division, Mie Prefectural Science and Technology Promotion Center Mie Prefecture	150
Joyo City Kyoto Prefecture	300
Environmental Pollution Control Center, Osaka Prefectural Government Osaka Prefecture	580
Hyogo Prefectural Institute of Public Health and Environmental Sciences Hyogo Prefecture	440
Yamaguchi Prefectural Research Institute for Environmental Sciences and Public Health Yamaguchi Prefecture	62
Omuta City Office Fukuoka Prefecture	150
Nagasaki Prefectural Office Nagasaki Prefecture	1,100
Kogakura Monitoring station Nagasaki Prefecture	260
North-Fire-Station Monitoring station Nagasaki Prefecture	220
Inside of Nagoya City Nagoya City	91
Inside of Hiroshima City Hiroshima City	340

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).

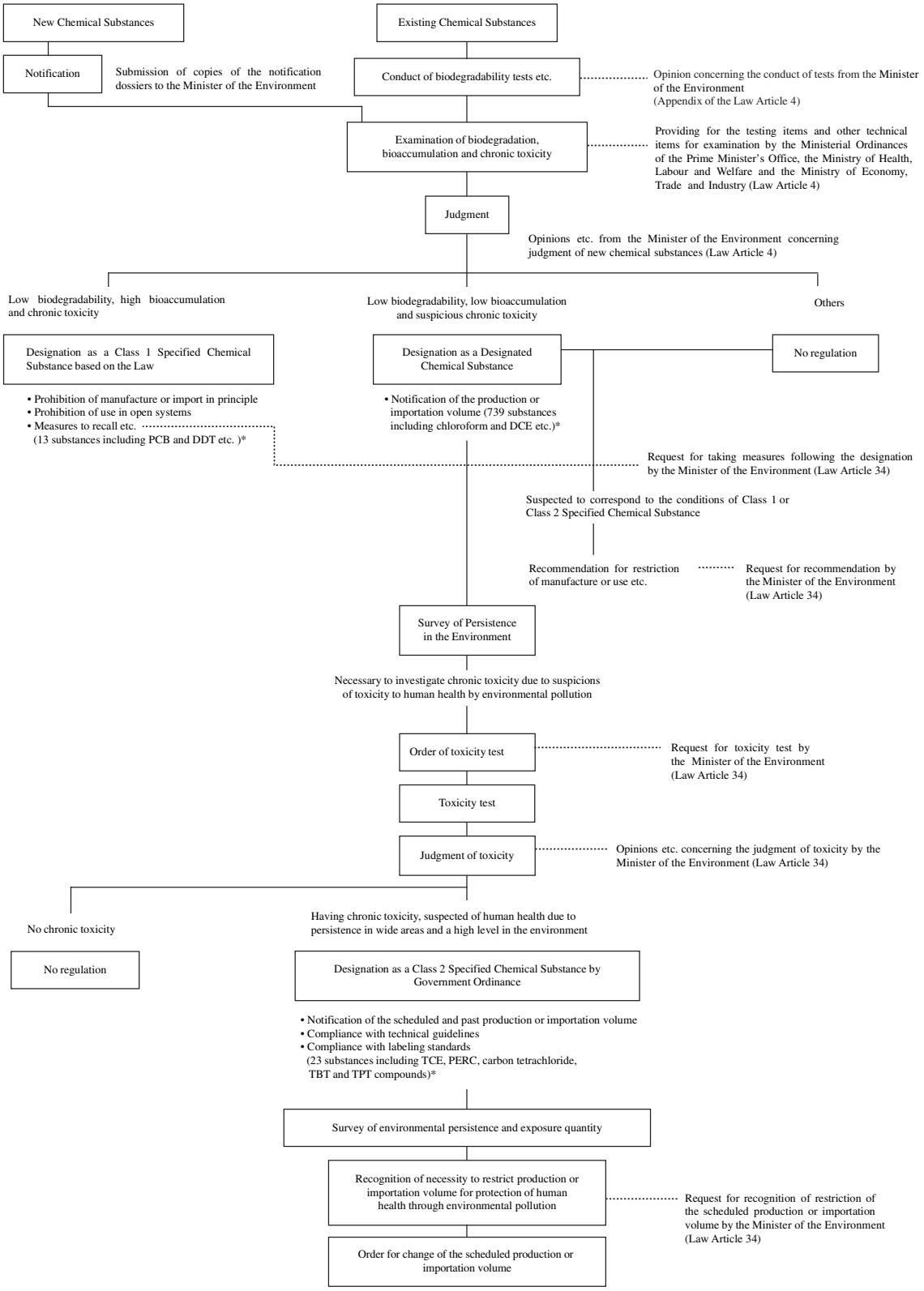
[5] To request that the Ministers of Health, Labour and Welfare and Economy, Trade and Industry (Article 34, No. 3) recognize the necessity to restrict the manufacture, etc. of Class 2 Specified Chemical Substances (Article 26, No. 4).

[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 1 The System of the Law Concerning the Examination and Manufacture etc. of Chemical Substances



* The numbers in parentheses indicate chemical substances designated as of January 2004.

Appendix B

Surveyed Chemical Substances and Detected Levels in the Environment (A Cumulative List for Fiscal Years 1974–2001) [Extraction]

There are first 2 pages out of 45 of the list, here.

Whole list, “appendix_B.xls” and “appendix_B.pdf” are available on the CD-ROM.

Surveyed Chemical Substances and their Detected Levels in the Environment (A Cumulative List for Fiscal Year 1974 - 2001)

Surveyed Chemical Substances and their Detected Levels in the Environment (A Cumulative List for Fiscal Year 1974 - 2001)

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/m^3 at 20 degree C 1atm

#	Substance	CAS RN	Fis. Year	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
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
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

Surveyed Chemical Substances and their Detected Levels in the Environment
(A Cumulative List for Fiscal Year 1974 - 2001)

#	Substance	CAS RN	Fis. Year	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	
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)									
17	acetone	67-64-1	1995													A 49/49		150 - 31,000ng/m^3	(2)	17
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)									

Appendix C

Suggested Sampling Method for Environmental Surveys Concerning Chemical Substances

Appendix C Suggested Sampling Method for Environmental Surveys Concerning Chemical Substances

○ Environmental Survey (Water)

1. Sampling method

(1) Water

[1] Sampling time

Water sampling should be conducted at a time when the days preceding the day of sampling have been relatively sunny and the water quality is stable.

[2] Sampling depth

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

[3] Preparation for analyzing

Supernatant-removing garbage, etc. should be used. In doing so, take care not to include the surface water. No filtration or centrifugal separation, etc. is 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 should be placed in a clean tray and after removing extraneous substances such as pebbles, shells and bits of animals and plants, it should be provided for analysis after sieving with a 16-mesh sieve (hole diameter of 1 mm). The sludge content (weight of sample through the sieve / weight of original sample) (%) should be measured. Dry weight (105–110°C for about 2 hours) and ignition loss (600 ± 25°C for about 2 hours) should be measured for part of the samples.

[2] Other points

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

(3) Wildlife

[1] Samples

Samples should be 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 are acceptable), and in the lakes, marshes and rivers, dace should be used (if not available, then carp or crucian carp is acceptable) as standard samples. It would be desirable to use a single body for the samples, but the use of several bodies is also possible. However, a small-bodied sample should be used after sufficient cleansing.

[2] Preparation for analyzing

(a) Fish

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

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

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

[2] Other points

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

Place 5 g of the sample in a homogenizer cup, add 20 mℓ of chloroform and 40 mℓ of methanol and homogenize for 2 minutes. Add an additional 20 mℓ of chloroform and homogenize for 2 minutes. Filter with a Buchner funnel and then homogenize the precipitate with 80 mℓ of chloroform:methanol (1:1). Place the entire chloroform and methanol fraction into the separation funnel and add 60 mℓ of distilled water and shake gently. Collect the lower chloroform fraction and after drying with anhydrous sodium sulfate, evaporate the solvent using a rotary evaporator. Dry the residue using phosphorus pentoxide and measure the weight.

2. Hints for sampling

(1) The primary purpose of this survey is 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 are being released (for example, near the outlet for waste water of a factory, etc. where the substances are being manufactured or used, or near points through which transportation facilities pass, etc.) and points directly affected by pollution should be avoided as points for sampling.

(2) Three samples should be collected within a range of 500 square meters as a unit in the survey for water and bottom sediments, so that they are collected in as wide spread a point as possible. In this case, the sampling for bottom sediments should be 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 is sufficient. (It would be desirable to collect extra samples for frozen preservation in case a problem should arise.)

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. Storage, etc. of samples

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

Environmental Survey (Air)

1. Sampling method

[1] Sampling time

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

[2] Sampling method

Samples should be collected by adsorption to resin or glass fiber filters, etc.

2. Hints for sampling

The points for sampling should be where it is possible to grasp the status of the air. Points strongly affected by a particular source or by transportation facilities, etc. should be avoided.

3. Investigation items on the sampling

Weather, temperature, humidity, direction of the wind, velocity of the wind and surrounding geography and status of roads at the sampling time.

4. Storage, etc. of samples

Follow the case described for the environmental survey (water).

Appendix D

Summary of Analytical Methods in General Inspection Survey

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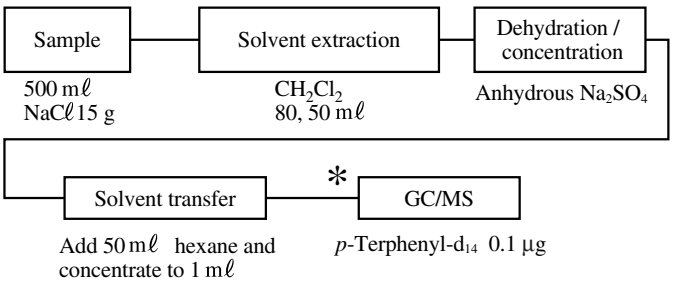
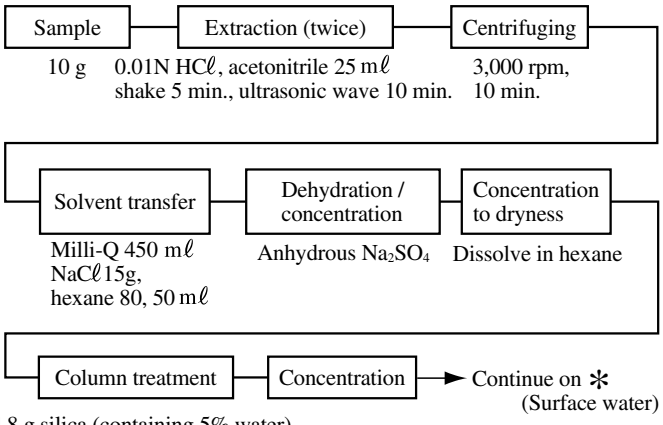
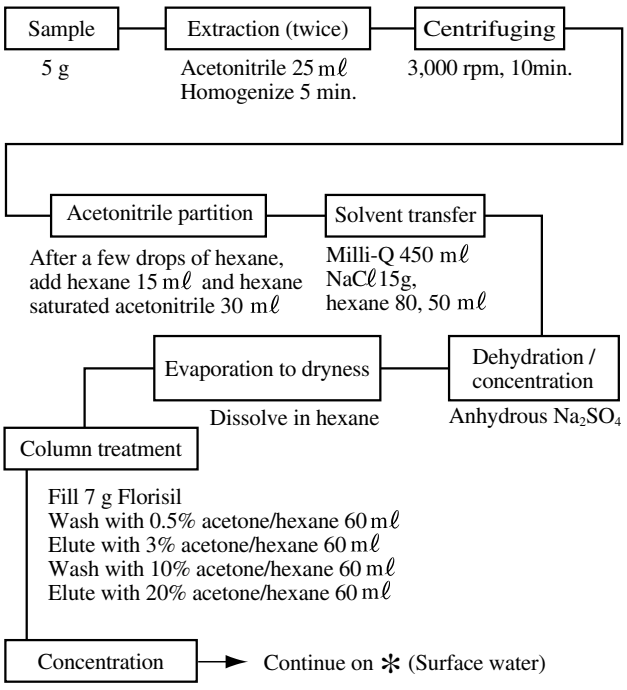
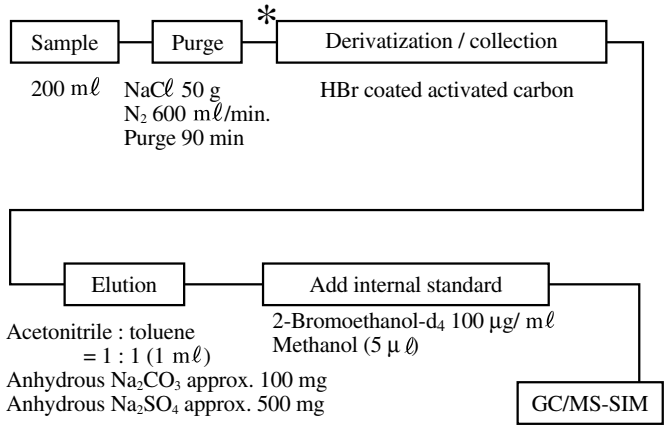
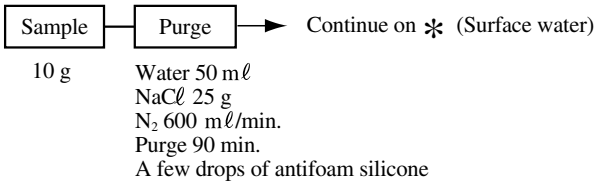
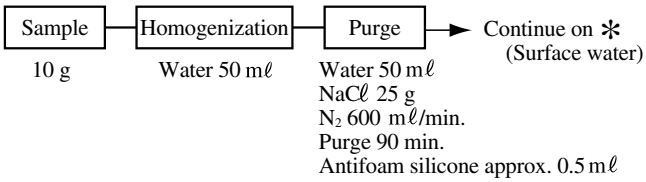
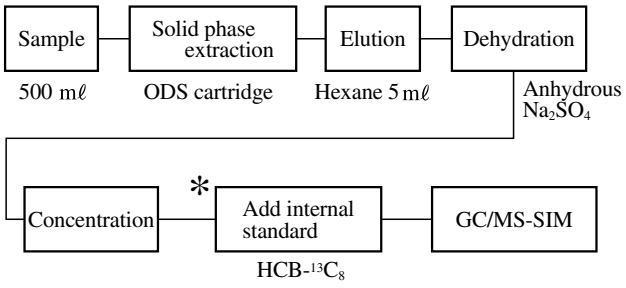
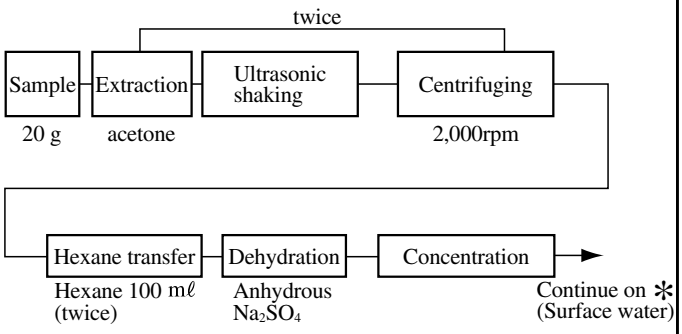
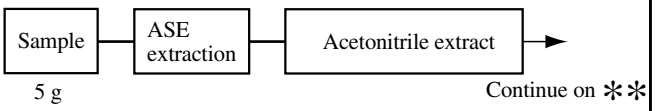
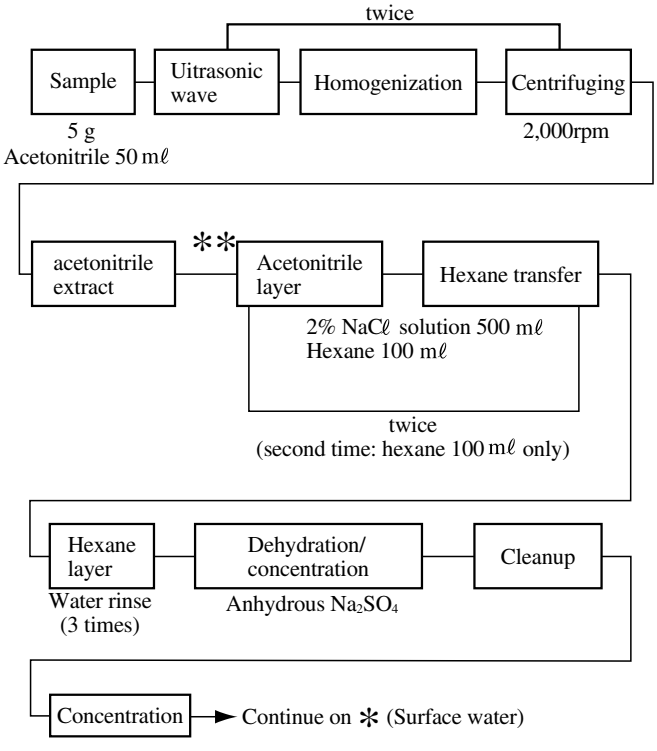
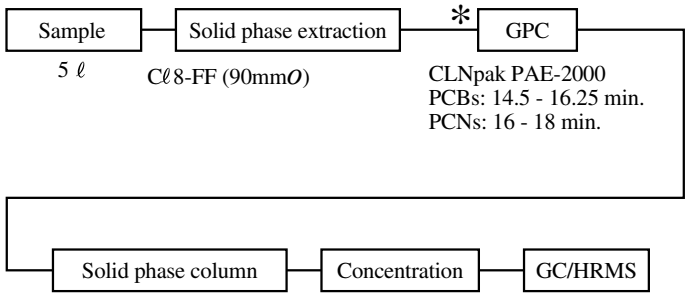
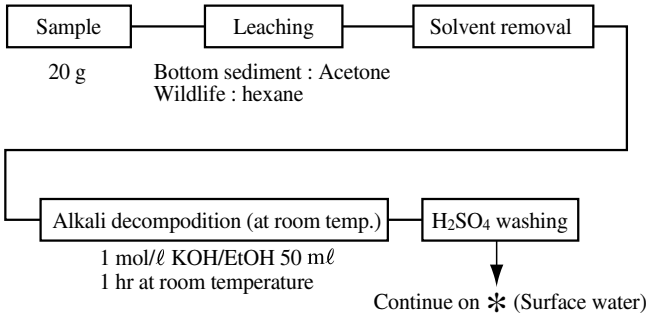
Target Chemical Substances for Environmental Survey (Aquatic System)

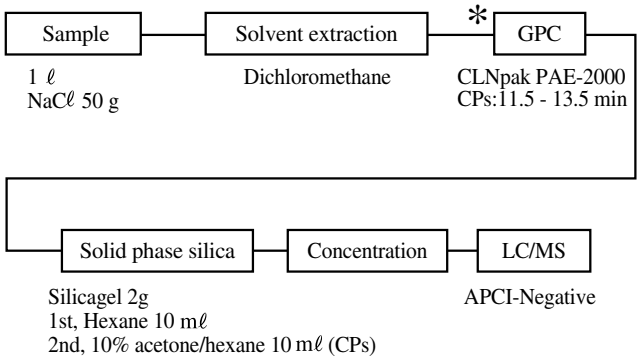
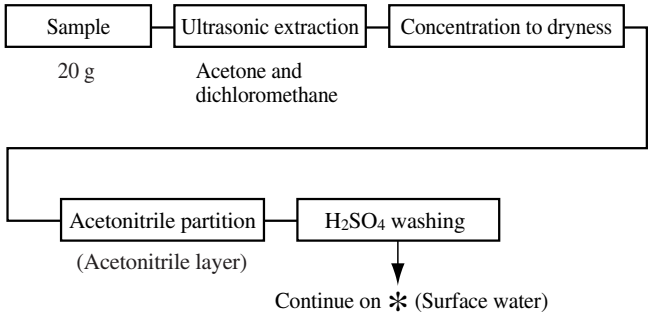
Substance	Analytical Method / Flow Chart	Remarks
(1) Nitrobenzene (2) *p*-Chloronitrobenzene	**Surface water** Sample 500 mℓ → Extraction by continuous steam distillation → Dehydration NaCℓ 15g, Surrogate solution, Hexane 5mℓ Essential oil distillator Anhydrous Na_2SO_4 Concentration 1mℓ → GC/MS-SIM Add internal standard **Bottom sediment** Sample 20g → Extraction by continuous steam distillation → Dehydration NaCℓ 15g, Pure water 500mℓ, Surrogate solution, Hexane 5mℓ Essential oil distillator Anhydrous Na_2SO_4 Purification → Concentration → Column cleanup Silica or florisil cartridge column Concentration 1mℓ → GC/MS-SIM Add internal standard **Wildlife** Sample 10g → Extraction by continuous steam distillation → Dehydration NaCℓ 15g, Pure water 500mℓ, Surrogate solution, Hexane 5mℓ Essential oil distillator Anhydrous Na_2SO_4 Concentration → Column cleanup Florisil cartridge column Concentration 1mℓ → GC/MS-SIM Add internal standard	GC/MS(SIM) Column: DB-17 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.5 μm Detection Limit: Surface water (μg/ℓ): (1) 0.037 (2) 0.029 Bottom sediment (ng/g-dry) (1) 1.4 (2) 2.2 Wildlife (ng/g-wet) (1) 3.5 (2) 7.8

Substance	Analytical Method / Flow Chrt	Remarks
(3) Chlorothalonil (4) Pyridaphenthion (5) Butachlor	**Surface water**  **Bottom sediment**  Fill 8 g silica (containing 5% water) Wash with 1% acetone/hexane 60 mℓ Elute with 5% aceton/hexane 50 mℓ Wash with 10% aceton/hexane 60 mℓ Elute with 20% aceton/hexane 50 mℓ **Wildlife**  	GC/MS Column: HP-5 Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection Limit: Surface water (µg/ ℓ) (3) 0.010 (4) 0.11 (5) 0.011 Bottom sediment (ng/g-dry) (3) 1.3 (4) 2.1 (5) 1.5 Wildlife (ng/g-wet) (3) – (4) 6.8 (5) 1.1

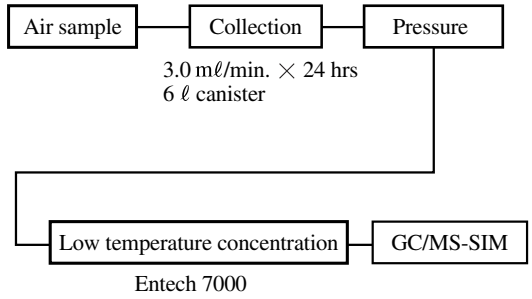
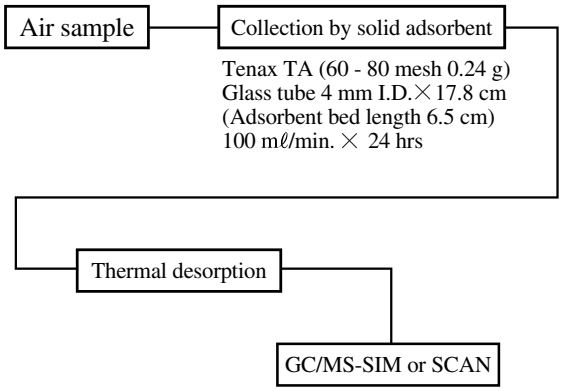
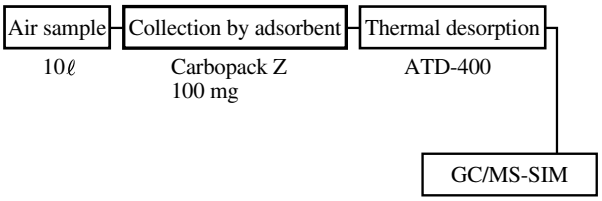
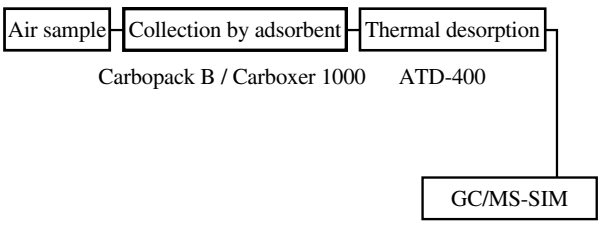
Substance	Analytical Method / Flow Chart	Remarks
(6) Ethyleneoxide	**Surface water**  **Bottom sediment**  **Wildlife**  	GC/MS-SIM Column: DB-WAX Column length: 60m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection Limit: Surface water (µg/ℓ) (6) 0.098 Bottom sediment (ng/g-dry) (6) 2.1 Wildlife (ng/g-wet) (6) 1.9

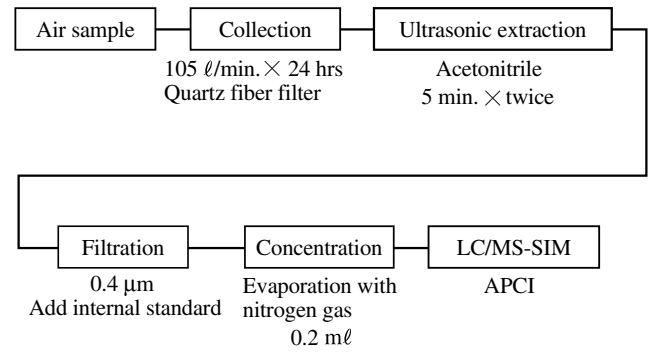
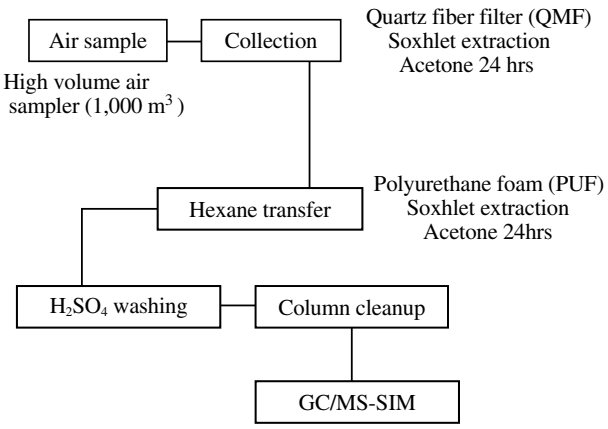
Substance	Anallytical Method / Flow Chart	Remarks
(7) 2,6-Di-*tert*-butylphenol (8) 2,6-Di-*tert*-butyl-4-metylphenol (9) 2,4,6-Tri-*tert*-butylphenol (10) 2,6-Di-*tert*-butyl-4-ethylphenol	**Surface water**  **Bottom sediment**  **Wildlife sample** • ASE extraction → Acetonitrile extraction  • Solvent extraction → Acetonitrile extraction  	GC/MS Column: Agilent Ultra-2 Column length: 25 m Column I.D.: 0.2 mm Film thickness: 0.33 µm Detection Limit: Surface water (µg/ℓ) (7) 0.050 (8) 0.050 (9) 0.020 (10) 0.055 Bottom sediment (ng/g-dry) (7) 1.9 (8) 6.4 (9) 6.5 (10) 2.6 Wildlife (ng/g-wet) Solvent extraction (7) 16 (8) 24 (9) 21 (10) 19 ASE extraction (7) 24 (8) – (9) 20 (10) –

Substance	Analytical Method / Flow Chart	Remarks
(11) Polychlorinated naphthalene (PCNs) (and Polychlorinated biphenyls (PCBs))	**Surface water**  Surface water, bottom sediment Silicagel 1 g, Hexane 6 mℓ Wildlife Florisil 5 g, hexane 5 mℓ + 5% ether/hexane 8 mℓ **Bottom sediment, Wildlife**  	GC/HRMS resolution: 10,000 Column: J&W DB-5MS Column length : 60 m Column I.D. : 0.32 mm Film thickness: 0.25 µm Detection Limit (PCNs): Surface water (pg/ℓ) (11) 5.0 Bottom sediment (pg/g-dry) (11) 5 Wildlife (pg/g-wet) (11) 2

Substance	Analytical Method / Flow Chart	Remarks
(12) Long-chain chlorinated paraffins (CPs, C24) (40% and 70% chlorinated paraffin)	**Surface water**  **Bottom sediment, Wildlife**  	LC/MS APCI-Negative Column: SHOWA DENKO Mspak GF-310 4B Column length: 50 mm Column I.D.: 4.6 mm Detection Limit: Surface water (μg/ ℓ) 40%CPs: 0.28 70%CPs: 0.14 Bottom sediment (ng/g-dry) 40%CPs: 38 70%CPs: 11 Wildlife (ng/g-wet) 40%CPs: 8.0 70%CPs: 3.7

Target Chemical Substances for Environmental Survey (Air)

Substance	Analytical Metod / Flow Chart	Remarks
(1) 1,1,1-Trichloroethane (2) 1,1,2-Trichloroethane (3) Ethyl chloride (4) Methyl chloride		GC/MS Column: HP-VOC Column length: 60 m Column I.D.: 0.32 mm Film thickness: 1.8 µm Detction Limit (ng/m³) (1) 12 (2) 20 (3) 6.0 (4) 12
(5) Dimethyl terephthalate (6) Diethyl terephthalate		GC/MS-SIM Column: HP-5MS Column length: 60 m Column I.D.: 0.25 mm Film thickness: 0.5 µm Detction Limit (ng/m³) (5) 0.018 (6) 0.015
(7) Methyl acrylate (8) Ethyl acrylate		GC/MS-SIM Column: Supel-Qplot Column length: 30 m Column I.D.: 0.32 mm Film thickness: 12 µm Detction Limit (ng/m³) (7) 0.6 (8) 0.5
(9) Acetonitrile		GC/MS-SIM Column: DB-WAX Column length: 60 m Column I.D.: 0.32 mm Film thickness: 0.25 µm Detction Limit (ng/m³) (9) 76

Substance	Analytical Method / Flow Chart	Remarks
(10) Diisononyl phthalate (11) Diisodecyl phthalate (12) Diisotridecyl phthalate		LC/MS-SIM Column: GF310HQ4D Column length: 150 mm Column I.D.: 4.6 mm Film thickness: 3.5 µm Detection Limit (ng/m³) (1) 0.40 (2) 0.30 (3) 0.1
(13) Polybrominated diphenylether		GC/MS-SIM Column: Ultra-alloy Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection Limit 0.05 - 0.5 pg/m³