CHEMICALS
IN THE ENVIRONMENT

Report on Environmental Survey
and Wildlife Monitoring of Chemicals
in FY2001

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
PBDD	Polybrominated dibenzo-*p*-dioxin
PBDF	Polybrominated dibenzofuran
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
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 of 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 has published the results in "Chemicals in the Environment." Results of the environmental surveys of FY2000 are compiled in "Chemicals in the Environment (FY2001)." 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

FY2000 General Inspection Survey of Chemical Substances on Environmental 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 794 substances were investigated from FY1974 to FY2000.

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 the 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 an 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 environmental survey programs for surface water, bottom sediment, aquatic wildlife and air are being carried out by cooperation between MOE and all local governments in Japan. These surveys have been designed to collect information about 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)

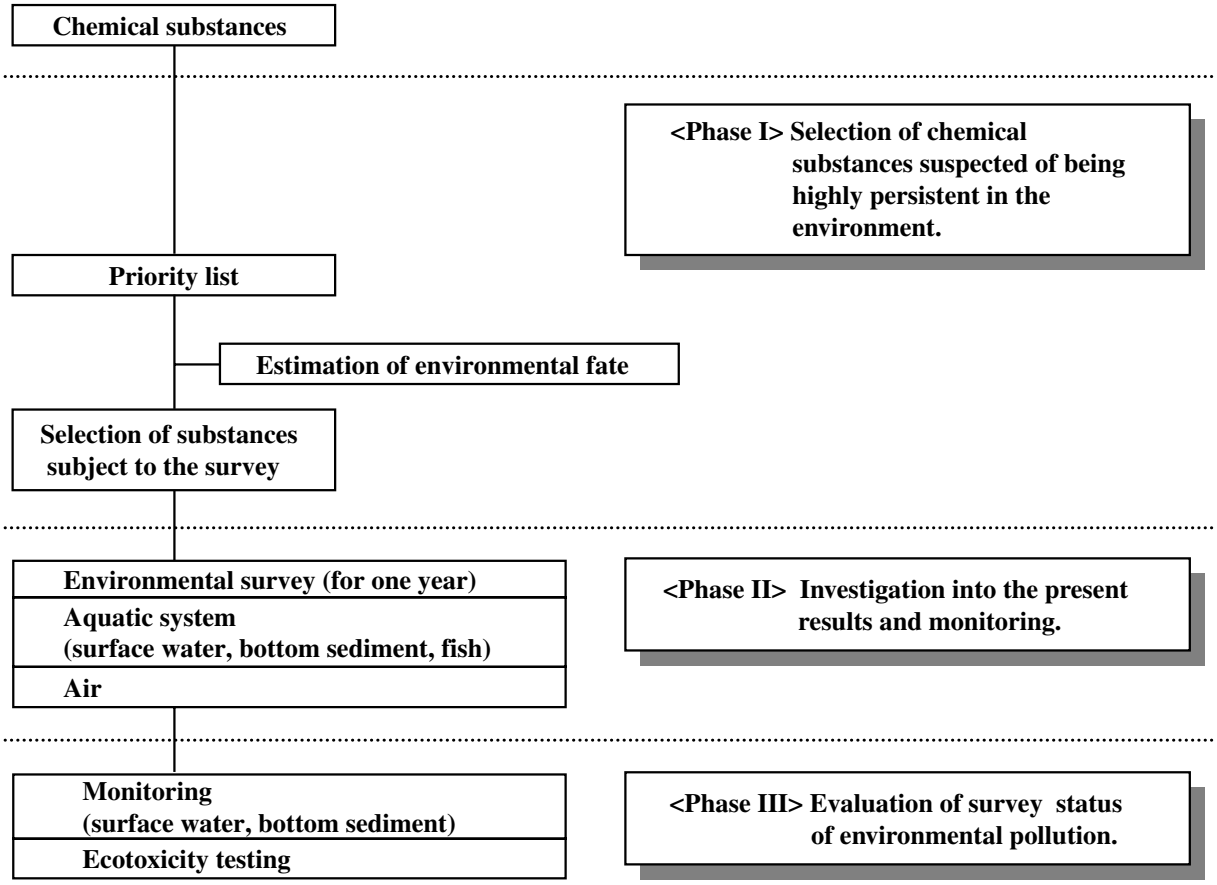
Enactment (amendment): 1973 (1986)	
Purpose:	1) Prevention of environmental pollution by the chemical substances that are hardly degradable and have the risk of affecting human health; 2) Enactment of necessary regulations on the production, import, and use of new chemical substances in response to the examination results of their characteristics.
Contents:	Regulation (substantial prohibition) on production and import of "Class 1 Specified Chemical Substance" that are hardly degradable, highly accumulative and chronically toxic. Regulation (notification of production, import amount, etc.) on production and import of hardly degradable and chronically toxic "Class 2 Specified Chemical Substance", and regulation (notification of production, import amount, etc.) on "Designated Chemical Substance" that are suspected as being hardly degradable and chronically toxic.

2. System of the Comprehensive Survey

In order to effectively and systematically investigate the tens of thousands of existing chemical, 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 surveyed thus far have been detected.

Figure 1-1 The System of the Second Comprehensive Survey



3. Monitoring of major chemical substances

In order to grasp the persistence of toxic substances artificially produced in the manufacturing and disposing processes of chemical substances, such as Designated Chemical Substances designated by the Chemical Substances Control Law, toxic substances unintentionally formed in the natural reaction processes, and other toxic substances, consecutive measurement shown in Table 1-2 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 1-2 Target Chemical Substances and Media for Monitoring

	Chemical substance	Media				
		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

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 other divisions of MOE since 1998 in related simultaneous surveys of the environment, dioxins were excluded from the items investigated in this survey. In FY2000, brominated dioxins (PBDDs, PBDFs), PCBs (total, each Homolog, coplanar-PCBs) were investigated in four media, namely surface water, bottom sediment, wildlife (fish) and air.

note:

PCB Homolog

"Homologs" are subcategories of PCB congeners having equal numbers of chlorine substituents. For example, the "Tetrachlorobiphenyls" (or "T4CBs" or "Tetra-CBs" or "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 chlorine. 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 2000 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 the concentration level.

2. Surveyed substances and areas

Twenty-seven substances (including 12 newly selected substances) were surveyed in FY2000 for their persistence in the general environment of the aquatic system (surface water, bottom sediment, fish) and air.

1) Environmental survey (aquatic system)

Surveyed substances (14 substances or groups) are shown in Tables 2-1 (surface water), 2-2 (bottom sediment) and 2-3 (fish), and surveyed areas (56 areas throughout Japan) are shown in Fig. 2-1. As high priority substances, dioctyltin compounds were surveyed in 49 areas and butyl benzyl phthalate in 46 areas. Other substances were surveyed in 6 to 13 areas.

2) Environmental survey (air)

Fourteen substances (Table 2-4), considered to be persistent in the air, were selected in the FY2000 survey and were each subject to survey in 9 to 15 areas. The 22 areas surveyed throughout Japan are shown in Fig. 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)

One substance (group) in water, 4 substances in bottom sediment and 2 substances in fish were detected (Tables 2-1, 2-2, 2-3).

2) Environmental survey (air)

All of the 14 substances (groups) were detected in air (Table 2-4).

5. Summary of surveyed substances

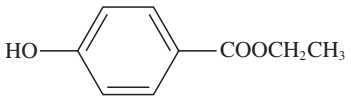
(1) Aquatic system

Although only 4 out of the 14 surveyed substances were detected and the detection frequency was generally low in the aquatic system, it is necessary to obtain further information in the future, since the relevant information on these substances is presently limited.

√: detected substance

√ [1] Ethyl *p*-hydroxybenzoate	[8] Tris(4-chlorophenyl) methane
[2] Isopropyl *p*-hydroxybenzoate	[9] 1,3,5-Tri-*tert*-butylbenzene
[3] *n*-Propyl *p*-hydroxybenzoate	√ [10] Hexabromobenzene
[4] Isobutyl *p*-hydroxybenzoate	[11] TetrabromobisphenolA
[5] *n*-Butyl *p*-hydroxybenzoate	[12] 2-*tert*-Butyl-4-methoxyphenol
√ [6] Dioctyltin compounds	√ [13] Butyl benzyl phthalate
[7] Tris(4-chlorophenyl) methanol	[14] Maneb + Zineb + Manzeb

[1] Ethyl *p*-hydroxybenzoate (CAS RN: 120-47-8)



Chemical formula / molecular weight: $C_9H_{10}O_3$ / 166.17
Melting point: 116°C, 116 – 118°C
Boiling point: Decomposes at 297 – 298°C
Water solubility (Sw): 700 mg/ℓ (20°C)
n-Octanol/water partition coefficient (Log Pow): 2.47
Solubility in organic solvents: Soluble in alcohols and ethers.
Use: Preservatives, antiseptics and antibiotics for cosmetics, medicine and foodstuff.
Production/import amount: Unknown

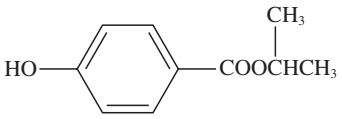
Survey results

In this survey, ethyl *p*-hydroxybenzoate was not detected in any water samples (11 areas, 33 samples), but it was detected in bottom sediment in 1 area out of 11 (1 sample out of 33) and in 1 area out of 10 in fish (2 samples out of 28). The range of detected values was 3.3 ng/g-dry in bottom sediment and 1.9 to 2.2 ng/g-wet in fish.

○Survey Results of Ethyl *p*-hydroxybenzoate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/33)	0% (0/11)	ND	0.027 μg/
Bottom sediment	FY2000	3% (1/33)	9% (1/11)	3.3 ng/g-dry	1.5 ng/g-dry
Fish	FY2000	7% (2/28)	10% (1/10)	1.9 − 2.2 ng/g-wet	1.9 ng/g-wet

[2] Isopropyl *p*-hydroxybenzoate (CAS RN: 4191-73-5)



Chemical formula / molecular weight: $C_{10}H_{12}O_3$ / 180.20

Melting point: 84 – 86°C

Boiling point: Unknown

Water solubility (Sw): Unknown

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

Use: Preservatives, antiseptics and antibiotics for cosmetics, medicine and foodstuff.

Production/import amount: Unknown

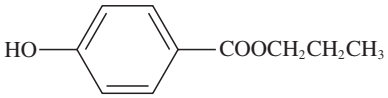
Survey results

In this survey, Isopropyl *p*-hydroxybenzoate was not detected in any water samples (11 areas, 33 samples), bottom sediment (11areas, 33 samples) or fish (10 areas, 28 samples).

○Survey Results of Isopropyl *p*-hydroxybenzoate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/33)	0% (0/11)	ND	0.018 μg/ℓ
Bottom sediment	FY2000	0% (0/33)	0% (0/11)	ND	2.1 ng/g-dry
Fish	FY2000	0% (0/28)	0% (0/10)	ND	1.6 ng/g-wet

[3] *n*-Propyl *p*-hydroxybenzoate (CAS RN: 94-13-3)



Chemical formula / molecular weight: $C_{10}H_{12}O_3$ / 180.20

Melting point: 95 – 98°C, 96 – 97°C

Boiling point: Unknown

Water solubility (Sw): 463 mg/ℓ (25°C), 500 mg/ℓ (20°C)

n-Octanol/water partition coefficient (Log Pow): 3.04

Solubility in organic solvents: Soluble in alcohols and ethers.

Use: Preservatives, antiseptics and antibiotics for cosmetics, medicine and foodstuff.

Production/import amount: Unknown

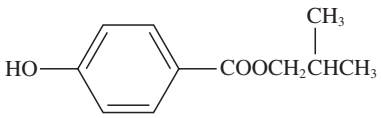
Survey results

In this survey, *n*-propyl *p*-hydroxybenzoate was not detected in any water samples (11 areas, 33 samples), bottom sediment (11areas, 33 samples) or fish (10 areas, 28 samples).

○Survey Results of *n*-Propyl *p*-hydroxybenzoate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/33)	0% (0/11)	ND	0.014 μg/ℓ
Bottom sediment	FY2000	0% (0/33)	0% (0/11)	ND	2.3 ng/g-dry
Fish	FY2000	0% (0/28)	0% (0/10)	ND	2.3 ng/g-wet

[4] Isobutyl *p*-hydroxybenzoate (CAS RN: 4247-02-3)



Chemical formula / molecular weight: $C_{11}H_{14}O_3$ / 194.23

Melting point: 75 – 77°C

Boiling point: Unknown

Water solubility (Sw): Unknown

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

Use: Preservatives, antiseptics and antibiotics for cosmetics, medicine and foodstuff.

Production/import amount: Unknown

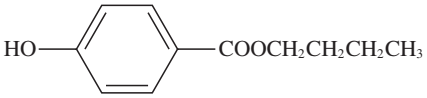
Survey results

In this survey, isobutyl *p*-hydroxybenzoate was not detected in any water samples (11 areas, 33 samples), bottom sediment (10 areas, 30 samples) or fish (10 areas, 28 samples).

○Survey Results of Isobutyl *p*-hydroxybenzoate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/33)	0% (0/11)	ND	0.023 μg/ℓ
Bottom sediment	FY2000	0% (0/30)	0% (0/10)	ND	2.3 ng/g-dry
Fish	FY2000	0% (0/28)	0% (0/10)	ND	2.6 ng/g-wet

[5] *n*-Butyl *p*-hydroxybenzoate (CAS RN: 94-26-8)



Chemical formula / molecular weight: $C_{11}H_{14}O_3$ / 194.23

Melting point: 68 – 69°C, 69 – 72°C

Water solubility (Sw): 150 mg/ℓ (25°C), 154 mg/ℓ (25°C)

n-Octanol/water partition coefficient (Log Pow): 3.57

Solubility in organic solvents: Soluble in alcohols, ethers chloroform.

Use: Preservatives, antiseptics and antibiotics for cosmetics, medicine and foodstuff.

Production/import amount: Unknown (Most commonly used among *p*-hydroxybenzoates in Japan.)

Survey results

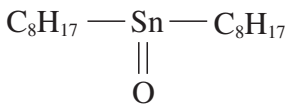
In this survey, *n*-butyl *p*-hydroxybenzoate was not detected in any water samples (11 areas, 33 samples), bottom sediment (10 areas, 30 samples) or fish (10 areas, 28 samples).

○Survey Results of *n*-Butyl *p*-hydroxybenzoate

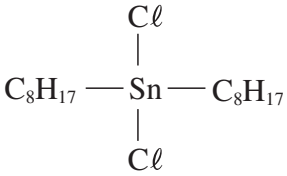
Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/33)	0% (0/11)	ND	0.027 μg/ℓ
Bottom sediment	FY2000	0% (0/30)	0% (0/10)	ND	2.3 ng/g-dry
Fish	FY2000	0% (0/28)	0% (0/10)	ND	2.9 ng/g-wet

[6] Dioctyltin compounds

Dioctyltin oxide (CAS RN: 870-08-6)



Dioctyltin dichloride (CAS RN: 3542-36-7)



Chemical formula / molecular weight: $C_{16}H_{34}OSn$ / 361.16	$C_{16}H_{34}C\ell_2Sn$ / 416.09
Melting point: Decomposes at 100°C	48°C
Boiling point: Unknown	378°C
Water solubility (Sw): Insoluble	Insoluble
n-Octanol/water partition coefficient (Log Pow): Unknown	Unknown
Use: Feedstock of heat stabilizers for polyvinyl chloride	same as the left
Production amount: 6,597 t (FY1998, include dioctyltin dichloride)	

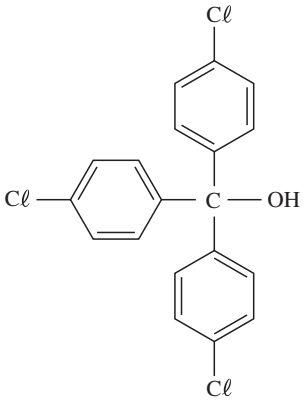
Survey results

In this survey, dioctyltin compounds were detected in 2 areas out of 49 (3 samples out of 147) in surface water, in 13 areas out of 49 (27 samples out of 147) in bottom sediment, and 12 areas out of 39 (23 samples out of 117) in fish. The range of detected values was 0.0073 to 0.072 μg/ℓ in surface water, 11 to 100 ng/g-dry in bottom sediment, and 0.64 to 6.5 ng/g-wet in fish.

○Survey Results of Dioctyltin oxide compounds

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	2% (3/147)	4% (2/49)	0.0073 − 0.072 μg/ℓ	0.0059 μg/ℓ
Bottom sediment	FY2000	18% (27/147)	27% (13/49)	11 − 100 ng/g-dry	10 ng/g-dry
Fish	FY2000	20% (23/117)	31% (12/39)	0.64 − 6.5 ng/g-wet	0.64 ng/g-wet

[7] Tris(4-chlorophenyl) methanol (CAS RN: 3010-80-8)



Chemical formula / molecular weight: $C_{19}OH_{13}C\ell_3$ / 365.31

Melting point: 96 – 97°C

Boiling point: Unknown

Water solubility (Sw): Unknown

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

Use: None

Production/import amount: Unknown

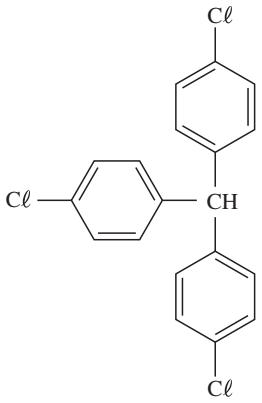
Survey results

Tris(4-chlorophenyl) methanol was not detected in any samples of surface water (13 areas, 39 samples), bottom sediment (11areas, 33 samples) or fish (13 areas, 39 samples).

○Survey Results of Tris(4-chlorophenyl) methanol

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/39)	0% (0/13)	ND	0.0052 μg/ℓ
Bottom sediment	FY2000	0% (0/33)	0% (0/11)	ND	3.2 ng/g-dry
Fish	FY2000	0% (0/39)	0% (0/13)	ND	0.97 ng/g-wet

[8] Tris(4-chlorophenyl) methane (CAS RN: 27575-78-6)



Chemical formula / molecular weight: $C_{19}H_{13}C\ell_3$ / 349.31

Melting point: Unknown

Boiling point: Unknown

Water solubility (Sw): Unknown

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

Use: None

Production/import amount: Unknown

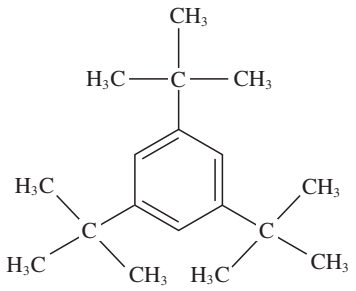
Survey results

Tris(4-chlorophenyl) methane was not detected in any samples of surface water (13 areas, 39 samples), bottom sediment (13 areas, 39 samples) or fish (13 areas, 39 samples).

○Survey Results of Tris(4-chlorophenyl) methane

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/39)	0% (0/13)	ND	0.0033 μg/ℓ
Bottom sediment	FY2000	0% (0/39)	0% (0/13)	ND	1.7 ng/g-dry
Fish	FY2000	0% (0/39)	0% (0/13)	ND	0.44 ng/g-wet

[9] 1,3,5-Tri-*tert*-butylbenzene (CAS RN: 1460-02-2)



Chemical formula / molecular weight: $C_{18}H_{30}$ / 246.44

Melting point: 69 – 71°C

Boiling point: 122°C (12mmHg)

Water solubility (Sw): 0.59 (μg/ℓ)

n-Octanol/water partition coefficient (Log Pow): 6.98

Use: Unknown

Production/import amount: Unknown

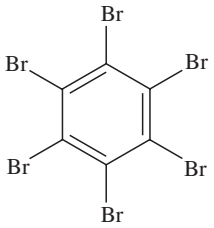
Survey results

1,3,5-Tri-*tert*-butylbenzene was not detected in any samples of surface water (13 areas, 39 samples), bottom sediment (11areas, 33 samples) or fish (11 areas, 33 samples).

○Survey Results of 1,3,5-Tri-*tert*-butylbenzene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/39)	0% (0/13)	ND	0.00031 μg/ℓ
Bottom sediment	FY2000	0% (0/33)	0% (0/11)	ND	0.30 ng/g-dry
Fish	FY2000	0% (0/33)	0% (0/11)	ND	0.43 ng/g-wet

[10] Hexabromobenzene (CAS RN: 87-82-1)



Chemical formula / molecular weight: C_6Br_6 / 551.52

Melting point: >315°C, 327°C

Water solubility (Sw): 0.16×10^{-3} mg/ℓ (25°C)

n-Octanol/water partition coefficient (Log Pow): 6.07

Solubility in organic solvents: Slightly soluble in chlorobenzene, xylene and DMF.

Use: Flame retardant for thermoplastic resin, thermosetting resin, synthetic fiber and synthetic rubber.

Production/import amount: Unknown

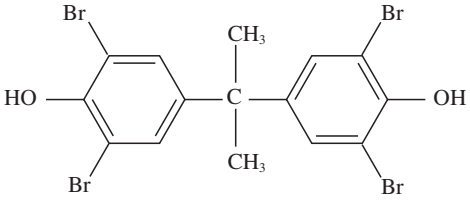
Survey results

In this survey, hexabromobenzene was detected in 2 areas out of 11 (4 samples out of 33) in bottom sediment and in 8 areas out of 11 (14 samples out of 33) in air. However, it was not detected in either surface water (12 areas, 36 samples) or fish (11 areas, 33 samples). The range of detected values was 8.4 to 43 ng/g-dry in bottom sediment and 0.031 to 0.1 ng/m^3 in air.

○Survey Results of Hexabromobenzene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/36)	0% (0/12)	ND	0.0064 μg/ℓ
Bottom sediment	FY2000	12% (4/33)	18% (2/11)	8.4 – 43 ng/g-dry	4.8 ng/g-dry
Fish	FY2000	0% (0/33)	0% (0/11)	ND	3.2 ng/g-wet
Air	FY2000	42% (14/33)	73% (8/11)	0.031 – 0.1 ng/m^3	0.030 ng/m^3

[11] Tetrabromobisphenol A (CAS RN: 79-94-7)



Chemical formula / molecular weight: $C_{15}H_{12}Br_4O_2$ / 543.90

Melting point: 181°C, 180 – 184°C

Boiling point: Decomposes at 316°C

Water solubility (Sw): Unknown

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

Solubility in organic solvents: Soluble in methanol and ethers.

Use: Flame retardant for plastics, paper and fiber; reactive or additive flame retardant for ABS resin, epoxy resin, polycarbonate resin, high-impact polystyrene, phenolic resin, adhesive and others.

Production/import amount: Unknown

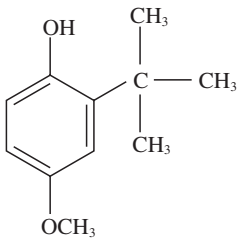
Survey results

In this survey, tetrabromobisphenol A was not detected in any samples of surface water (9 areas, 27 samples), bottom sediment (9 areas, 27 samples) or fish (9 areas, 27 samples).

○Survey Results of Tetrabromobisphenol A

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/27)	0% (0/9)	ND	0.090 μg/ℓ
Bottom sediment	FY2000	0% (0/27)	0% (0/9)	ND	5.5 ng/g-dry
Fish	FY2000	0% (0/27)	0% (0/9)	ND	20 ng/g-wet

[12] 2-*tert*-Butyl-4-methoxyphenol (CAS RN: 121-00-6)



Chemical formula / molecular weight: $C_{11}H_{16}O_2$ / 180.24

Melting point: 48 – 55°C, 47 – 56°C

Boiling point: 264 – 270°C (733mmHg)

Water solubility (Sw): Unknown

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

Solubility in organic solvents: Soluble in ethers and alcohols. Easily soluble in fat, paraffin, propylene glycol, acetone, ethanol and others.

Use: Antioxidant for foodstuff, medicine, cosmetics and others, component of BHA* (Butylated Hydroxy Anisole) * an antioxidant for rubber and petroleum

Production/import amount: Unknown

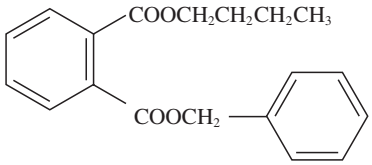
Survey results

In this survey, 2-*tert*-butyl-methoxyphenol was not detected in any samples of surface water (10 areas, 30 samples) or bottom sediment (10 areas, 30 samples).

○Survey Results of 2-*tert*-butyl-methoxyphenol

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/30)	0% (0/10)	ND	0.016 μg/ℓ
Bottom sediment	FY2000	0% (0/30)	0% (0/10)	ND	2.0 ng/g-dry
Fish	FY2000	No survey			---

[13] Butyl benzyl phthalate (CAS RN: 85-68-7)



Chemical formula / molecular weight: $C_{19}H_{20}O_4$ / 312.36

Specific weight: 1.117 (20°C), 1.1 (25°C)

Melting point: –35°C

Boiling point: 370°C

Water solubility (Sw): 2.9 ± 1.2 mg/ℓ (25°C), 0.7 mg/ℓ

n-Octanol/water partition coefficient (Log Pow): 4.78

Solubility in organic solvents: Easily soluble in ethanol, benzene and ether.

Use: Plasticizer for PVC and nitrocellulose (application: flooring and wall tile, painting, pastes, artificial leather and interior accessories)

Production amount: Approximately 2,000 t (estimated) in 1999

Survey results

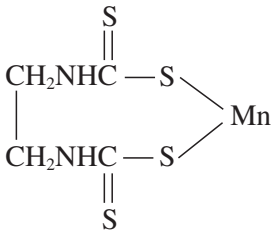
In this survey, butyl benzyl phthalate was not detected in any samples of surface water (46 areas, 138 samples). However, it was detected in bottom sediment (11 areas out of 46, 25 samples out of 138); the range of detected values was 32 to 134 ng/g-dry.

○Survey Results of Butyl benzyl phthalate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/138)	0% (0/46)	-	0.14 μg/ℓ
Bottom sediment	FY2000	18% (25/138)	24% (11/46)	32 – 134 ng/g-dry	28 ng/g-dry
Fish	FY2000	No survey			---

[14] Maneb+Zineb+Manzeb

Maneb (Manganese ethylene-1,2-bisdithiocarbamate) (CAS RN: 12427-38-2)



Chemical formula / molecular weight: $C_4H_6MnN_2S_4$ / 265.30

Specific weight: 1.92 (25°C)

Melting point: Decomposes at 194 – 204°C without melting. Decomposes at approximately 135°C below the melting point. Decomposes at 131°C.

Water solubility (Sw): 6 – 20 mg/ℓ

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

Solubility in organic solvents: Soluble in chloroform, pyridine.

Vapor pressure: 7.5×10^{-8} mmHg (20°C), 0.00001 Pa (20°C), $<10^{-7}$ mbar (20°C), $< 7.5 \times 10^{-8}$ mmHg (20°C)

Production amount (Agricultural Year 1999): Active ingredient: 652 t, Hydrate: 941 t

Use: Organic sulfur fungicide for treating vegetables, fruits and their seeds. (As it contains manganese, it is especially effective for soil with manganese deficiency.)

Import amount (Agricultural Year 1999): Active ingredient: 211 t

Survey results

Maneb was not detected in any samples of surface water (5 areas, 15 samples).

○Survey Results of Maneb + Zineb + Manzeb

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water	FY2000	0% (0/15)	0% (0/5)	ND	0.043 μg/ℓ
Bottom sediment	FY2000	No survey			---
Fish	FY2000	No survey			---

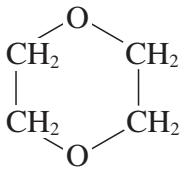
(2) Air

It is necessary to continue the environmental survey and collect further relevant information on the following 14 surveyed substances, which were all detected in the air.

√ : detected substance

√ [1] 1,4-Dioxane
√ [2] Isobutyl acetate
√ [3] Ethyl acetate
√ [4] Vinyl acetate
√ [5] Butyl acetate
√ [6] α-Methylstyrene
√ [7] *cis*-β-Methylstyrene + *o*-Methylstyrene + *p*-Methylstyrene
√ [8] *m*-Methylstyrene
√ [9] *trans*-β-Methylstyrene
√ [10] 2-Ethoxyethanol
√ [11] 2-Methoxyethanol
√ [12] 2-Butoxyethanol
√ [13] Hexabromobenzene
√ [14] Polychlorinated terphenyl

[1] 1,4-Dioxane (CAS RN: 123-91-1)



Chemical formula / molecular weight: $C_4H_8O_2$ / 88.11

Specific weight: 1.0337 (20 C), 1.033 (20 C), 1.03 – 1.04 (20 C), 1.0329, 1.03, 1.0356 (20 C), 1.0353

Melting point: 11.8 C, 12 C, 10 C

Boiling point: 101.1 C, 101 C, 101.3 C, 101.6 C

Water solubility (Sw): Miscible with water, miscible with water in any arbitrary ratio, miscible, miscible freely, soluble.

n-Octanol/water partition coefficient (Log Pow): -0.27, -0.42

Solubility in organic solvents: Miscible with most organic solvents, soluble in most organic solvents in any arbitrary ratio, soluble in ethanol and benzene.

Vapor pressure: 37 mmHg (25 C), 30 mmHg (20 C)

Use: Solvent for cellulose esters and cellulose ethers, solvent for organic synthesis reaction, transistor, synthetic leather, paint / medicine, preparation of stabilizer and detergent in chlorinated organic solvent, dispersing agent / lubricant in processing / dying / printing of textiles, solvent for pulp refining, and others.

Production amount: Approximately 4,500 t in 1999 (7,000 t in 1995)

Survey results

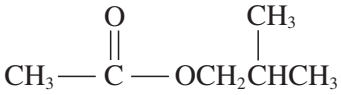
In this survey 1,4-Dioxane was detected in all of the surveyed media (air, surface water, bottom sediment). Detection frequencies in air, surface water and bottom sediment were 9 areas out of 12 (22 samples out of 34), 21 areas out of 31 (58 samples out of 92) and 1 area out of 30 (1 sample out of 90), respectively. The range of detected values in air, surface water and bottom sediment was 15 to 1,200 ng/m^3, 0.09 to 160 μg/ℓ and 10 ng/g-dry, respectively.

○Survey Results of 1,4-Dioxane

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	65% (22/34)	75% (9/12)	15 – 1,200 ng/m^3	6.8 ng/m^3
Surface water*	FY2000	63% (58/92)	68% (21/31)	0.09 – 160 μg/ℓ	0.08 μg/ℓ
Bottom sediment*	FY2000	1% (1/90)	3% (1/30)	10 ng/g-dry	8 ng/g-dry

∗: see page 74 in Chapter 3.

[2] Isobutyl acetate (CAS RN: 110-19-0)



Chemical formula / molecular weight: $C_6H_{12}O_2$ / 116.16

Specific weight: 0.8712 (20°C), 0.871 (20°C), 0.871 – 0.878 (15°C), 0.87, 0.8685 (15°C)

Melting point: -98.8°C, -98.9 – -98.6°C, -99°C, -98.9°C, 98.58°C

Boiling point: 116.5°C, 117.2°C, 116°C, 118°C, 116 – 118°C, 116 – 117°C

Water solubility (Sw): 0.67 g/100g (20°C), 6,300 mg/ℓ (25°C), 0.63 – 0.7g/100g (20°C), 0.55%

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

Solubility in organic solvents: Fairly soluble in ethanol and ethers. Soluble in acetone. Soluble in most organic solvents such as ethanol, diethylether, ketones, esters. Easily miscible in organic solvents such as propyleneglycol, alcohol, and others.

Vapor pressure: 17.8 mmHg (25°C), 12.5 – 13 mmHg (20°C), 1.7 kPa (20°C), 20 mmHg (25°C)

Use: Solvent for nitrocellulose lacquer; excellent solvent for other various resins; solvent for manufacturing synthetic leather, synthetic fiber and synthetic resin; extraction solvent for fat and medicine; component for perfume and synthetic perfume.

Production amount: 1 t in 1999

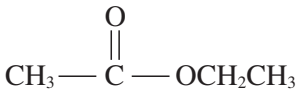
Survey results

In this survey, isobutyl acetate was detected in 12 areas out of 15 (29 samples out of 44) and the range of detected values was 73 to 710 ng/m^3.

○Survey Results of Isobutyl acetate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	66% (29/44)	80% (12/15)	73 – 710 ng/m^3	70 ng/m^3

[3] Ethyl acetate (CAS RN: 141-78-6)



Chemical formula / molecular weight: CHO / 88.12

Specific weight: 0.902 (20°C), 0.898 (25°C), 0.90 (20°C), 0.8946 (20°C),

Melting point: -83.77, -83 – 83.6°C, -82.4°C, -83°C, -84°C, -83.6 – 82°C, -83.6°C

Boiling point: 76.5 – 77.5°C, 77.1°C, 77°C, 77.15°C

Water solubility (Sw): 8.6 g/100mℓ (9.6% v/v) (20°C), 1 mℓ/10mℓ (25°C), 76,000 mg/ℓ (20°C), 86,000 mg/ℓ (20°C), 74,000 mg/ℓ (35°C)

n-Octanol/water partition coefficient (Log Pow): 0.73, 0.66

Solubility in organic solvents: Soluble in alcohols, ethers, acetone, benzene, diethyl ether and benzene. Miscible with chloroform, glycerin and most organic solvents.

Vapor pressure: 73 mmHg (20°C), 10 kPa (20°C), 72.8 mmHg (20°C), 115 mmHg (30°C), 100 mmHg (27°C)

Use: Printing ink, adhesive and lacquer; vehicle paint; solvent for nitrocellulose in manufacturing synthetic leather, ink, adhesive, film, flooring material and others.

Production/import amount:

Production: 228,776 t in 1999

Import: 6,997 t in 1999

Export: 44,093 t in 1999

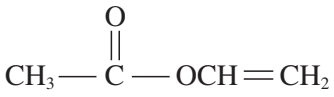
Survey results

In this survey, ethyl acetate was detected in 15 areas out of 15 (44 samples out of 45) and the range of detected values was 170 to 160,000 ng/m^3.

○Survey Results of Ethyl acetate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	98% (44/45)	100% (15/15)	170 – 160,000 ng/m^3	40 ng/m^3

[4] Vinyl acetate (CAS RN: 108-05-4)



Chemical formula / molecular weight: $C_4H_6O_2$ / 86.09

Specific weight: 0.932 (20°C), 0.9, 0.9345 (20°C), 0.9335 (20°C)

Melting point: -93.2°C, -84°C, -100°C, -93°C, -92.8°C

Boiling point: 72.7°C, 73°C, 72°C

Water solubility (Sw): 20,000 mg/ℓ(20°C), 2 – 2.4 g/100mℓ (20°C), 1 g/50mℓ (20°C), 2.5 g/50mℓ (20°C), 23,000 mg/ℓ (20°C)

n-Octanol/water partition coefficient (Log Pow): 0.73, 0.21 – 0.73

Solubility in organic solvents: Soluble in ethane, diethyl ether, acetone, benzene, chloroform, and most organic solvents. Miscible with alcohols and ethers in any arbitrary ratio.

Vapor pressure: 90.2 mmHg (20°C), 83 mmHg (20°C), 115 mmHg (25°C), 11.3 kPa (20°C), 140 mmHg (30°C), 100 mmHg (21.5°C)

Use: Feedstock monomer for polyvinyl acetate resin; copolymerization monomer with ethylene, styrene, acrylates, methacrylates; polyvinyl alcohol; adhesives; ethylene-vinyl acetate copolymer; synthetic fiber; gum base; water paint; paper coating; polish for synthetic leather.

Production/import amount:

Production: 593,882 t in 1999

Import: 28,989 t in 1999

Export: 54,672 t in 1999

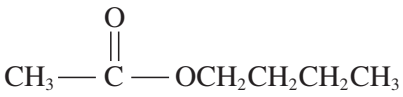
Survey results

In this survey, vinyl acetate was detected in 5 areas out of 14 (8 samples out of 42) and the range of detected values was 120 to 5,500 ng/m^3.

○Survey Results of Vinyl acetate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	19% (8/42)	36% (5/14)	120 – 5,500 ng/m^3	120 ng/m^3

[5] Butyl acetate (CAS RN: 123-86-4)



Chemical formula / molecular weight: $C_6H_{12}O_2$ / 116.16

Specific weight: 0.8826 (20°C), 0.882 (20°C), 0.88

Melting point: -78°C, -77.9°C, -77°C, -76.8°C

Boiling point: 126.1°C, 126°C, 120 – 125°C, 125 – 126°C, 124 – 127°C, 126.3°C

Water solubility (Sw): 14,000 mg/ℓ (20°C), 5,000 mg/ℓ (20°C), 6,700 ppm (25°C), 0.7 g/l00mℓ (20°C), 0.83 g/100mℓ (25°C)

n-Octanol/water partition coefficient (Log Pow): 1.78, 1.82, 1.81

Solubility in organic solvents: Soluble in most hydrocarbons. Soluble in ethanol and ethers. Soluble in acetone. Soluble in alcohols, ethers, and hydrocarbons.

Vapor pressure: 11.5 mmHg (25°C), 10 mmHg (20°C), 15 mmHg (25°C), 8.7 mmHg (20°C)

Use: Excellent solvent for many resins; solvent for nitrocellulose lacquer; solvent for manufacturing synthetic leather, synthetic fiber and synthetic resin; extraction solvent for fat/medicine; component of perfume and synthetic perfume; photo film; safety glass; shoe polish and others.

Production/import amount:

Production: 55,018 t in 1999
Import: 4,233 t in 1999
Export: 10,585 t in 1999

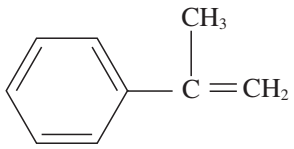
Survey results

In this survey, butyl acetate was detected in 14 areas out of 15 (39 samples out of 45) and the range of detected values was 110 to 13,000 ng/m^3.

○Surveyed Results of Butyl acetate

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	87% (39/45)	93% (14/15)	110 − 13,000 ng/m^3	88 ng/m^3

[6] α-Methylstyrene (CAS RN: 98-83-9)



Chemical formula / molecular weight: C_9H_{10} / 118.18

Melting point: -23.21°C, -23°C, -24°C, -23.2°C

Boiling point: 165°C, 164°C, 165 – 169°C, 165.38°C, 167 – 170°C, 163 – 164°C, 161 – 162°C

Water solubility (Sw): 0.1 g/100mℓ, 560 ppm (25°C), 0.1 g/100mℓ

n-Octanol/water partition coefficient (Log Pow): 3.38, 3.35

Solubility in organic solvents: Miscible with alcohols and ethers. Soluble in acetone and carbon tetrachloride in any arbitrary ratio. Soluble in alcohols, ethers, benzene, chloroform, diethyl ether, n-heptane and ethanol.

Vapor pressure: 29 Pa (20°C)

Use: ABS resin (for strengthening heat and impact resistance and for preventing ultraviolet degradation); polyester resin and alkyd resin (for modification).

Production amount: 33,000 t (estimated) in 1999

Survey results

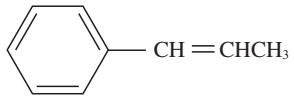
In this survey, α-methylstyrene was detected in 8 areas out of 9 (20 samples out of 26) and the range of detected values was 1.9 to 110 ng/m^3.

○Surveyed Results of α- Methylstyrene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	77% (20/26)	89% (8/9)	1.9 − 110 ng/m^3	1.9 ng/m^3

[7] *cis*-β-Methylstyrene + *o*-Methylstyrene + *p*-Methylstyrene

β-Methylstyrene (CAS RN: 637-50-3)



Chemical formula / molecular weight: C_9H_{10} / 118.18

Specific weight: 0.921, 0.911

Melting point: 172 – 173°C (754 mmHg)

Boiling point: 175°C

Water solubility (Sw): 55.3 ppm (25°C)

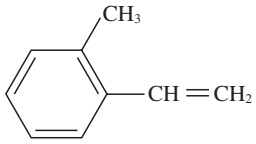
n-Octanol/water partition coefficient (Log Pow): 3.35

Vapor pressure: 0.97 mmHg (25°C)

Use: Unknown

Production/import amount: Unknown

***o*-Methylstyrene** (CAS RN: 611-15-4)



Chemical formula / molecular weight: C_9H_{10} / 118.18

Specific weight: 0.890 (25°C), 0.91, 0.9164 (15°C)

Melting point: -76.67°C, -69°C

Boiling point: 170 – 171°C, 170°C

Water solubility (Sw): 0.0089 wt% (25°C), 89 ppm

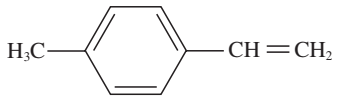
n-Octanol/water partition coefficient (Log Pow): 3.58

Solubility in organic solvents: Soluble in methanol, ethanol, ethers, acetone, carbon tetrachloride, benzene, *n*-heptane

Use: Copolymer with oil-modified alkyd resin for surface coating; instant dry coating; manufacturing unsaturated polyester resin; modified alkyd resin, drying oil; cross-linking agent under ultraviolet radiation.

Production/import amount: Unknown

***p*-Methylstyrene** (CAS RN: 622-97-9)



Chemical formula / molecular weight: C_9H_{10} / 118.18

Specific weight: 0.9173 (25°C), 0.911 (20°C), 0.897 (20/4°C), 0.88, 0.892 (25°C)

Melting point: -34.1°C, -37.8°C, -34°C

Boiling point: 172.8°C, 173°C, 170 – 175°C

Water solubility (Sw): 0.0089 g/100mℓ (25°C)

n-Octanol/water partition coefficient (Log Pow): 3.580, 3.35

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

Vapor pressure: <0.1 kPa (20°C), 1.81 mmHg (25°C)

Use: Poly paramethyl styrene resin, copolymer resin including acrylonitrile and rubber, polyester resin, synthetic rubber, paint for synthetic resin

Production/import amount: No domestic production

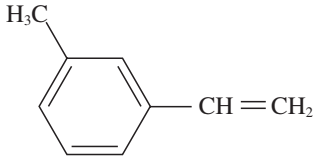
Survey results

In this survey, *cis*-*β*-Methylstyrene + *o*-Methylstyrene + *p*-Methylstyrene was detected in 8 areas out of 8 (22 samples out of 24) and the range of detected values was 5.4 to 190 ng/m^3.

○Survey Results of *cis*-*β*-Methylstyrene + *o*-Methylstyrene + *p*-Methylstyrene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	92% (22/24)	100% (8/8)	5.4 – 190 ng/m^3	4.8 ng/m^3

[8] *m*-Methylstyrene (CAS RN: 100-80-1)



Chemical formula / molecular weight: C_9H_{10} / 118.18

Specific weight: 0.890 (25°C), 0.91, 0.892 (25°C), 0.897 (20°C)

Melting point: -76.67°C, -77°C

Boiling point: 170 – 171°C, 172°C, 171.5°C

Water solubility (Sw): 0.0089 wt% (25°C)

n-Octanol/water partition coefficient (Log Pow): 3.35, 3.580

Solubility in organic solvents: Soluble in methanol, ethanol, ethers, acetone, carbon tetrachloride, benzene, n-heptane

Vapor pressure: 1.9 mmHg (260Pa) (25°C), 1.1 mmHg (147Pa) (20°C), <0.1 kPa (20°C)

Use: Unsaturated polyester resin, modified alkyd resin, intermediate of drying oil, copolymer with oil-modified alkyd resin for surface coating, cross-linking agent under ultraviolet radiation, instant dry coating, and others.

Production/import amount: Unknown

Survey results

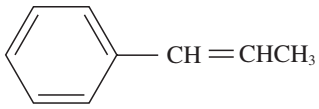
In this survey, *m*-methylstyrene was detected in 7 areas out of 9 (21 samples out of 26) and the range of detected values was 2.6 to 190 ng/m^3.

○Survey Results of *m*-Methylstyrene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	81% (21/26)	78% (7/9)	2.6 – 190 ng/m^3	1.5 ng/m^3

[9] *trans*-β-Methylstyrene

β-Methylstyrene (CAS RN: 637-50-3)



Chemical formula / molecular weight: C_9H_{10} / 118.18

Specific weight: 0.921, 0.911

Melting point: 172 – 173°C (754 mmHg)

Boiling point: 175°C

Water solubility (Sw): 55.3 ppm (25°C)

n-Octanol/water partition coefficient (Log Pow): 3.35

Vapor pressure: 0.97 mmHg (25°C)

Use: Unknown

Production/import amount: Unknown

Survey results

In this survey, *trans*-β-Methylstyrene was detected in 8 areas out of 9 (19 samples out of 27) and the range of detected values was 2.4 to 22 ng/m^3.

○Survey Results of *trans*-β-Methylstyrene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	70% (19/27)	89% (8/9)	2.4 − 22 ng/m^3	1.6 ng/m^3

[10] 2-Ethoxyethanol (CAS RN: 110-80-5)

$CH_3CH_2OCH_2CH_2OH$

Chemical formula / molecular weight: $C_4H_{10}O_2$ / 90.12

Specific weight: 0.93 (20°C), 0.931 (20°C), 0.9311 (20°C), 0.9360 (15°C)

Melting point: -90°C, -70°C

Boiling point: 135°C, 135.6°C, 135.1°C

Water solubility (Sw): Soluble in any arbitrary ratio. Soluble; Miscible

n-Octanol/water partition coefficient (Log Pow): -0.54, -0.43, -0.10

Solubility in organic solvents: Soluble in ethanol, diethyl ether, acetone, and liquid esters in any arbitrary ratio. Miscible with alcohols, ethers, acetone, diethyl ether, dimethyl ketones, and liquid esters.

Use: Solvent for various resins, extractant of medicine, solvent for nitrocellulose, lacquer, etc., removing agent for varnish, stabilizer for emulsified liquid, solvent for coating agent (epoxy and others), dying and printing of fiber, printing, stabilizer for emulsion, antifreeze for aircraft fuel, and other uses.

Production amount: 7,000 t (estimated) in 1999

8,596 t (manufacture: 6,906 t, import: 1,690 t) in 1996

Survey results

In this survey, 2-ethoxyethanol was detected in 9 areas out of 13 (24 samples out of 38) and the range of detected values was 2.3 to 950 ng/m^3.

○Survey Results of 2-Ethoxyethanol

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	63% (24/38)	69% (9/13)	2.3 − 950 ng/m^3	2.3 ng/m^3

[11] 2-Methoxyethanol (CAS RN: 109-86-4)

$CH_3OCH_2CH_2OH$

Chemical formula / molecular weight: $C_3H_8O_2$ / 76.10

Specific weight: 0.9647 (20°C), 0.9663 (20°C), 0.97 (20°C), 0.9660 (20°C)

Melting point: -85°C, -85.1°C

Boiling point: 124°C, 124.43°C (760 mmHg), 34 – 41°C (20 mmHg), 125°C (768mmHg), 124.5°C

Water solubility (Sw): Miscible

n-Octanol/water partition coefficient (Log Pow): -0.503, -0.77

Solubility in organic solvents: Soluble in alcohols, ketones, glycols and most hydrocarbons in any arbitrary ratio.

Vapor pressure: 6.2 mmHg (20°C), 9.7 mmHg (25°C), 0.83 kPa (20°C), 14 mmHg (30°C)

Use: Solvent, moisture measurement, dying of leather, drying oil, modified Karl Fischer reagent, antifreeze for aircraft fuel; solvent for nitrocellulose, cellulose acetate, synthetic resin; manufacturing of photo film; perfume fixative; semiconductor, microfilm and others.

Production/import amount: Unknown

Survey results

In this survey, 2-methoxyethanol was detected in 5 areas out of 15 (8 samples out of 43) and the range of detected values was 6.7 to 97 ng/m^3.

○Survey Results of 2-Methoxyethanol

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	19% (8/43)	33% (5/15)	6.7 – 97 ng/m^3	6.1 ng/m^3

[12] 2-Butoxyethanol (CAS RN: 111-76-2)

$CH_3CH_2CH_2CH_2OCH_2CH_2OH$

Chemical formula / molecular weight: $C_6H_{14}O_2$ / 118.18

Specific weight: 0.903 (20°C), 0.900 – 0.904 (20°C), 0.9012 (20°C), 0.9019 (20°C)

Melting point: -70°C, -75°C, <-40°C

Boiling point: 170.8°C, 171.2°C, 171 – 172°C, 171°C, 170°C

Water solubility (Sw): Soluble in any arbitrary ratio. Soluble; Miscible

n-Octanol/water partition coefficient(Log Pow): 0.83

Solubility in organic solvents: Soluble in acetone, benzene, carbon tetrachloride, diethyl ether, ethanol, n-heptane, and other organic solvents in any arbitrary ratio.

Vapor pressure: 0.76 mmHg (20°C), 0.88 mmHg (25°C), 0.10 kPa (20°C), 0.6 mmHg (20°C), 300 mmHg (140°C)

Use: Paint, printing ink, dye, detergent (liquid detergent, industrial detergent, dry cleaning); solvent for brake oil, agricultural chemicals and others; feedstock for agricultural chemicals, plasticizer, penetrating agent, softening agent, solvent for surface coating, solvent for various resins, solvent for paint, cutting oil, domestic cleaner, hydraulic fluid, coupling agent for many water-based coating agents, and solvent for cosmetics, and others.

Production amount: 25,000 t in 1999 (estimated)
19,280 t (production: 13,709 t, import: 5,571 t) in 1996

Import amount: 9,827 t in 1999

Export amount: 22,734 t in 1999

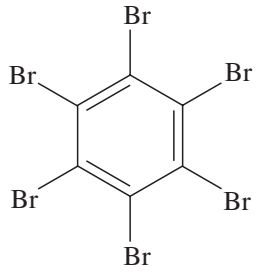
Survey results

In this survey, 2-butoxyethanol was detected in 15 areas out of 15 (43 samples out of 45) and the range of detected values was 4.8 to 560 ng/m^3.

○Survey Results of 2-Butoxyethanol

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	96% (43/45)	100% (15/15)	4.8 – 560 ng/m^3	2.2 ng/m^3

[13] Hexabromobenzene (CAS RN: 87-82-1)



Chemical formula / molecular weight: C_6Br_6 / 551.52

Melting point: >315°C, 327°C

Water solubility (Sw): 0.16×10^{-3} mg/ℓ (25°C)

n-Octanol/water partition coefficient (Log Pow): 6.07

Solubility in organic solvents: Slightly soluble in chlorobenzene, xylene and DMF

Use: Flame retardant for thermoplastic resin, thermosetting resin, synthetic fiber and synthetic rubber.

Production/import amount: Unknown

Survey results

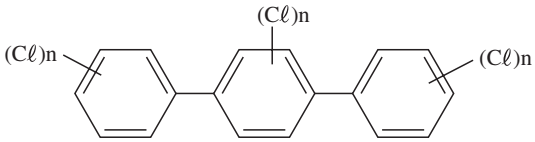
In this survey, hexabromobenzene was detected in 2 areas out of 11 (4 samples out of 33) in bottom sediment and in 8 areas out of 11 (14 samples out of 33) in air. However, it was not detected in either surface water (12 areas, 36 samples) or fish (11 areas, 33 samples). The range of detected values was 8.4 to 43 ng/g-dry in bottom sediment and 0.031 to 0.1 ng/m^3 in air.

○Survey Results of Hexabromobenzene

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Surface water*	FY2000	0% (0/36)	0% (0/12)	ND	0.0064 μg/ℓ
Bottom sediment*	FY2000	12% (4/33)	18% (2/11)	8.4 − 43 ng/g-dry	4.8 ng/g-dry
Fish*	FY2000	0% (0/33)	0% (0/11)	ND	3.2 ng/g-wet
Air	FY2000	42% (14/33)	73% (8/11)	0.031 − 0.1 ng/m^3	0.030 ng/m^3

∗: see page 49 in Chapter 3.

[14] Polychlorinated terphenyl (CAS RN: 6178-33-8)



Chemical formula: Mixture

Production amount: Unknown

Survey results

In this survey, polychlorinated terphenyl was detected in 7 areas out of 8 (21 samples out of 24) and the range of detected values was 0.00092 to 0.0060 ng/m^3.

○Survey Results of Polychlorinated terphenyl

Media	Year	Detection frequency (number)		Range	Detection limit
		Sample	Area		
Air	FY2000	88% (21/24)	88% (7/8)	0.00092 − 0.0060 ng/m^3	Determined individually

Figure 2-1 Locations of the Environmental Survey for the Aquatic System (FY2000)

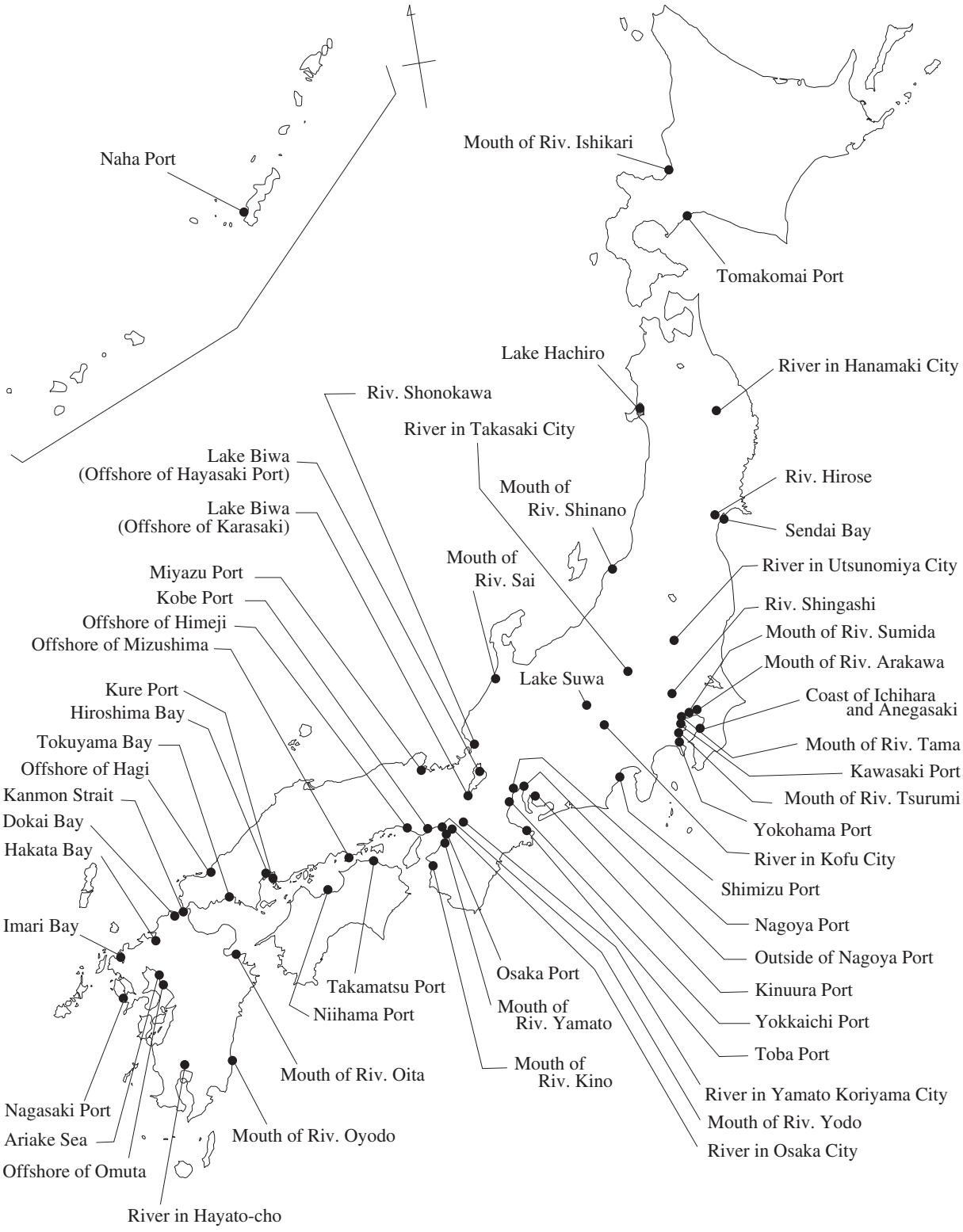


Table 2-1 Outline of the Environmental Survey for Surface Water (FY2000)
(A/B: Detected samples/Total samples, C/D: Detected areas/Total areas)

Chemical substance		Surface water(μg/ℓ)			
		A/B	C/D	Range*	Detection limit
1	Ethyl *p*-hydroxybenzoate	0/33	0/11		0.027
2	Isopropyl *p*-hydroxybenzoate	0/33	0/11		0.018
3	*n*-Propyl *p*-hydroxybenzoate	0/33	0/11		0.014
4	Isobutyl *p*-hydroxybenzoate	0/33	0/11		0.023
5	*n*-Butyl *p*-hydroxybenzoate	0/33	0/11		0.027
6	Dioctyltin compounds	3/147	2/49	0.0073 – 0.072	0.0059
7	Tris(4-chlorophenyl) methanol	0/39	0/13		0.0052
8	Tris(4-chlorophenyl) methane	0/39	0/13		0.0033
9	1,3,5-Tri-*tert*-butylbenzene	0/39	0/13		0.00031
10	Hexabromobenzene	0/36	0/12		0.0064
11	Tetrabromobisphenol A	0/27	0/9		0.090
12	2-*tert*-Butyl-4-methoxyphenol	0/30	0/10		0.016
13	Butyl benzyl phthalate	0/138	0/46		0.14
14	Maneb+Zineb+Manzeb	0/15	0/5		0.043

* Range: detected minimum value – detected maximum value

Table 2-2 Outline of the Environmental Survey for Bottom Sediment (FY2000)
(A/B: Detected samples/Total samples, C/D: Detected areas/Total areas)

Chemical substance		Bottom sediment (ng/g-dry)			
		A/B	C/D	Range*	Detection limit
1	Ethyl *p*-hydroxybenzoate	1/33	1/11	3.3	1.5
2	Isopropyl *p*-hydroxybenzoate	0/33	0/11		2.1
3	*n*-Propyl *p*-hydroxybenzoate	0/33	0/11		2.3
4	Isobutyl *p*-hydroxybenzoate	0/30	0/10		2.3
5	*n*-Butyl *p*-hydroxybenzoate	0/30	0/10		2.3
6	Dioctyltin compounds	27/147	13/49	11 – 100	10
7	Tris(4-chlorophenyl) methanol	0/33	0/11		3.2
8	Tris(4-chlorophenyl) methane	0/39	0/13		1.7
9	1,3,5-Tri-*tert*-butylbenzene	0/33	0/11		0.30
10	Hexabromobenzene	4/33	2/11	8.4 – 43	4.8
11	Tetrabromobisphenol A	0/27	0/9		5.5
12	2-*tert*-Butyl-4-methoxyphenol	0/30	0/10		2.0
13	Butyl benzyl phthalate	25/138	11/46	32 – 134	28

* Range: detected minimum value – detected maximum value

Table 2-3 Outline of the Environmental Survey for Fish (FY2000)
(A/B: Detected samples/Total samples, C/D: Detected areas/Total areas)

Chemical substance		Fish (ng/g-wet)			
		A/B	C/D	Range*	Detection limit
1	Ethyl *p*-hydroxybenzoate	2/28	1/10	1.9 – 2.2	1.9
2	Isopropyl *p*-hydroxybenzoate	0/28	0/10		1.6
3	*n*-Propyl *p*-hydroxybenzoate	0/28	0/10		2.3
4	Isobutyl *p*-hydroxybenzoate	0/28	0/10		2.6
5	*n*-Butyl *p*-hydroxybenzoate	0/28	0/10		2.9
6	Dioctyltin compounds	23/117	12/39	0.64 – 6.5	0.64
7	Tris(4-chlorophenyl) methanol	0/39	0/13		0.97
8	Tris(4-chlorophenyl) methane	0/39	0/13		0.44
9	1,3,5-Tri-*tert*-butylbenzene	0/33	0/11		0.43
10	Hexabromobenzene	0/33	0/11		3.2
11	Tetrabromobisphenol A	0/27	0/9		20

* Range: detected minimum value – detected maximum value

Figure 2-2 Locations of the Environmental Survey for Air (FY2000)

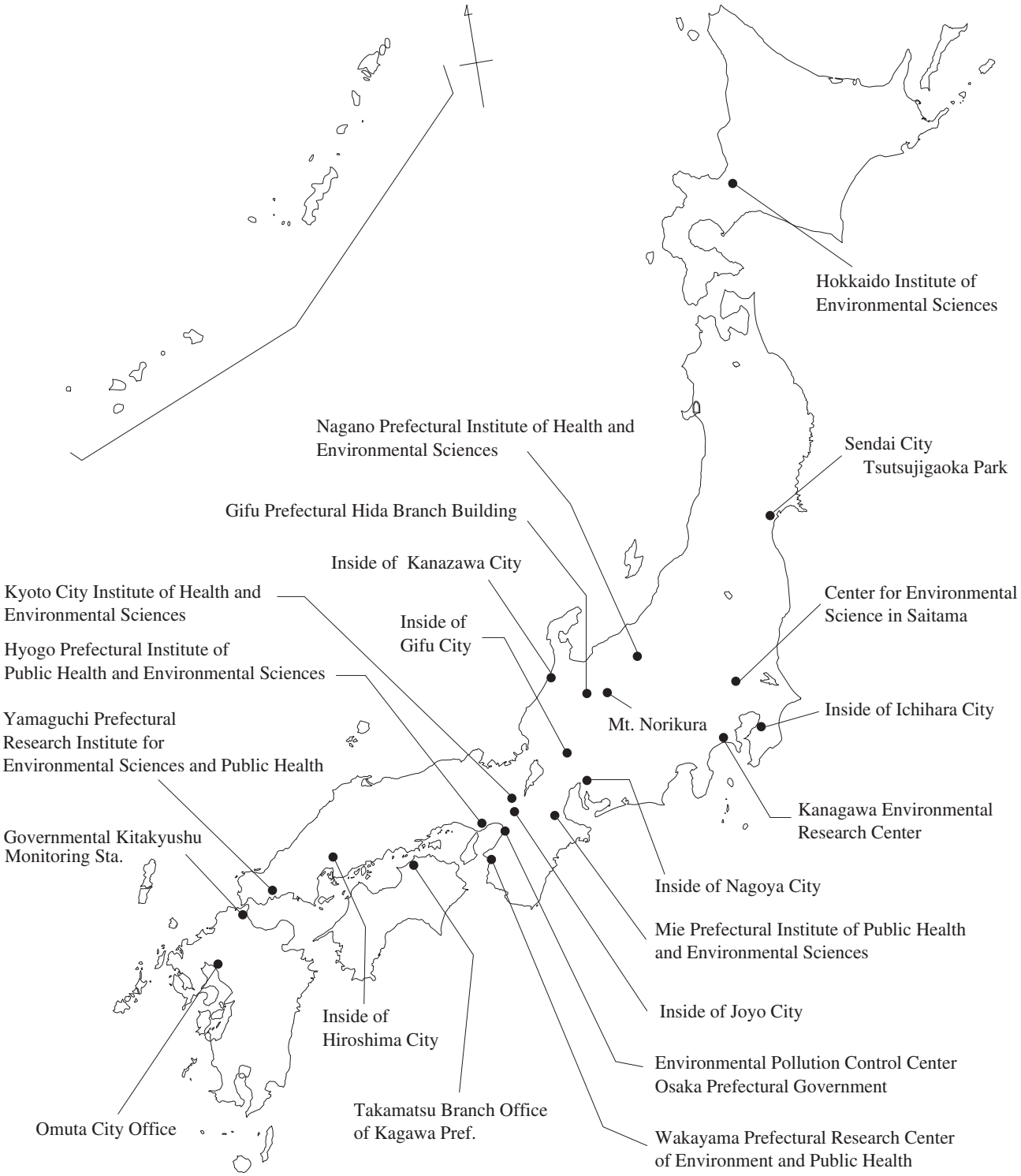


Table 2-4 Outline of the Environmental Survey for Air (FY2000)
(A/B: Detected samples/Total samples, C/D: Detected areas/Total areas)

Chemical substance		Air (ng/m³)			
		A/B	C/D	Range*	Detection limit
1	1,4-Dioxane	22/34	9/12	15 – 1200	6.8
2	Isobutyl acetate	29/44	12/15	73 – 710	70
3	Ethyl acetate	44/45	15/15	170 – 160000	40
4	Vinyl acetate	8/42	5/14	120 – 5500	120
5	Butyl acetate	39/45	14/15	110 – 13000	88
6	α -Methylstyrene	20/26	8/9	1.9 – 110	1.9
7	*cis*- β -Methylstyrene + *o*-Methylstyrene + *p*-Methylstyrene	22/24	8/8	5.4 – 190	4.8
8	*m*-Methylstyrene	21/26	7/9	2.6 – 190	1.5
9	*trans*-β -Methylstyrene	19/27	8/9	2.4 – 22	1.6
10	2-Ethoxyethanol	24/38	9/13	2.3 – 950	2.3
11	2-Methoxyethanol	8/43	5/15	6.7 – 97	6.1
12	2-Butoxyethanol	43/45	15/15	4.8 – 560	2.2
13	Hexabromobenzene	14/33	8/11	0.031 – 0.1	0.03
14	Polychlorinated terphenyl	21/24	7/8	0.00092 – 0.0060	
14-1	Monochloro-terphenyl	21/24	7/8	0.00092 – 0.0060	0.0001
14-2	Dichloro-terphenyl	4/24	3/8	0.00055 – 0.0011	0.00053
14-3	Trichloro-terphenyl	0/24	0/8		0.0073
14-4	Tetrachloro-terphenyl	0/24	0/8		0.0072
14-5	Pentachloro-terphenyl	0/24	0/8		0.0010

* Range: minimum value – maximum value

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 of 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 compounds (TBT), [13] Tiphenyltin compounds (TPT)

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

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

[4] DDTs and their 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] TBT, [8] TPT

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

Surveyed areas in the FY2000 survey were 38 areas for bottom sediment (Fig. 3-A/3-C), 20 areas for wildlife (Fig. 3-B), 31 areas for atmospheric air (Fig. 3-D) and 8 areas (3 homes each, Fig. 3-D) for exposure route (indoor air and diet).

(3) Analytical method

GC/MS was adopted for the analysis of bottom sediment, water and air and GC-ECD was adopted for the analysis of chloroform in diet.

3. Survey results

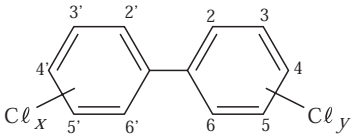
Survey results are as follows. And detailed results are also contained on the supplement CD-ROM ; Table 3-2 (bottom sediment), Table 3-3 (wildlife), Table 3-4 (Designated Chemical Substances – Persistence in the Environment), Table 3-5 (Designated Chemical Substances – Exposure Route), and Table 3-6 (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] PCB



PCB (polychlorinated biphenyl) was 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 high accumulative in wildlife and is 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, PCB was selected as a substance subject to the survey and has been monitored since that time.

Survey results

<Wildlife>

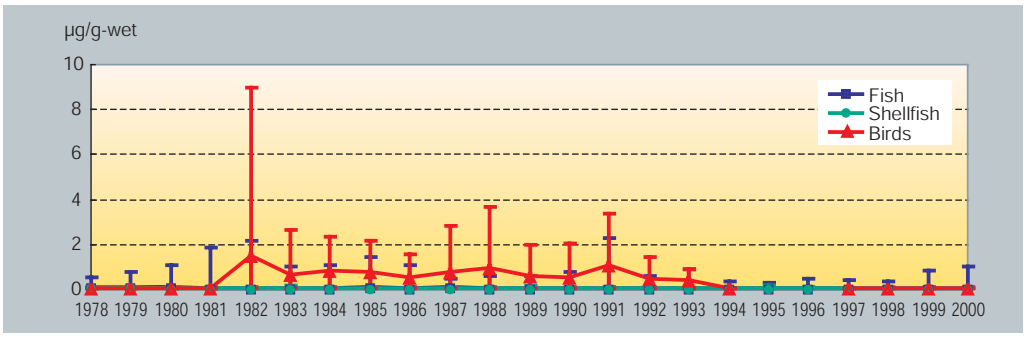
PCB was detected in fish, shellfish and birds. The range of detected values for fish was 0.01 to 0.95 μg/g-wet, the detection frequency was 51% (36 samples out of 70), and the detection frequency in terms of area was 57% (8 areas out of 14). The range of detected values for shellfish was 0.02 to 0.04 μg/g-wet, the detection frequency was 33% (10 samples out of 30), and the detection frequency in terms of area was 33% (2 areas out of 6). The range of detected values for birds was 0.01 to 0.02 μg/g-wet, the detection frequency was 50% (5 samples out of 10), and the detection frequency in terms of area was 50% (1 area out of 2).

○ Survey Results of PCB in Wildlife (FY2000)

Substance	Media	Detection frequency		Range (mg/g-wet)	Detection limit (mg/g-wet)
		sample	area		
PCB	Fish	51% (36/70)	57% (8/14)	0.01 – 0.95	0.01
	Shellfish	33% (10/30)	33% (2/6)	0.02 – 0.04	0.01
	Birds	50% (5/10)	50% (1/2)	0.01 – 0.02	0.01

Figure 3-1 Detection Frequency and Range of PCB

Wildlife

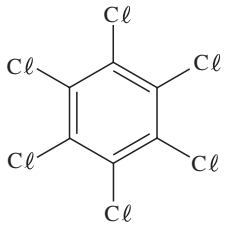


	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
F	25/ 30	35/ 40	33/ 50	24/ 45	27/ 50	28/ 50	35/ 60	35/ 60	39/ 55	52/ 65	47/ 65	41/ 65	46/ 70	41/ 70	37/ 70	39/ 70	39/ 70	34/ 70	65/ 105	71/ 108	39/ 70	40/ 70	73/ 107
SF	15/ 15	15/ 15	15/ 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
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

Detection Limit: Fish (0.02 pg/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 a hardly degradable, bio-accumulative and chronically toxic substance, 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 0.18 to 4.9 ng/g-dry. The detection frequency was 24% (4 samples out of 17).

○ Survey Results of HCB in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range (ng/g-dry)
		sample	
HCB	Bottom sediment	24% (4/17)	0.18 − 4.9

< Wildlife>

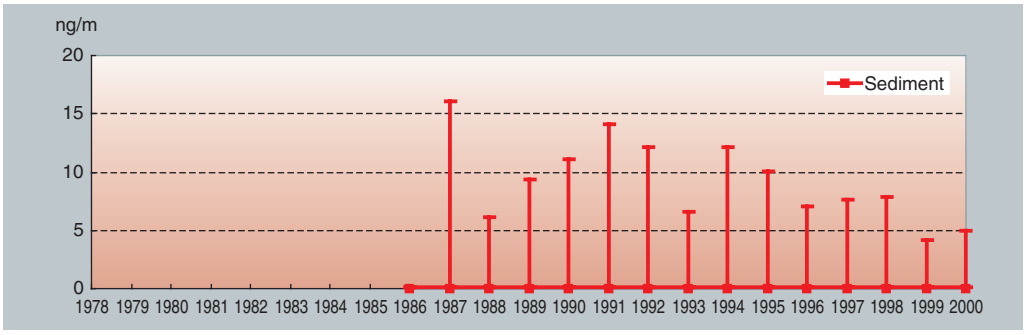
HCB was detected in fish and birds with a range of detected values from 0.001 to 0.002 μg/g-wet. Detection frequencies of HCB in fish and birds were 10% (7 samples out of 69) and 50% (5 samples out of 10), respectively, in the FY2000 survey. The detection frequencies in terms of area were 21% (3 areas out of 14) and 50% (1 area out of 2), respectively.

○Survey Results of HCB in Wildlife (FY2000)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		sample	area		
HCB	Fish	10% (7/69)	21% (3/14)	0.001 − 0.002	0.001
	Shellfish	0% (0/30)	0% (0/6)	ND	0.001
	Birds	50% (5/10)	50% (1/2)	0.001 − 0.002	0.001

Figure 3-2 Detection Frequency and Range of HCB

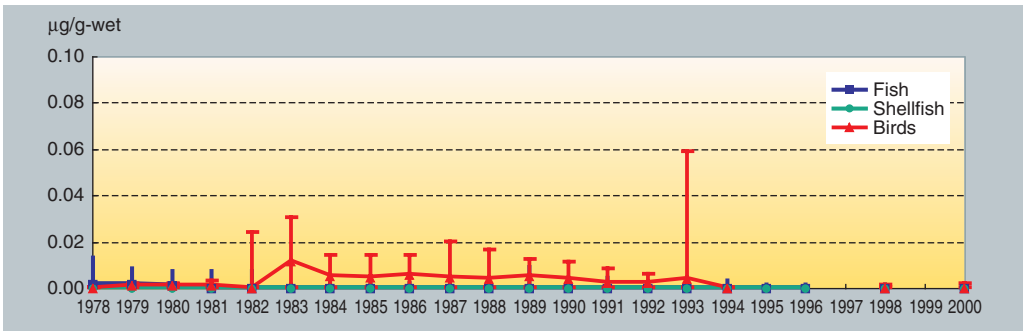
(A) Bottom sediment



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

Detection Limit: 1 ng/g-dry

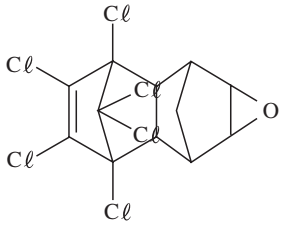
(B) Wildlife



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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
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
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

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 were substantially discontinued in 1971, dieldrin was still being used as an anti-termite agent in the treatment of housing. However, in October 1981, together with aldrin and endorin, 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. At the same time, it was also regulated as an agricultural chemical.

Survey results

<Bottom sediment>

As a result of the FY2000 survey, dieldrin was detected in one sample out of 17 (6%) and its concentration was 1.8 ng/g-dry.

○ Survey Results of Dieldrin in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range (ng/g-dry)
		sample	
Dieldrin	Bottom sediment	6% (1/17)	1.8

<Wildlife>

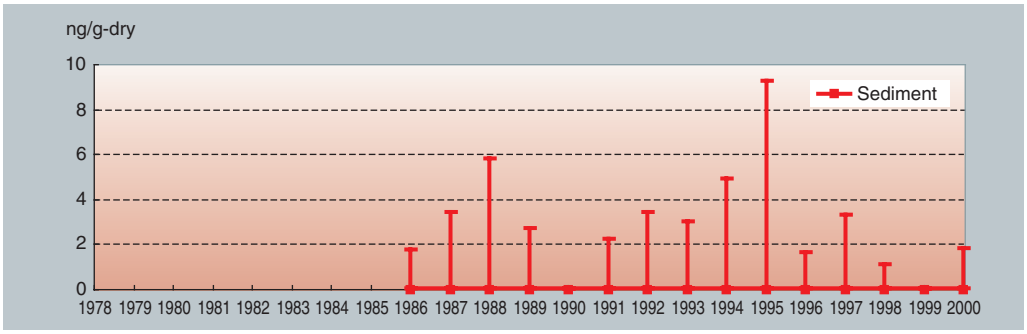
Dieldrin was detected in fish, shellfish and birds. The detected concentrations were 0.001 to 0.004 μg/g-wet, 0.038 to 0.16 μg/g-wet and 0.001 to 0.002 μg/g-wet, respectively, in the FY2000 survey. The detection frequency was 14% (10 samples out of 70) for fish, 17% (5 samples out of 30) for shellfish, and 20% (2 samples out of 10) for birds. Detection frequencies in terms of area were 14% (2 areas out of 14) for fish, 17% (1 area out of 6) for shellfish, and 50% (1 area out of 2) for birds.

○ Survey Results of Dieldrin in Wildlife (FY2000)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		sample	area		
Dieldrin	Fish	14% (10/17)	14% (2/14)	0.001 – 0.001	0.001
	Shellfish	17% (5/30)	17% (1/6)	0.038 – 0.16	0.001
	Birds	20% (2/10)	50% (1/2)	0.001 – 0.002	0.001

Figure 3-3 Detection Frequency and Range of Dieldrin

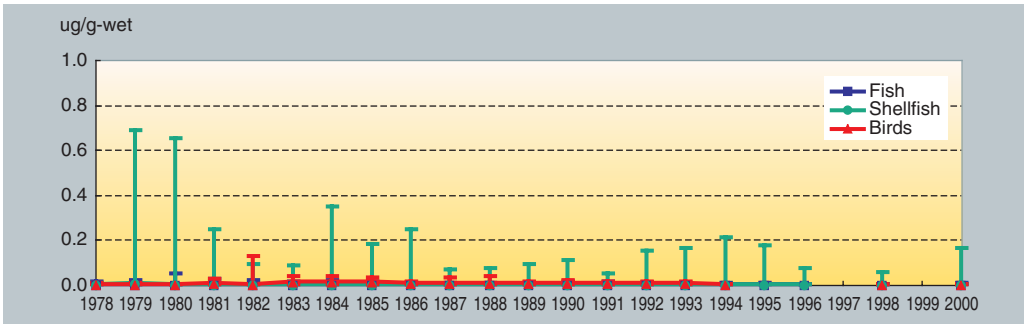
(A) Bottom sediment



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

Detection Limit: 1 ng/g-dry

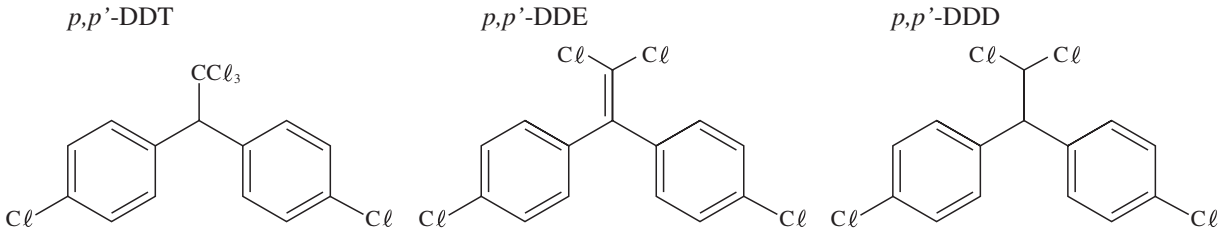
(B) Wildlife



	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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
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
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

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 Substances 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'*-DDD and *p,p'*-DDE (degradation products of DDT in the environment) in the case of bottom sediment, and *p,p'*-DDD, *p,p'*-DDE, *o,p'*-DDT, *o,p'*-DDD, *o,p'*-DDE in the case of wildlife, were selected as substances subject to the survey.

Survey results

<Bottom sediment>

In the FY2000 survey, *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD were detected in bottom sediment. The range of detected values was 0.20 to 5.9 ng/g-dry, 0.13 to 11 ng/g-dry, 0.15 to 15 ng/g-dry, respectively. The detection frequencies were 24% (4 samples out of 17), 59% (10 samples out of 17) and 41% (7 samples out of 17), respectively.

○Survey Results of DDTs in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range
		sample	(ng/g-dry)
p,p'-DDT	Bottom sediment	24% (4/17)	0.20 – 5.9
p,p'-DDE		59% (10/17)	0.13 – 11
p,p'-DDD		41% (7/17)	0.15 – 15

<Wildlife>

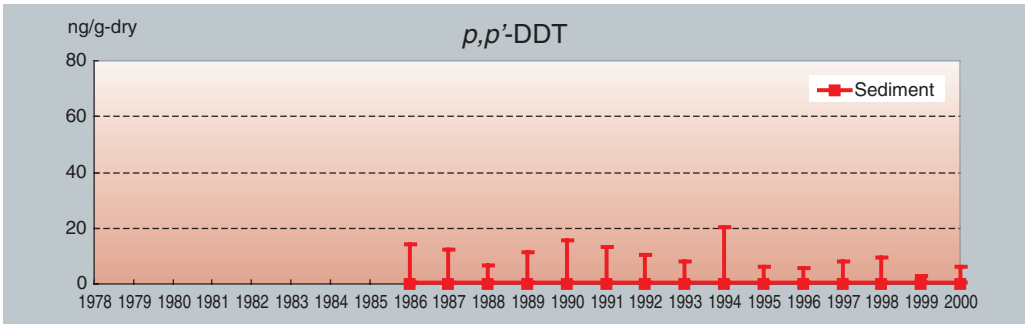
p,p'-DDT was detected in fish, shellfish and birds. The range of detected values for fish was 0.001 to 0.018 μg/g-wet, the detection frequency was 23% (16 samples out of 69), and that in terms of area was 36% (5 areas out of 14). The detected value for shellfish was 0.001 μg/g-wet, the detection frequency was 13% (4 samples out of 30), and that in terms of area was 17% (1 area out of 6). The detected value for birds was 0.001 μg/g-wet, the detection frequency was 20% (2 samples out of 10), and that in terms of area was 50% (1 area out of 2).

○ Survey Results of DDTs in Wildlife (FY2000)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		sample	area		
p,p'-DDT	Fish	23% (16/69)	36% (5/14)	0.001 – 0.018	0.001
	Shellfish	13% (4/30)	17% (1/6)	0.001	0.001
	Birds	20% (2/10)	50% (1/2)	0.001	0.001
p,p'-DDE	Fish	72% (50/69)	86% (12/14)	0.001 – 0.048	0.001
	Shellfish	47% (14/30)	50% (3/6)	0.001 – 0.003	0.001
	Birds	100% (10/10)	100% (2/2)	0.01 – 0.13	0.001
p,p'-DDD	Fish	46% (32/69)	50% (7/14)	0.001 – 0.010	0.001
	Shellfish	10% (3/30)	17% (1/6)	0.001	0.001
	Birds	50% (5/10)	50% (1/2)	0.001 – 0.002	0.001
o,p'-DDT	Fish	10% (7/69)	14% (2/14)	0.001 – 0.005	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	7% (5/69)	7% (1/14)	0.002 – 0.006	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	13% (9/69)	14% (2/14)	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

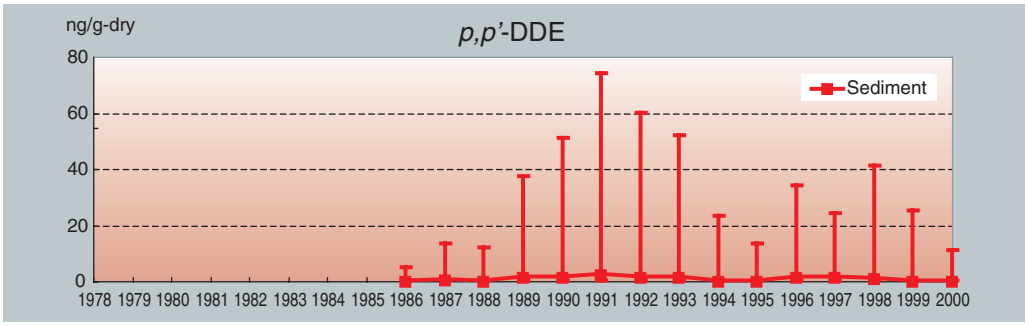
Figure 3-4 Detection Frequency and Range of *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD

(A) Bottom sediment



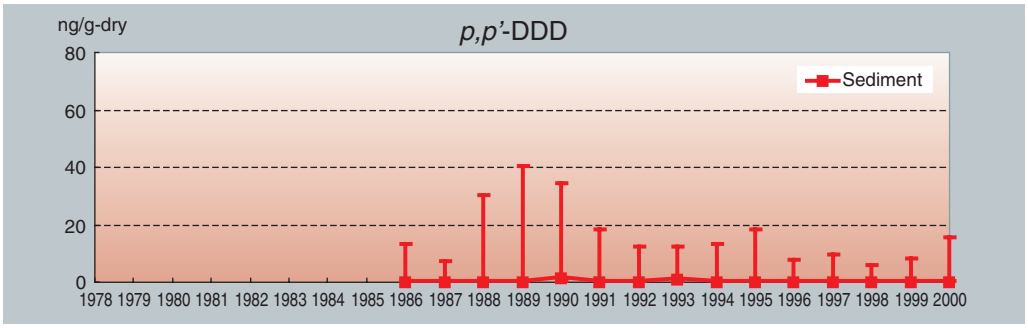
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
S									4/ 17	3/ 19	3/ 22	3/ 17	5/ 18	4/ 17	6/ 18	8/ 19	5/ 16	3/ 18	6/ 17	4/ 17	5/ 18	2/ 18	4/ 17

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
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

Detection Limit: 1 ng/g-dry

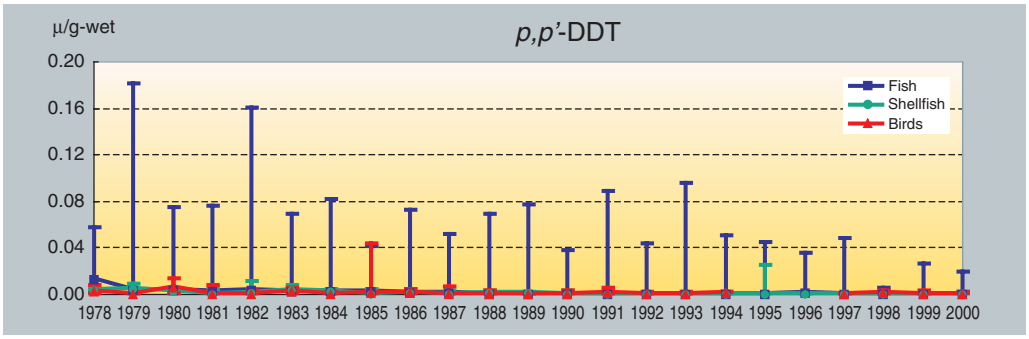


	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
S									5/ 17	2/ 19	5/ 22	4/ 17	7/ 18	7/ 18	8/ 18	9/ 19	9/ 17	10/ 18	9/ 18	8/ 17	8/ 18	7/ 18	8/ 17

Detection Limit: 1 ng/g-dry

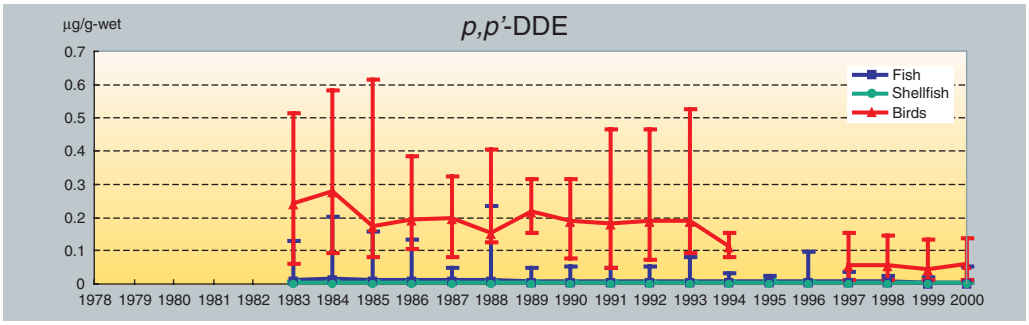
Figure 3-4 Detection Frequency and Range of *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD (continued)

(B) Wildlife



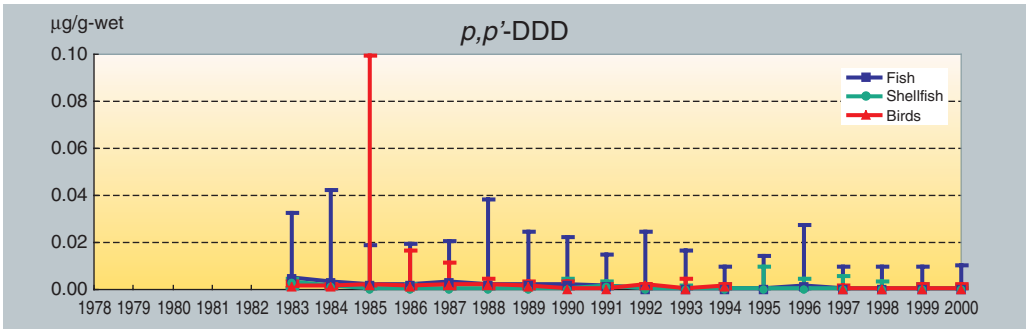
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
F	25/ 30	34/ 40	37/ 50	26/ 46	40/ 50	35/ 50	45/ 60	40/ 60	34/ 55	38/ 65	30/ 65	32/ 65	28/ 70	29/ 70	24/ 70	27/ 70	17/ 70	33/ 70	38/ 70	26/ 70	35/ 70	15/ 70	16/ 69
SF	10/ 10	15/ 15	15/ 15	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
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

Detection Limit(F.Y.1983-): 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
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
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
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

Detection Limit: 0.001 µg/g-wet

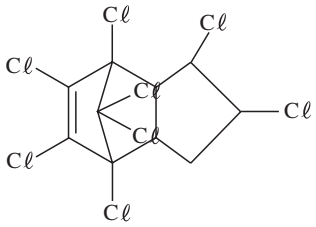


	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
F						40/ 50	35/ 60	35/ 60	37/ 55	43/ 65	36/ 65	41/ 65	40/ 70	39/ 70	32/ 70	31/ 70	31/ 70	31/ 70	35/ 70	35/ 70	29/ 70	26/ 70	32/ 69
SF						13/ 20	13/ 20	5/ 20	10/ 20	5/ 20	7/ 20	6/ 21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

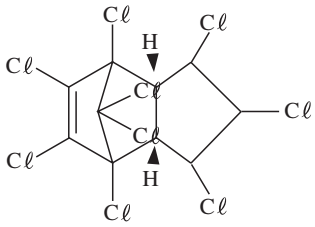
Detection Limit: 0.001 µg/g-wet

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

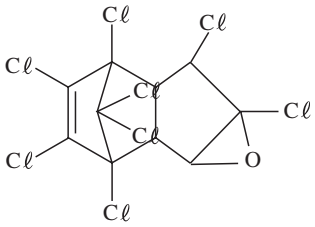
chlordane



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 chlordanes that were selected are the ones with high detection frequencies in the results of the FY1982 Detailed Environmental Survey for 8 chlordanes.

<Bottom sediment>

trans-Chlordane, *cis*-chlordane, *trans*-nonachlor and *cis*-nonachlor were detected with a range of values from 0.22 to 7.2 ng/g-dry, 0.21 to 5.7 ng/g-dry, 0.35 to 7.0 ng/g-dry and 1.9 to 3.0 ng/g-dry, respectively. The detection frequencies were 35% (6 samples out of 17), 29% (5 samples out of 17), 18% (3 samples out of 17) and 12% (2 samples out of 17), respectively.

○Survey Results of Chlordanes in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range
		sample	(ng/g-dry)
trans-Chlordane	Bottom sediment	35% (6/17)	0.22 – 7.2
cis-Chlordane		29% (5/17)	0.21 – 5.7
trans-Nonachlor		18% (3/17)	0.35 – 7.0
cis-Nonachlor		12% (2/17)	1.9 – 3.0

<Wildlife>

trans-Chlordane, *cis*-chlordane, *cis*-nonachlor and oxychlordane were detected in fish and shellfish, and *trans*-nonachlor was detected in fish, shellfish and birds. For fish, the range of detected values of each chlordane was 0.001 to 0.021 μg/g-wet and that of total chlordane was 0.001 to 0.034 μg/g-wet. For shellfish, the range of detected values of each chlordane was 0.001 to 0.025 μg/g-wet and that of total chlordane was 0.002 to 0.037 μg/g-wet. *trans*-Nonachlor was the only substance detected in birds and the range of detected values was 0.001 to 0.002. The detection frequency of total chlordanes in fis hwas 55%

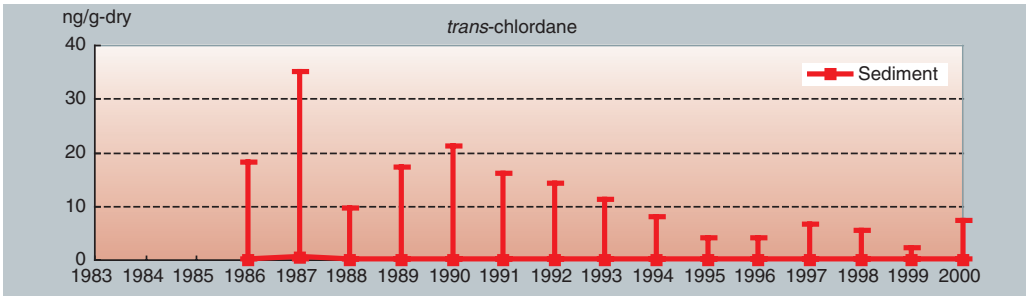
(38 samples out of 69) and that in terms of area was 71% (10 areas out of 14). The detection frequency of total chlordanes in shellfish was 67% (20 samples out of 30) and that in terms of area was also 67% (4 areas out of 6). The detection frequency of *trans*-nonachlor in birds was 50% (5 samples out of 10) and that in terms of area was also 50% (1 area out of 2).

○Survey Results of Chlordanes in Wildlife (FY2000)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		sample	area		
trans-Chlordane	Fish	20% (14/69)	29% (4/14)	0.001 – 0.021	0.001
	Shellfish	67% (20/30)	67% (4/6)	0.001 – 0.005	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001
cis-Chlordane	Fish	38% (26/69)	50% (7/14)	0.001 – 0.010	0.001
	Shellfish	50% (15/30)	50% (3/6)	0.001 – 0.025	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001
trans-Nonachlor	Fish	52% (36/69)	64% (9/14)	0.001 – 0.013	0.001
	Shellfish	47% (14/30)	50% (3/6)	0.001 – 0.002	0.001
	Birds	50% (5/10)	50% (1/2)	0.001 – 0.002	0.001
cis-Nonachlor	Fish	28% (19/69)	36% (5/14)	0.001 – 0.006	0.001
	Shellfish	3% (1/30)	17% (1/6)	0.001	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001
Oxychlordane	Fish	7% (5/69)	14% (2/14)	0.001 – 0.002	0.001
	Shellfish	17% (5/30)	17% (1/6)	0.004 – 0.006	0.001
	Birds	0% (0/10)	0% (0/2)	ND	0.001
Total chlordanes	Fish	55% (38/69)	71% (10/14)	0.001 – 0.034	0.001
	Shellfish	67% (20/30)	67% (4/6)	0.002 – 0.037	0.001
	Birds	50% (5/10)	50% (1/2)	0.001 – 0.002	0.001

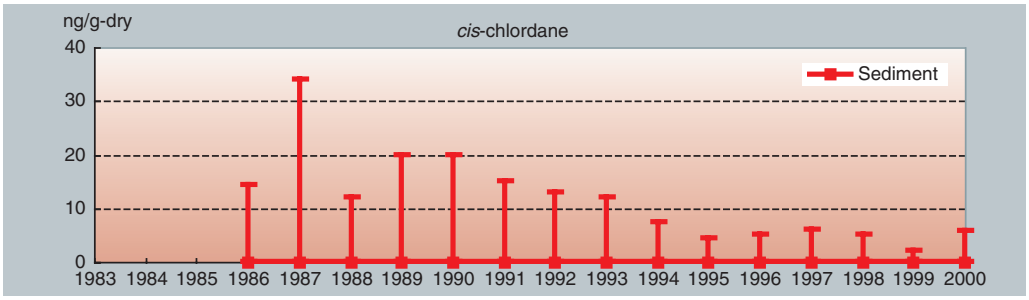
Figure 3-5 Detection Frequency and Range of *trans*- and *cis*-Chlordane

(A) Bottom sediment



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

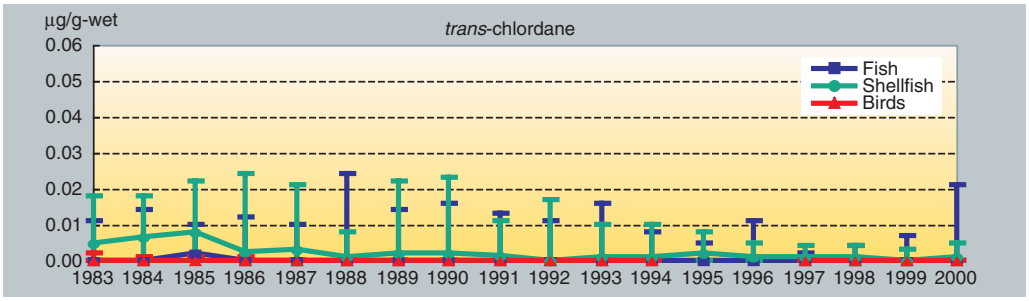
Detection Limit(F.Y.1986-): 1 ng/g-dry



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

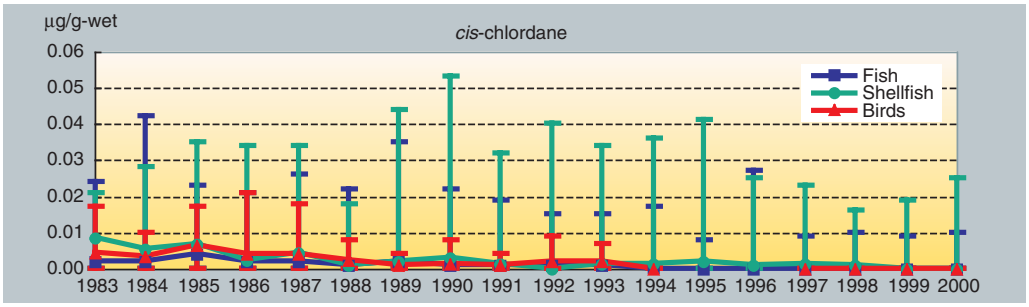
Detection Limit: 1 ng/g-dry

(B) Wildlife



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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
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
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

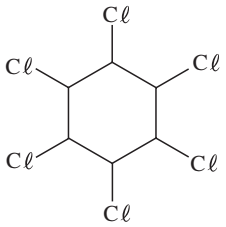
Detection Limit(F.Y.1983-): 0.001 µg/g-wet



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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
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
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

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 FY2000.

Survey results

<Bottom sediment>

The detected value of α-HCH was 0.15 ng/g-dry and the detection frequency was 6% (1 sample out of 17). The range of detected values of β-HCH was 0.58 to 0.80 ng/g-dry and the detection frequency was 12% (2 samples out of 17).

○Survey Results of HCHs in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range
		sample	(ng/g-dry)
α-HCH	Bottom sediment	6% (1/17)	0.15
β-HCH		12% (2/17)	0.58 − 0.80

<Wildlife>

α-HCH was detected only in fish, and β-HCH was detected in fish and birds. The detected value of α-HCH in fish was 0.001 μg/g-wet, the detection frequency was 1% (1 sample out of 69), and the detection frequency in terms of area was 7% (1 area out of 14). The range of detected values of β-HCH in fish and birds was 0.001 to 0.003 μg/g-wet and 0.002 to 0.008 μg/g-wet, respectively. The detection frequencies were 10% (7 samples out of 69) and 100% (10 samples out of 10), respectively. The detection frequencies in terms of area were 14% (2 areas out of 14) and 100% (2 areas out of 2), respectively.

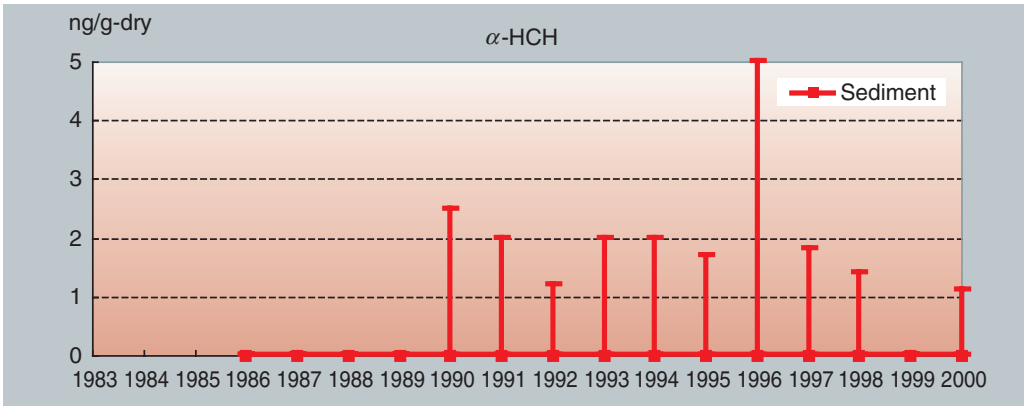
○Survey Results of HCHs in Wildlife (FY2000)

Substance	Media	Detection frequency		Range (μg/g-wet)	Detection limit (μg/g-wet)
		sample	area		
α-HCH	Fish	1% (1/69)	7% (1/14)	0.001	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	10% (7/69)	14% (2/14)	0.001 – 0.003	0.001
	Shellfish	0% (0/30)	0% (0/6)	ND	0.001
	Birds	100% (10/10)	100% (2/2)	0.002 – 0.008	0.001

HCH isomers, except γ-isomer, are considered to have high persistence and it is necessary to monitor and confirm their persistence in the environment by means of continued survey, from the point of view of global pollution monitoring.

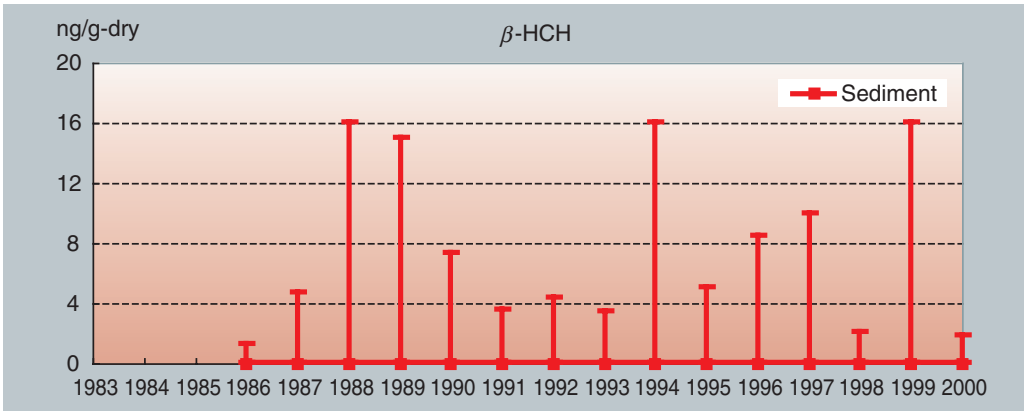
Figure 3-6 Detection Frequency and Range of α- and β-HCH

(A) Bottom sediment



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

Detection Limit: 1 ng/g-dry

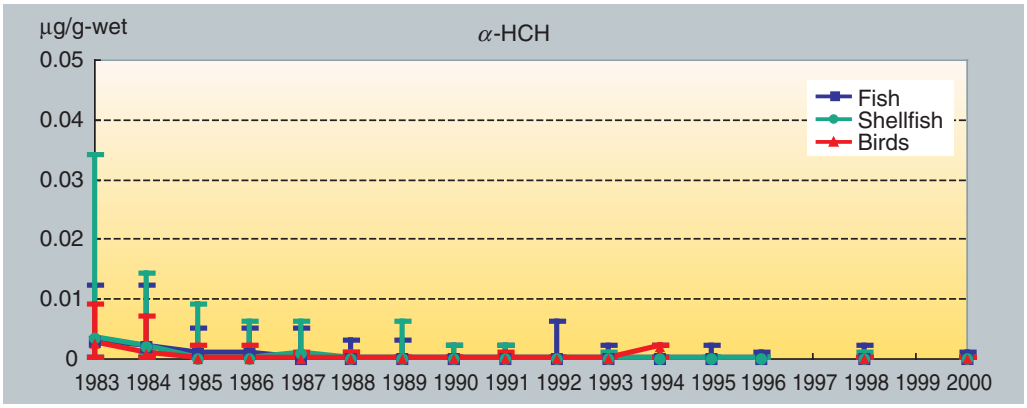


	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
S				2/17	1/19	2/22	2/17	4/18	2/18	2/18	1/19	1/17	3/18	5/18	3/17	1/18	1/18	2/17

Detection Limit: 1 ng/g-dry

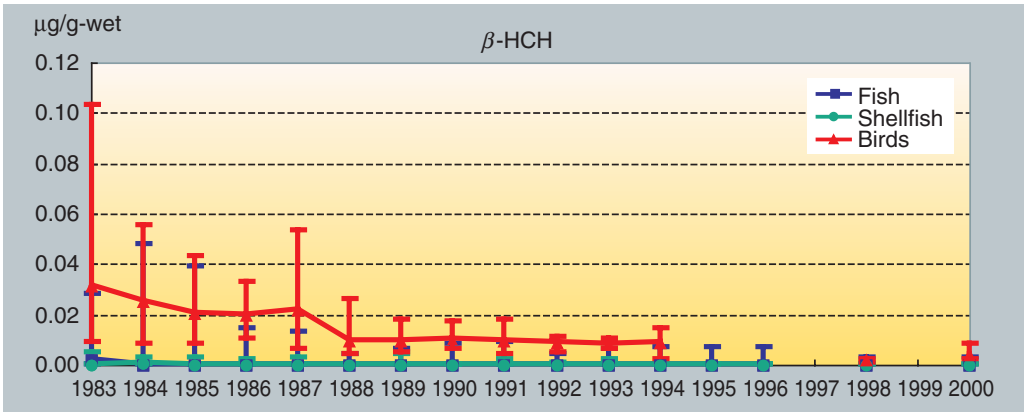
Figure 3-6 Detection Frequency and Range of α- and β-HCH (continued)

(B) Wildlife



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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
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
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

Detection Limit: 0.001 µg/g-wet

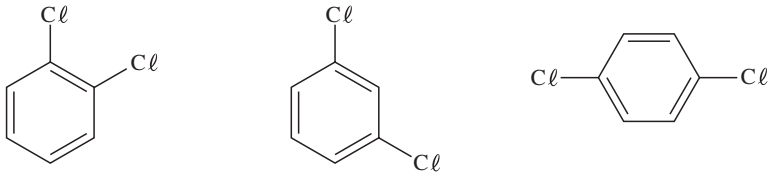


	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
F	33/ 50	29/ 60	25/ 60	20/ 55	19/ 65	15/ 65	17/ 65	20/ 70	13/ 70	25/ 70	11/ 70	14/ 70	10/ 70	12/ 70		10/ 70		7/ 69
SF	10/ 20	10/ 20	5/ 20	4/ 20	5/ 20	0/ 20	4/ 21	0/ 25	4/ 30	2/ 30	2/ 30	0/ 30	0/ 30	0/ 30		0/ 30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

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. The domestic production of dichlorobenzenes is 20,406 t (FY1999), 26,351 t (FY1998), 27,203 t (1997) and 22,870 t (1996).

Survey results

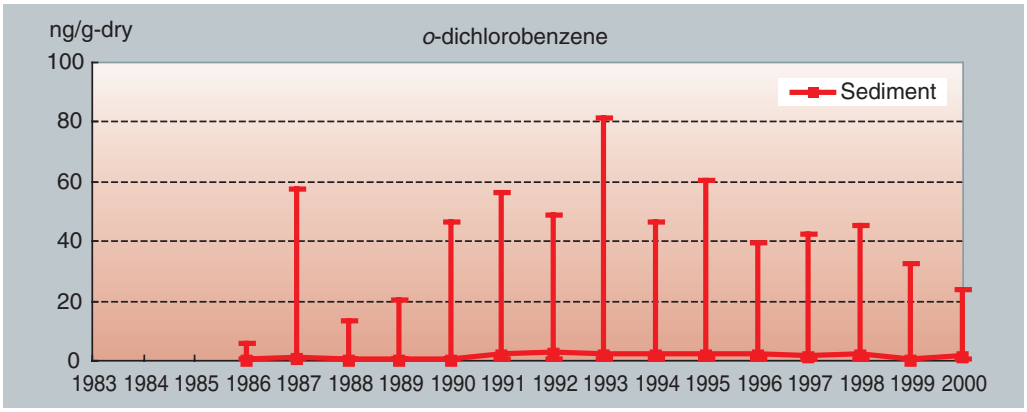
The detected range of values of *o*-dichlorobenzene, *m*-dichlorobenzene, and *p*-dichlorobenzene in FY2000 was 0.42 to 23 ng/g-dry, 0.28 to 5.8 ng/g-dry and 2.5 to 36 ng/g-dry, respectively. The detection frequencies were 53% (9 samples out of 17), 35% (6 samples out of 17) and 82% (14 samples out of 17), respectively.

○Survey Results of Dichlorobenzenes in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range (ng/g-dry)
		sample	
o-Dichlorobenzene	Bottom sediment	53% (9/17)	0.42 − 23
m-Dichlorobenzene		35% (6/17)	0.28 − 5.8
p-Dichlorobenzene		82% (14/17)	2.5 − 36

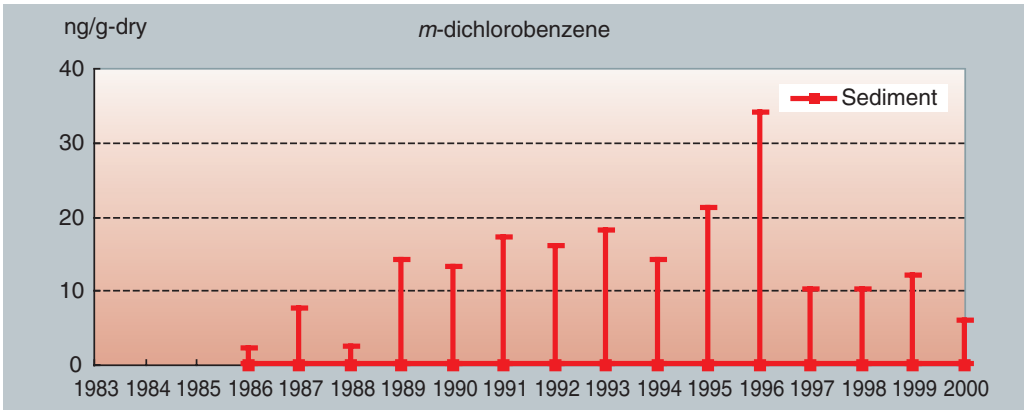
Figure 3-7 Detection Frequency and Range of *o*-, *m*- and *p*-Dichlorobenzene

Bottom sediment



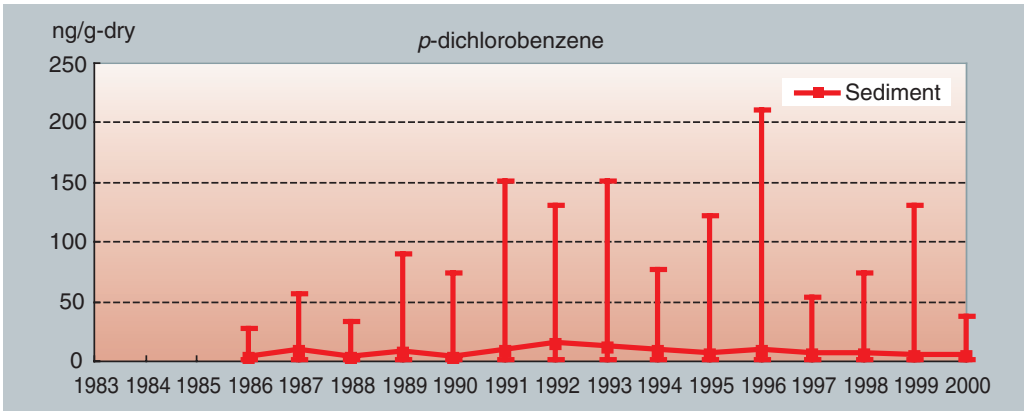
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
S				6/ 17	9/ 19	7/ 22	12/ 17	7/ 18	13/ 18	13/ 18	16/ 19	14/ 17	15/ 18	12/ 18	11/ 17	11/ 18	14/ 18	9/ 17

Detection Limit: 1 ng/g-dry



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

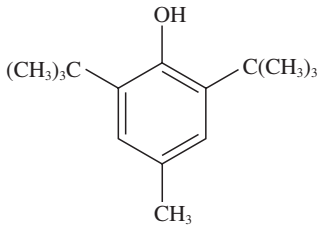
Detection Limit: 1 ng/g-dry



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

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>

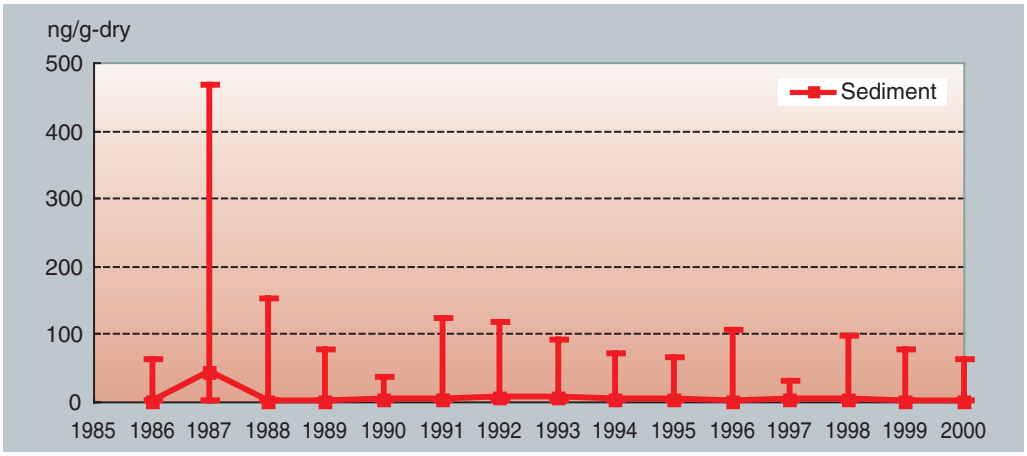
The range of detected values of BHT in the FY2000 survey was 1.2 to 60 ng/g-dry and the detection frequency was 41% (7 samples out of 17).

○Survey Results of BHT in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range
		sample	(ng/g-dry)
BHT	Bottom sediment	41% (7/17)	1.2 – 60

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

Bottom sediment

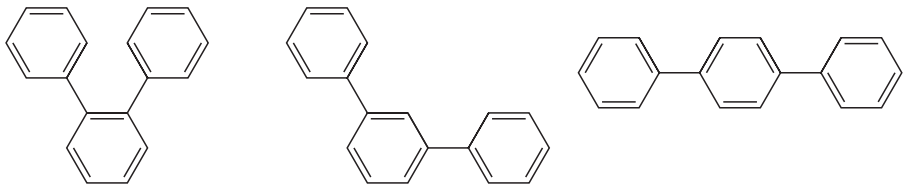


	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
S		5/17	4/4	9/22	5/16	9/18	10/18	12/18	14/19	9/16	12/18	11/51	12/17	14/18	7/18	7/17

Detection Limit: 1 - 90 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>

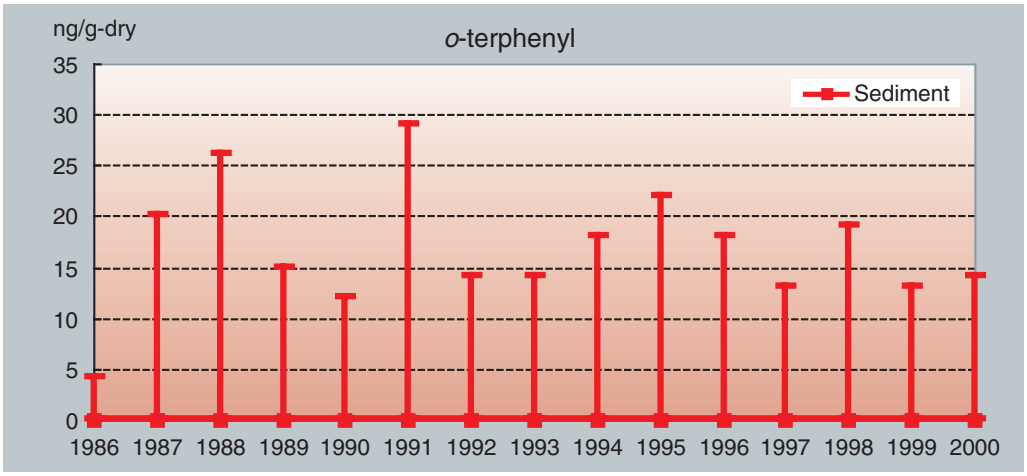
The range of detected values of *o*-terphenyl, *m*-terphenyl and *p*-terphenyl in the FY2000 survey was 0.28 to 14 ng/g-dry, 1.1 to 160 ng/g-dry and 0.54 to 82 ng/g-dry, respectively. The detection frequencies were 29% (5 samples out of 17), 65% (11 samples out of 17) and 59% (10 samples out of 17), respectively.

○Survey Results of Terphenyls in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range (ng/g-dry)
		sample	
o-Terphenyl	Bottom sediment	29% (5/17)	0.28 – 14
m-Terphenyl		65% (11/17)	1.1 – 160
p-Terphenyl		59% (10/17)	0.54 – 82

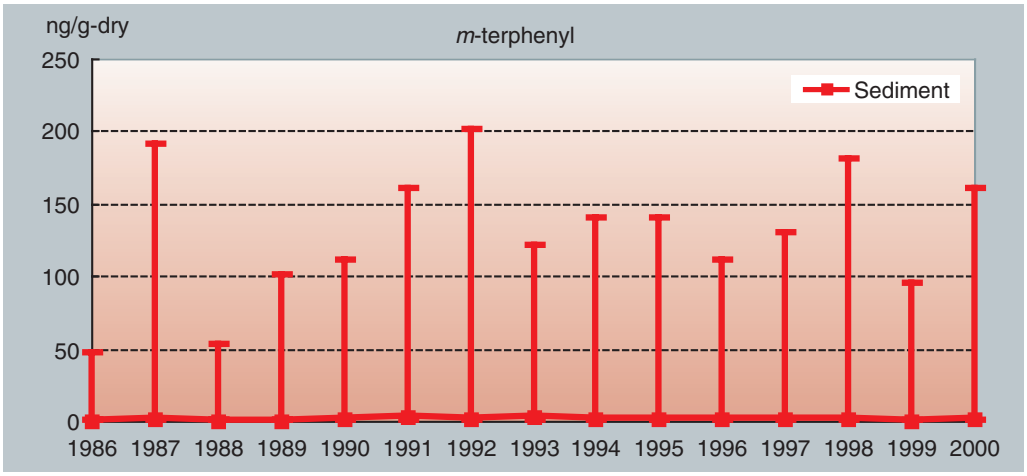
Figure 3-9 Detection Frequency and Range of *o*-,*m*- and *p*-Terphenyl

Bottom sediment



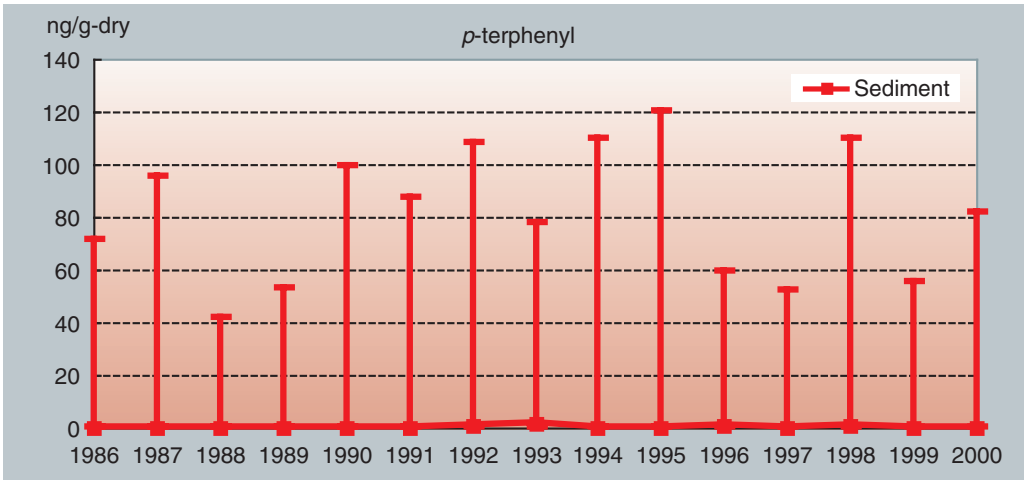
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
S	3/17	4/19	1/22	4/17	6/18	4/18	6/18	8/19	4/17	4/18	1/18	4/17	3/18	3/18	5/17

Detection Limit: 1 ng/g-dry



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

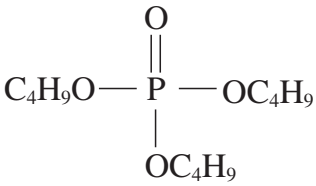
Detection Limit: 1 ng/g-dry



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

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>

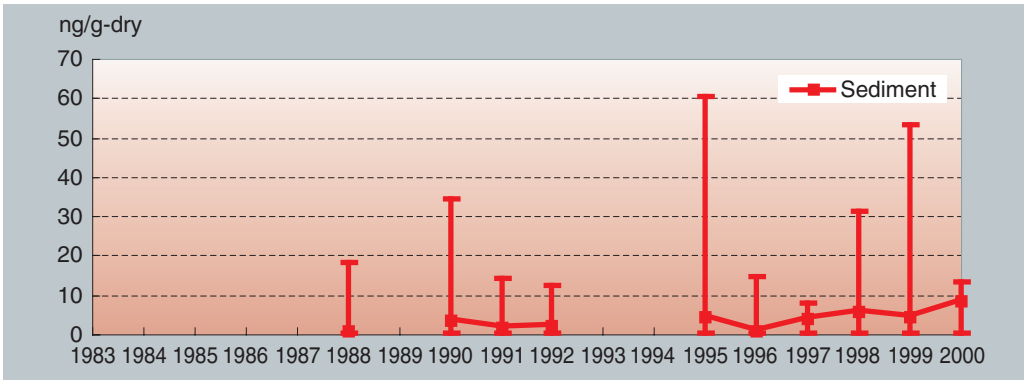
The range of detected values in the FY2000 survey was 0.61 to 13 ng/g-dry and the detection frequency was 53% (9 samples out of 17).

○Survey Results of TBP in Bottom sediment (FY2000)

Substance	Media	Detection frequency	Range
		sample	(ng/g-dry)
TBP	Bottom sediment	53% (9/17)	0.61 – 13

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

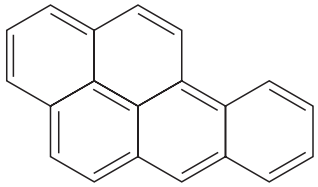
Bottom sediment



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
S						10/ 22		7/ 10	9/ 15	8/ 14			10/ 14	9/ 18	8/ 12	10/ 16	11/ 14	8/ 10

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>

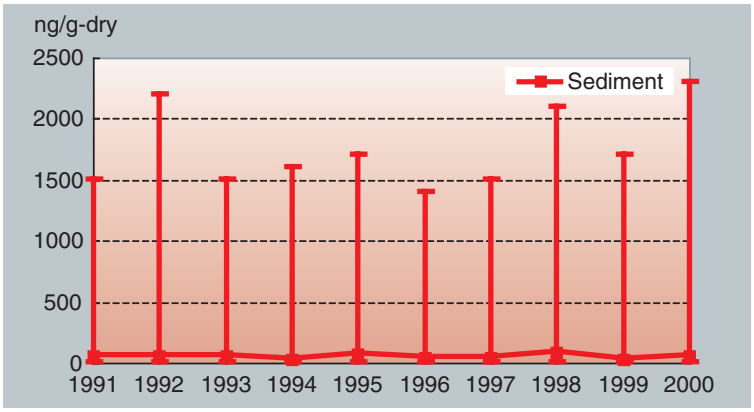
The range of detected values in the FY2000 survey was 2.4 to 2,300 ng/g-dry and the detection frequency was 71% (12 samples out of 17).

○Survey Results of Benzo[*a*]pyrene in Bottom sediment (FY2000)

Substance	Media	Detection frequency sample	Range (ng/g-dry)
Benzo[*a*]pyrene	Bottom sediment	71% (12/17)	2.4 – 2300

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

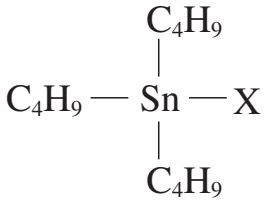
Bottom sediment



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

Detection Limit: 1 - 5 ng/g-dry

[12] Tributyltin compounds (TBT)



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 compounds (TBT) and since FY1989 for triphenyltin compounds (TPT). 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.

TBTs persist widely in the environment and their pollution levels remain largely 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 TBTs is expected to improve further, considering that the production and use of them for open systems has been substantially terminated in Japan.

Although the present pollution level does not seem to be at a harmful level, it is necessary to continue to promote measures against environmental pollution and to monitor the status of environmental pollution. Furthermore, since the substances are pointed out to be those suspected of having endocrine disrupting effects, it is also necessary to endeavor to collect toxicological and other related information.

Survey results

TBTs were detected in surface water, bottom sediment and fish. The range of detected values of TBTs* in surface water was 0.003 to 0.005 μg/ℓ, the detection frequency was 9% (9 samples out of 102), and that in terms of area was 18% (6 areas out of 34). The range of detected values of TBTs* in bottom sediment was 0.9 to 240 ng/g-dry, the detection frequency was 82% (81 samples out of 99), and that in terms of area was 88% (29 areas out of 33). The range of detected values of TBTs in fish was 0.05 to 0.16 μg/g-wet, the detection frequency was 14% (10 samples out of 70), and that in terms of area was 21% (3 areas out of 14).

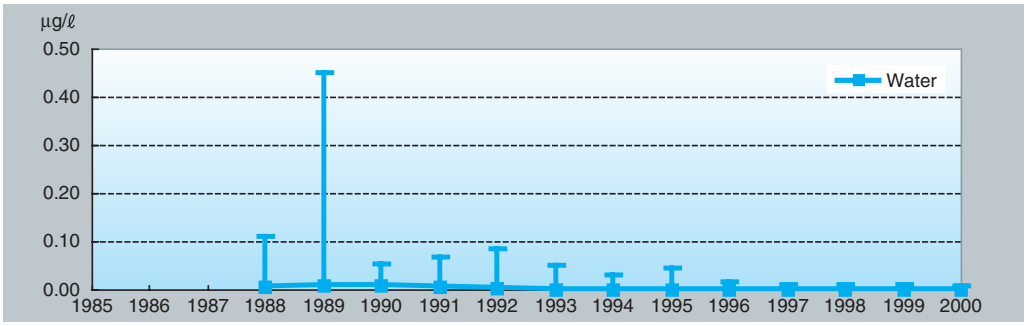
* Values are the equivalent value to TBTO (bis-tributyltin oxide).

○Survey Results of TBT in the Aquatic system and Wildlife (FY2000)

Substance	Media	Detection frequency		Range	Detection limit
		sample	area		
TBT	Surface water	9% (9/102)	18% (6/34)	0.003 – 0.005 μg/ℓ	0.003 μg/ℓ
	Bottom sediment	82% (81/99)	88% (29/33)	0.9 – 240 ng/g-dry	0.8 ng/g-dry
	Fish	14% (10/70)	21% (3/14)	0.05 – 0.16 μg/g-wet	0.05 μg/g-wet
	Shellfish	0% (0/30)	0% (0/6)	ND	0.05 μg/g-wet
	Birds	0% (0/10)	0% (0/2)	ND	0.05 μg/g-wet

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

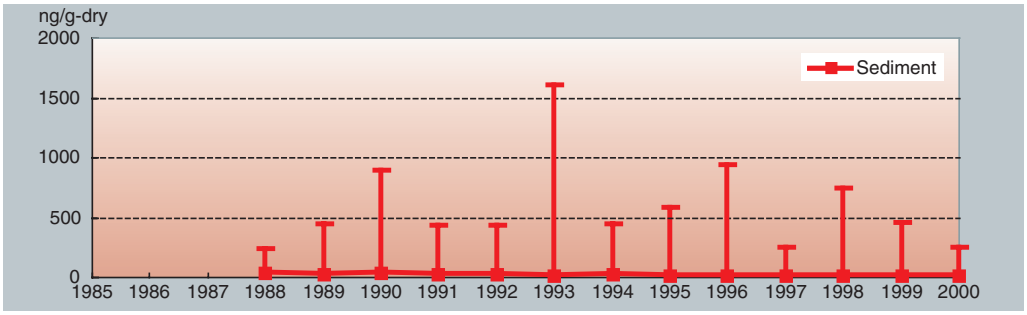
(A) Surface Water



	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

Detection Limit: 0.003 - 0.1 μg/ℓ

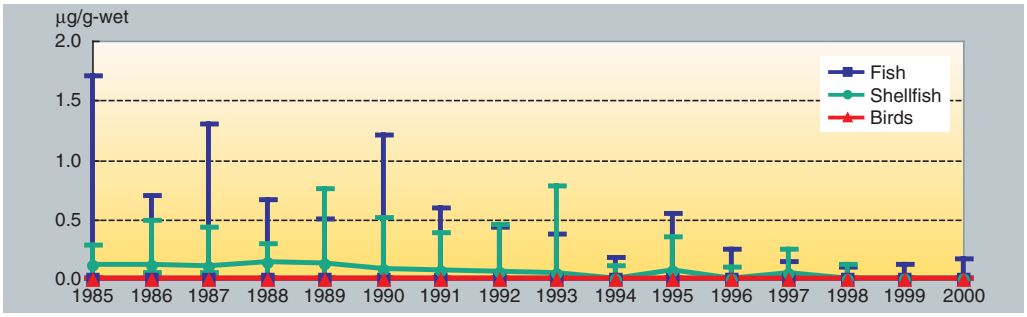
(B) Bottom sediment



	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

Detection Limit: 0.1 - 1 ng/g-dry

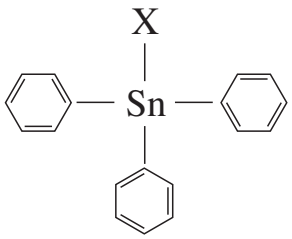
(C) Wildlife



	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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
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
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

Detection Limit: Fish(0.05 - 3 μg/g-wet), Shellfish(0.05 μg/g-wet), Birds(0.05 μg/g-wet)

[13] Triphenyltin compounds (TPT)



X: anion

Triphenyltin compounds (TPT) persist widely in the environment and their pollution levels remain largely 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 bottom sediment and wildlife (fish/shellfish). The range of detected values of TPTs* in bottom sediment was 1 to 70 ng/g-dry, the detection frequency was 54% (52 samples out of 96), and that in terms of area was 62% (20 areas out of 32). The range of detected values of TPTs* in fish was 0.03 to 0.10 μg/g-wet, the detection frequency was 19% (13 samples out of 70), and that in terms of area was 29% (4 areas out of 14). The detected value of TPTs in shellfish was 0.02 μg/g-wet, the detection frequency was 3% (1 sample out of 30), and that in terms of area was 17% (1 area out of 6).

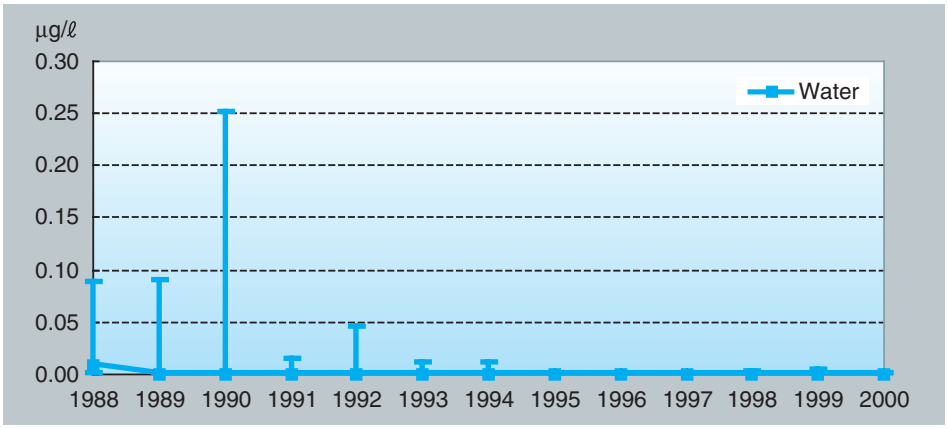
* Values are the equivalent value to TPTCl (triphenyltin chloride).

○Survey Results of TPT in the Aquatic system and Wildlife (FY2000)

Substance	Media	Detection frequency		Range	Detection limit
		sample	area		
TPT	Surface water	0% (0/102)	0% (0/34)	ND	0.001 μg/ℓ
	Bottom sediment	54% (52/96)	62% (20/32)	1 – 70 ng/g-dry	1 ng/g-dry
	Fish	19% (13/70)	29% (4/14)	0.03 – 0.10 μg/g-wet	0.02 μg/g-wet
	Shellfish	3% (1/30)	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

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

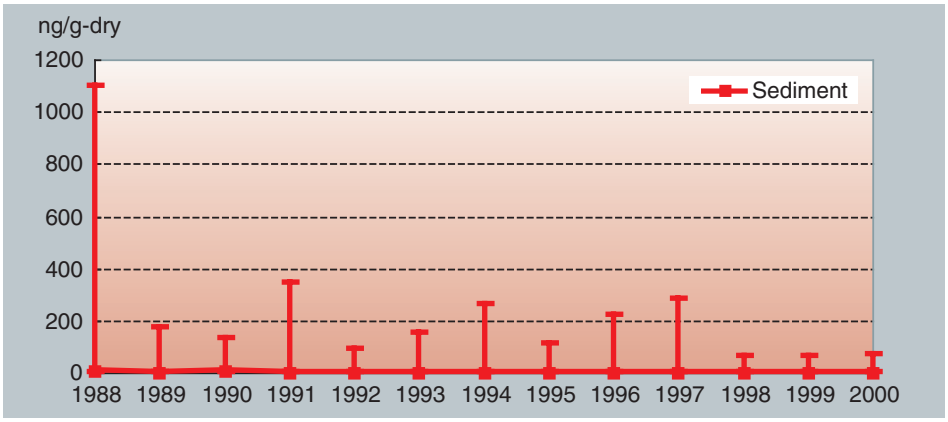
(A) Surface Water



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

Detection Limit: 0.001 - 0.01µg/ℓ

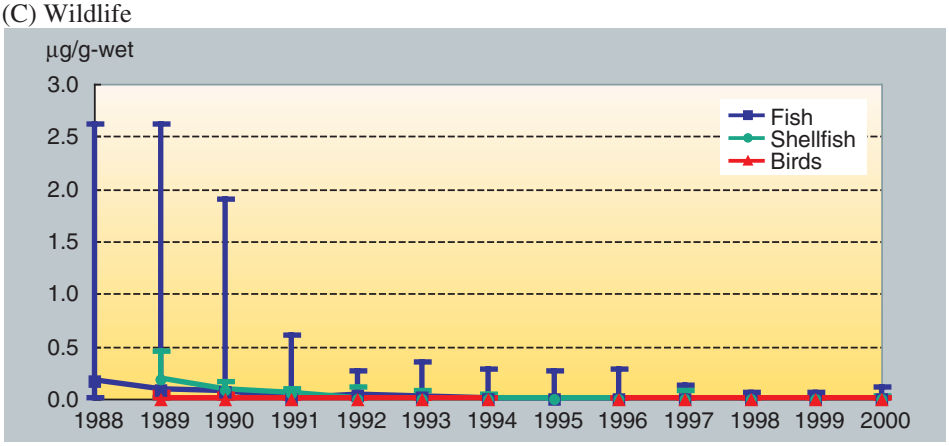
(B) Bottom sediment



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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

Detection Limit: 0.3 - 1 ng/g-dry

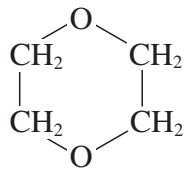
(C) Wildlife



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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
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
B		5/ 10	5/ 10	0/ 10	0/ 10	0/ 10	0/ 5		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 0.08 to 160 μg/ℓ in FY2000 and the geometric mean was 0.19 μg/ℓ. The detection frequency was 61% (60 samples out of 98) and that in terms of area was 67% (22 areas out of 33).

The detected value in bottom sediment was 10 ng/g-dry, and the geometric mean was 3.5 ng/g-dry. The detection frequency was 1% (1 sample out of 93) and that in terms of area was 3% (1 area out of 30).

Compared with past survey results for surface water and bottom sediment, there was no apparent difference in the pollution status.

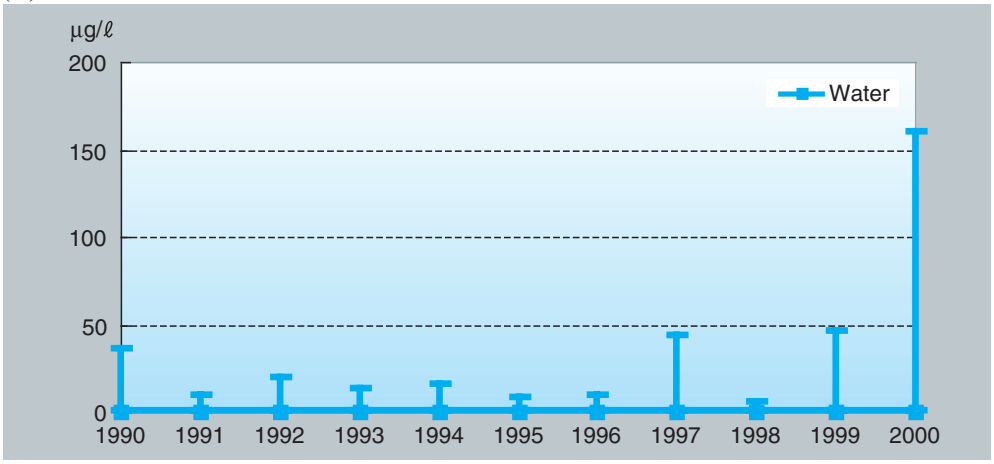
However, since 1,4-dioxane persists widely in the environment, it is necessary to continue surveys in order to monitor the status of pollution in the environment.

○Survey Results of 1,4-Dioxane in the Aquatic System (FY2000)

Substance	Media	Detection frequency		Geometric mean	Range	Detection limit
		sample	area			
1,4-Dioxane	Surface water	61% (60/98)	67% (22/33)	0.19 μg/ℓ	0.08 − 160 μg/ℓ	0.08 μg/ℓ
	Bottom sediment	1% (1/93)	3% (1/30)	3.5 ng/g-dry	10 ng/g-dry	8 ng/g-dry

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

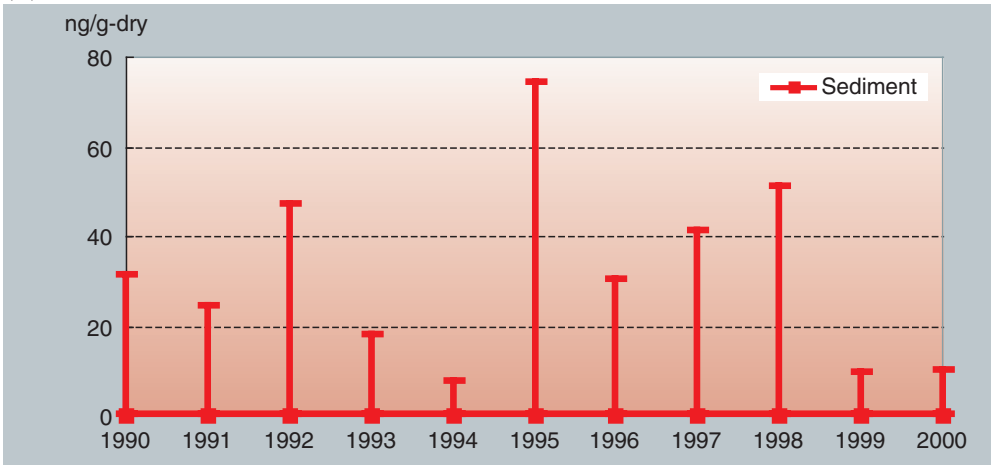
(A) Surface water



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

Detection Limit: 0.08 - 0.1 µg/ℓ

(B) Bottom sediment

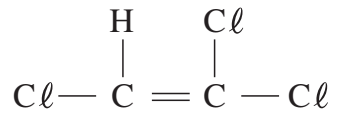


	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
S	29/ 94	12/ 96	6/ 102	15/ 93	13/ 90	9/ 102	5/ 108	3/ 105	5/ 108	1/ 99	1/ 93

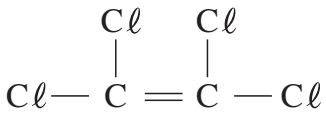
Detection Limit: 5 - 10 ng/g-dry

[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 FY2000, the Survey of the Persistence in the Environment (Table 3-3, contained on the CD-ROM) and the Study of the Exposure Route (Table 3-4, contained on the CD-ROM) were conducted.

The range of detected values in air was 0.05 to 3.8 μg/m^3, the detection frequency was 83% (38 samples out of 41), the geometric mean was 0.21 μg/m^3, and the exposure range was nd to 53 μg/person.day. The range of detected values in indoor air was 0.04 to 11 μg/m^3, the detection frequency was 94% (68 samples out of 72), the geometric mean was 0.34 μg/m^3, and the exposure range was 1.2 to 98 μg/person.day.

Although TCE was detected in many points in the FY2000 survey, the detection frequency has decreased compared with past survey results.

(PERC)

The range of detected values in air was 0.04 to 1.7 μg/m^3, the detection frequency was 100% (41 samples out of 41), the geometric mean was 0.34 μg/m^3, and the exposure range via air was 1.8 to 23 μg/person.day. The range of detected values in indoor air was 0.06 to 23 μg/m^3, the detection frequency was 100% (72 samples out of 72), the geometric mean was 0.49 μg/m^3, and the exposure range via indoor air was 2.2 to 110 μg/person.day.

Although PERC was detected in all areas, detected concentrations show a decreasing tendency.

Since TCE and PERC persist widely in the environment, it is necessary to continue surveys in order to monitor the status of pollution in the environment.

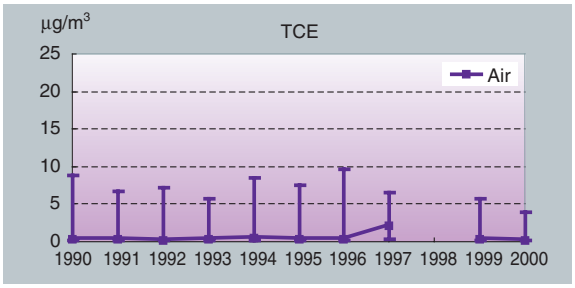
○Survey Results of TCE and PERC (FY2000)

Substance	Media	Detection frequency sample	Geometric mean (μg/m³)	Range of detected value (μg/m³)	Exposure range (μg/person.day)	Detection limit (μg/m³)
TCE	Air	83% (38/41)	0.21	0.05 – 3.8	ND – 53	0.02
	Indoor air	94% (68/72)	0.34	0.04 – 11	1.2 – 98	0.02
PERC	Air	100% (41/41)	0.34	0.04 – 1.7	1.8 – 23	0.01
	Indoor air	100% (72/72)	0.49	0.06 – 23	2.2 – 110	0.01

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 15m³ per day.

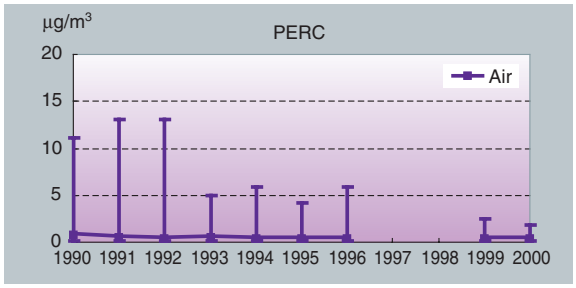
Figure 3-15 Detection Frequency and Range of Trichloroethylene (TCE) and Tetrachloroethylene (PERC)

(A) Air



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
A	109/ 128	109/ 126	118/ 138	98/ 110	88/ 110	91/ 108	108/ 126	10/ 10		37/ 38	38/ 41

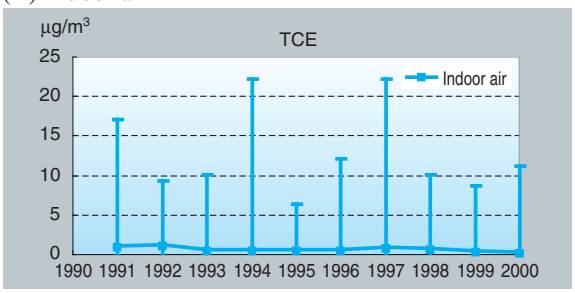
Detection Limit: 0.020 - 0.062 μg/m³



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

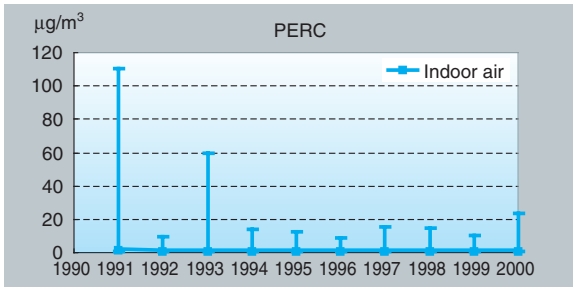
Detection Limit: 0.007 - 0.060 μg/m³

(B) Indoor air



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

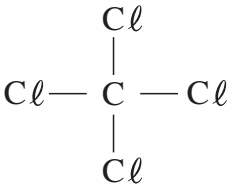
Detection Limit: 0.020 - 0.17 μg/m³



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

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 1.2 μg/m^3, and the geometric mean was 0.64 μg/m^3. The detection frequency was 100% (117 samples out of 117), and the exposure range via air was 2.9 to 12 μg/person.day. In the Study of the Exposure Route, the range of detected values in indoor air was 0.15 to 1.1 μg/m^3, the geometric mean was 0.58 μg/m^3, the detection frequency was 100% (72 samples out of 72), and the exposure range via indoor air was 4.2 to 12 μg/person.day.

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

○Survey Results of Carbon tetrachloride (FY2000)

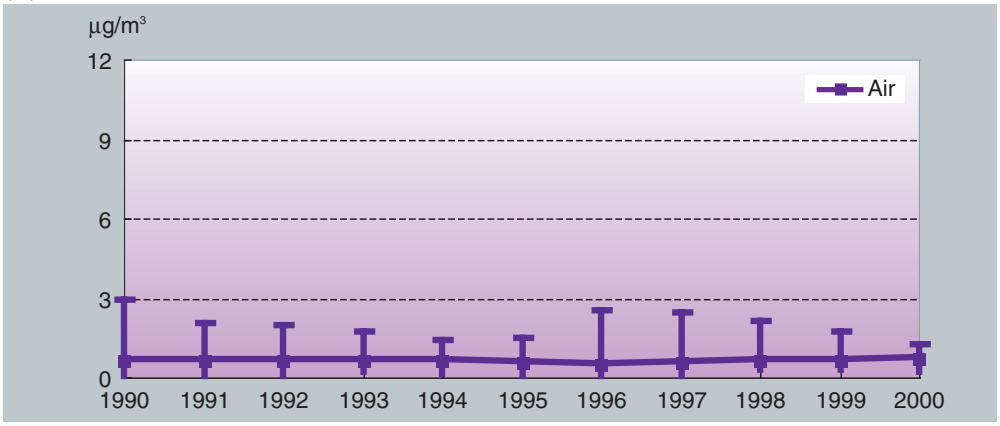
Substance	Media	Detection frequency	Geometric mean (μg/m^3)	Range of detected value (μg/m^3)	Exposure range (μg/person.day)	Detection limit (μg/m^3)
		sample				
Carbon tetrachloride	Air	100% (117/117)	0.64	0.13 – 1.2	2.9 – 12	0.01
	Indoor air	100% (72/72)	0.58	0.15 – 1.1	4.2 – 12	0.03

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.

Since carbon tetrachloride persists widely with a comparatively high concentration level in the environment, it is necessary to continue surveys to carefully monitor the status of environmental pollution. However, for the Study of the Exposure Route (diet), which has showed continued low-level exposure, it is possible to grasp the tendency through studies conducted at certain intervals (3 to 5 years).

Figure 3-16 Detection Frequency and Range of Carbon tetrachloride

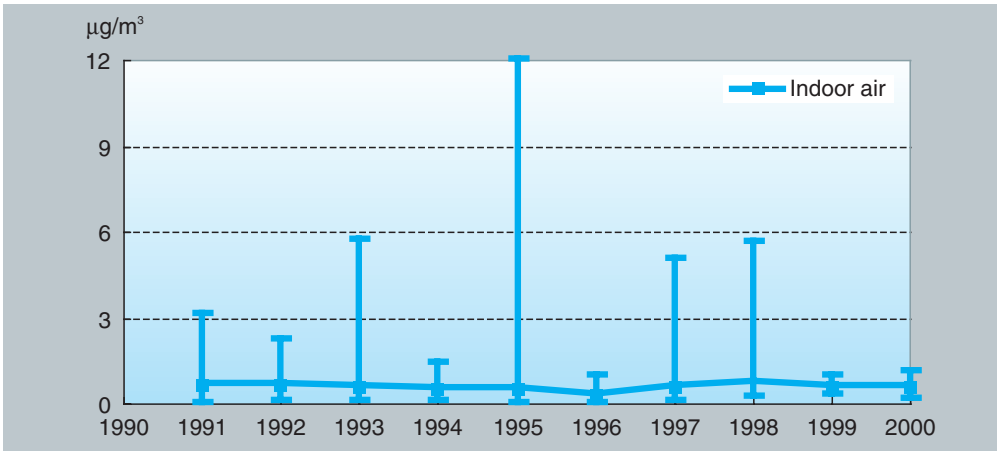
(A) Air



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

Detection Limit: 0.001 - 0.025 µg/m³

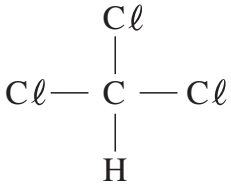
(B) Indoor air



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

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 0.07 to 17 μg/m^3, and the geometric mean was 0.31 μg/m^3. The detection frequency was 100% (116 samples out of 116), and the exposure range via air was 2.6 to 130 μg/person.day. In the Study of the Exposure Route, the range of detected values in indoor air was 0.20 to 23 μg/m^3, and the geometric mean was 0.85 μg/m^3. The detection frequency was 99% (71 samples out of 72), and the exposure range via indoor air was 6.0 to 130 μg/person.day. The range of detected values in diet was 1.6 to 52 ng/g-fresh weight and the geometric mean was 3.5 ng/g-fresh weight. The detection frequency was 80% (58 samples out of 72) and the exposure range via diet was tr to 28 μg/person.day.

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

○Survey Results of Chloroform (FY2000)

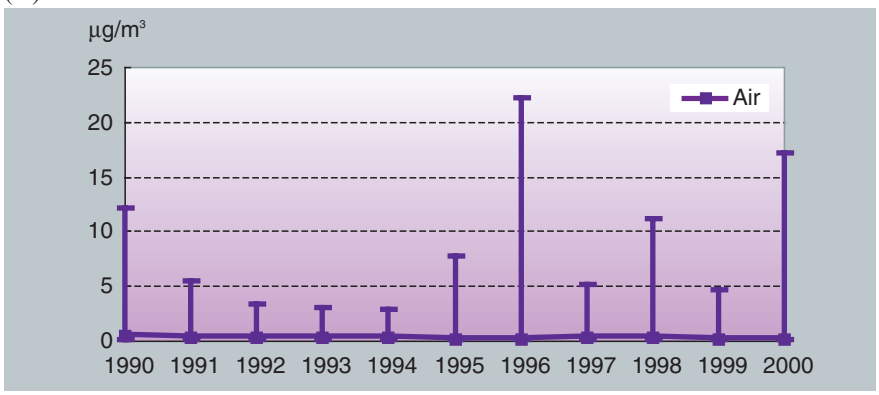
Substance	Media	Detection frequency	Geometric mean (μg/m^3)	Range of detected value (μg/m^3)	Exposure range (μg/person.day)	Detection limit (μg/m^3)
		sample				
Chloroform	Air	100% (116/116)	0.31	0.07 − 17	2.6 − 130	0.02
	Indoor air	99% (71/72)	0.85	0.20 − 23	6.0 − 130	0.17
	Diet	80% (58/72)	3.5	1.6 − 52	tr − 28	1.5

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.
"tr" means that the geometric mean of detected value is below the detection limit.

Since chloroform persists widely with a comparatively high concentration level in the environment, it is necessary to continue surveys to monitor the status of pollution in the environment.

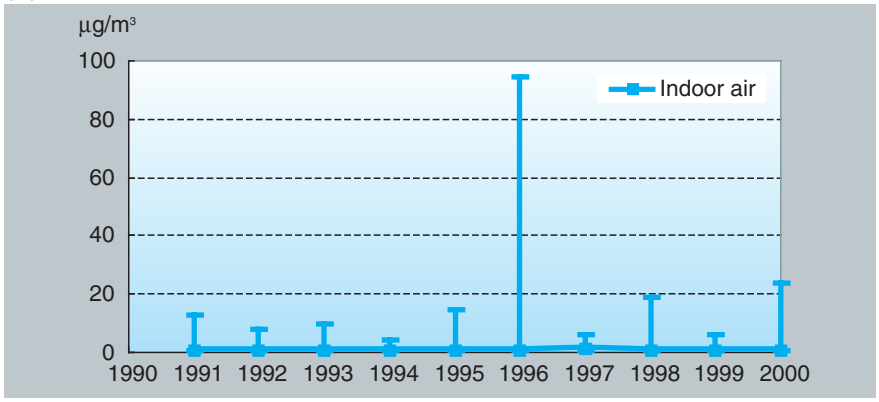
Figure 3-17 Detection Frequency and Range of Chloroform

(A) Air



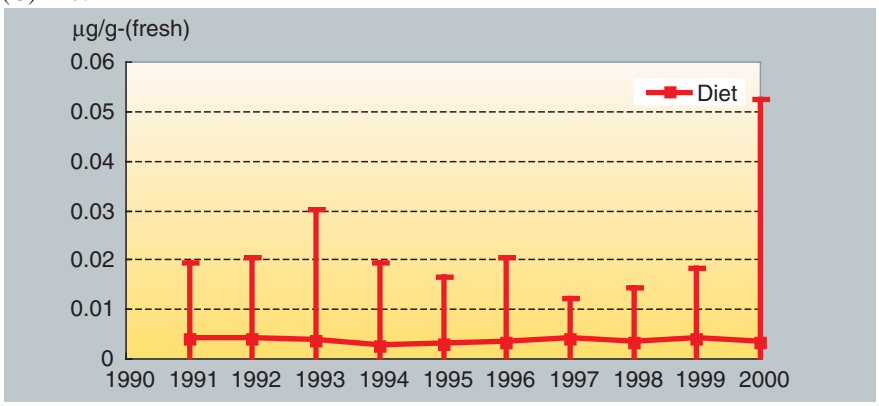
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
A	128/ 128	136/ 136	124/ 148	107/ 108	104/ 113	98/ 113	118/ 130	122/ 134	126/ 126	121/ 121	116/ 116

(B) Indoor air



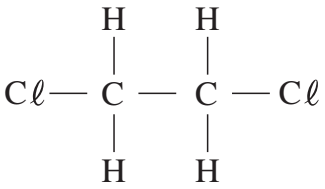
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
I		79/ 81	78/ 81	81/ 81	75/ 81	80/ 81	72/ 84	79/ 79	81/ 81	72/ 72	71/ 72

(C) Diet



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

[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 levels 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 0.0081 to 0.38 μg/m^3, the geometric mean was 0.076 μg/m^3, and the detection frequency was 100% (84 samples), and the exposure range via air was 0.37 to 4.4 μg/person.day.

The range of detected values in indoor air was 0.020 to 1.1 μg/m^3, the geometric mean was 0.089 μg/m^3, the detection frequency was 100% (70 samples), and the exposure range via indoor air was 0.12 to 6.8 μg/person.day.

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

○Survey Results of 1,2-DCE (FY2000)

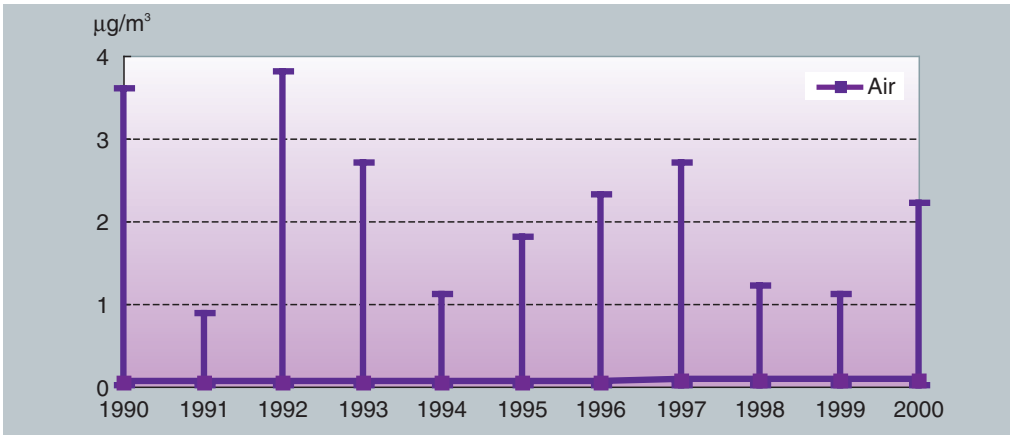
Substance	Media	Detection frequency (sample)	Geometric mean (μg/m^3)	Range of detected value (μg/m^3)	Exposure range (μg/person.day)	Detection limit (μg/m^3)
1,2-DCE	Air	100% (84/84)	0.076	0.0081 – 0.38	0.37 – 4.4	0.0012
	Indoor air	100% (70/70)	0.089	0.020 – 1.1	0.12 – 6.8	0.0013

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.

Since 1,2-DCE persists widely with a comparatively high concentration level in the environment, it is necessary to continue surveys to monitor the status of pollution in the environment.

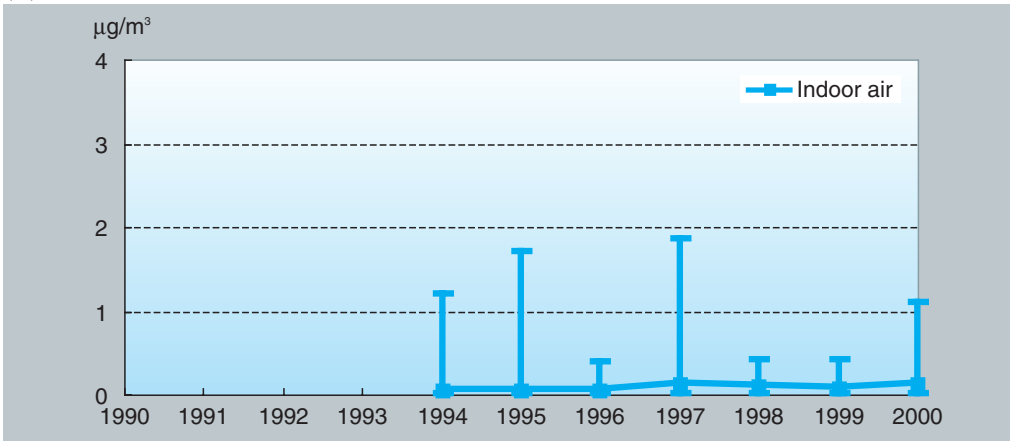
Figure 3-18 Detection Frequency and Range of 1,2-Dichloroethane (DCE)

(A) Air



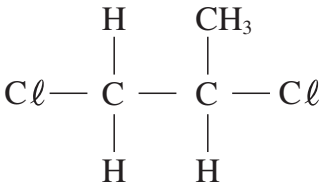
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
A	48/ 58	52/ 60	55/ 62	72/ 80	73/ 80	66/ 79	80/ 92	96/ 97	102/ 102	101/ 101	96/ 96

(B) Indoor air



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

[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 levels 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 0.0012 to 0.56 μg/m^3, the geometric mean was 0.028 μg/m^3, the detection frequency was 96% (74 samples out of 77), and the exposure range via air was 0.018 to 4.4 μg/person.day.

The range of detected values in indoor air was 0.002 to 0.6 μg/m^3, the geometric mean was 0.042 μg/m^3, the detection frequency was 98% (66 samples out of 67), and the exposure range via indoor air was 0.058 to 4.7 μg/person.day.

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

○Survey Results of 1,2-DCP (FY2000)

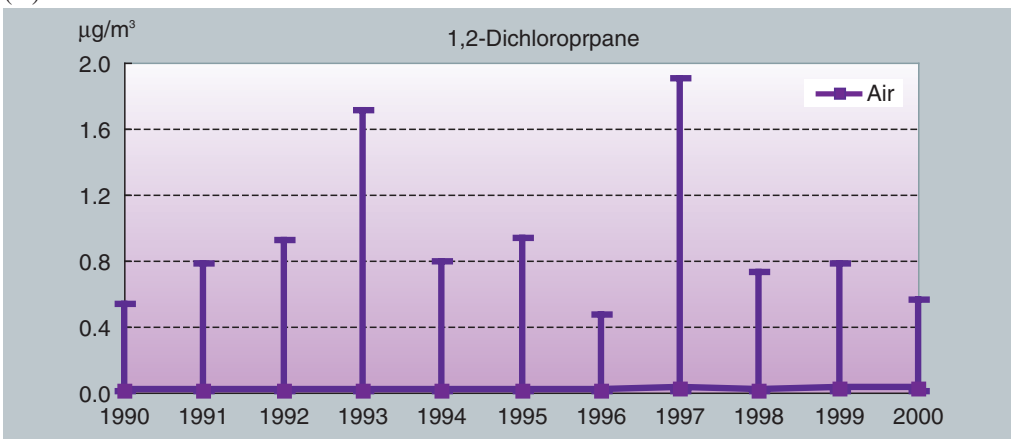
Substance	Media	Detection frequency / sample	Geometric mean (μg/m^3)	Range of detected value (μg/m^3)	Exposure range (μg/person.day)	Detection limit (μg/m^3)
1,2-DCP	Air	96% (74/77)	0.028	0.0012 − 0.56	0.018 − 4.4	0.0011
	Indoor air	98% (66/67)	0.042	0.002 − 0.6	0.058 − 4.7	0.0013

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.

Since 1,2-DCP persists widely with a comparatively high concentration level in the environment, it is necessary to continue surveys to monitor the status of pollution in the environment.

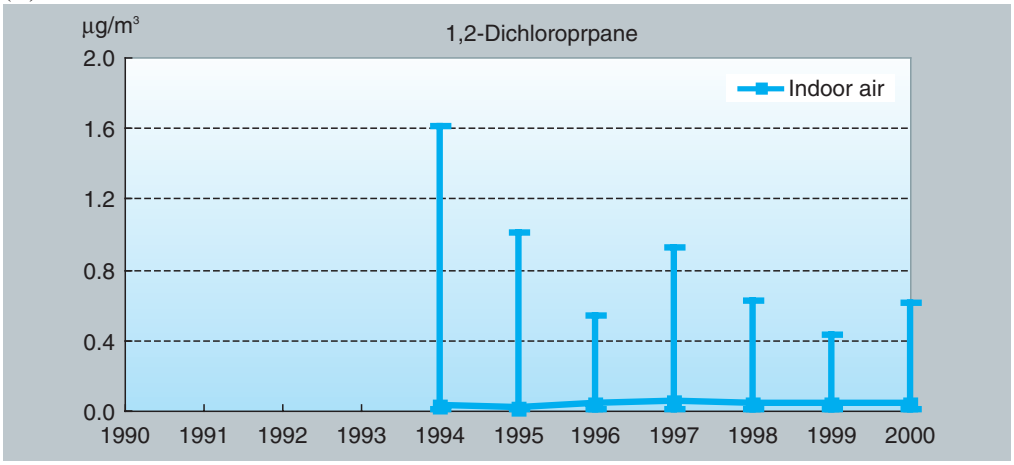
Figure 3-19 Detection Frequency and Range of 1,2-Dichloropropane (DCP)

(A) Air



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

(B) Indoor air



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

Figure 3-A Locations for Monitoring of Bottom Sediment (FY2000)

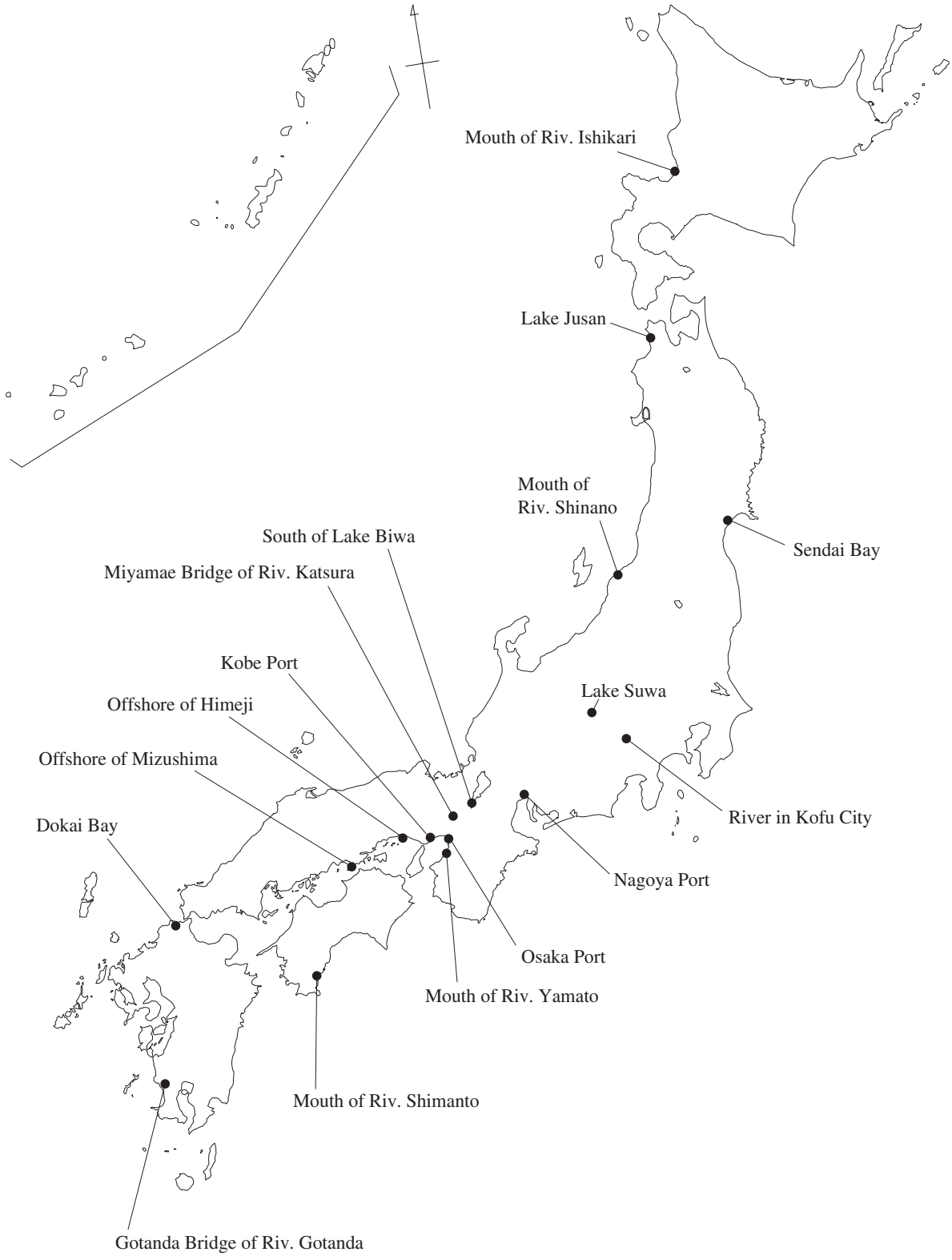


Figure 3-B Surveyed Areas and Species for Wildlife Monitoring (FY2000)

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

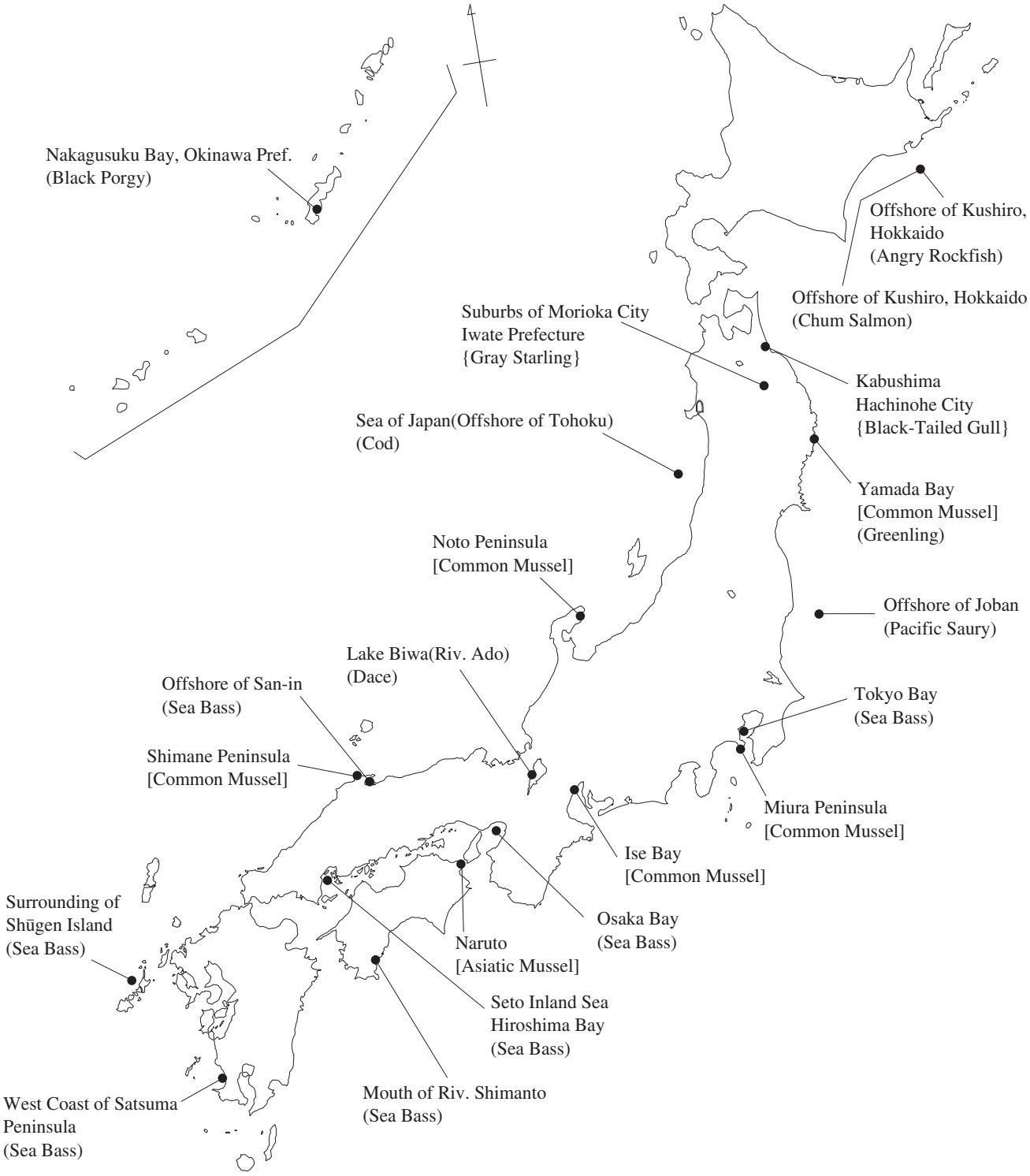


Figure 3-C Surveyed Areas for Persistence of Designated Chemical Substances (Surface Water/Bottom Sediment,FY2000)

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

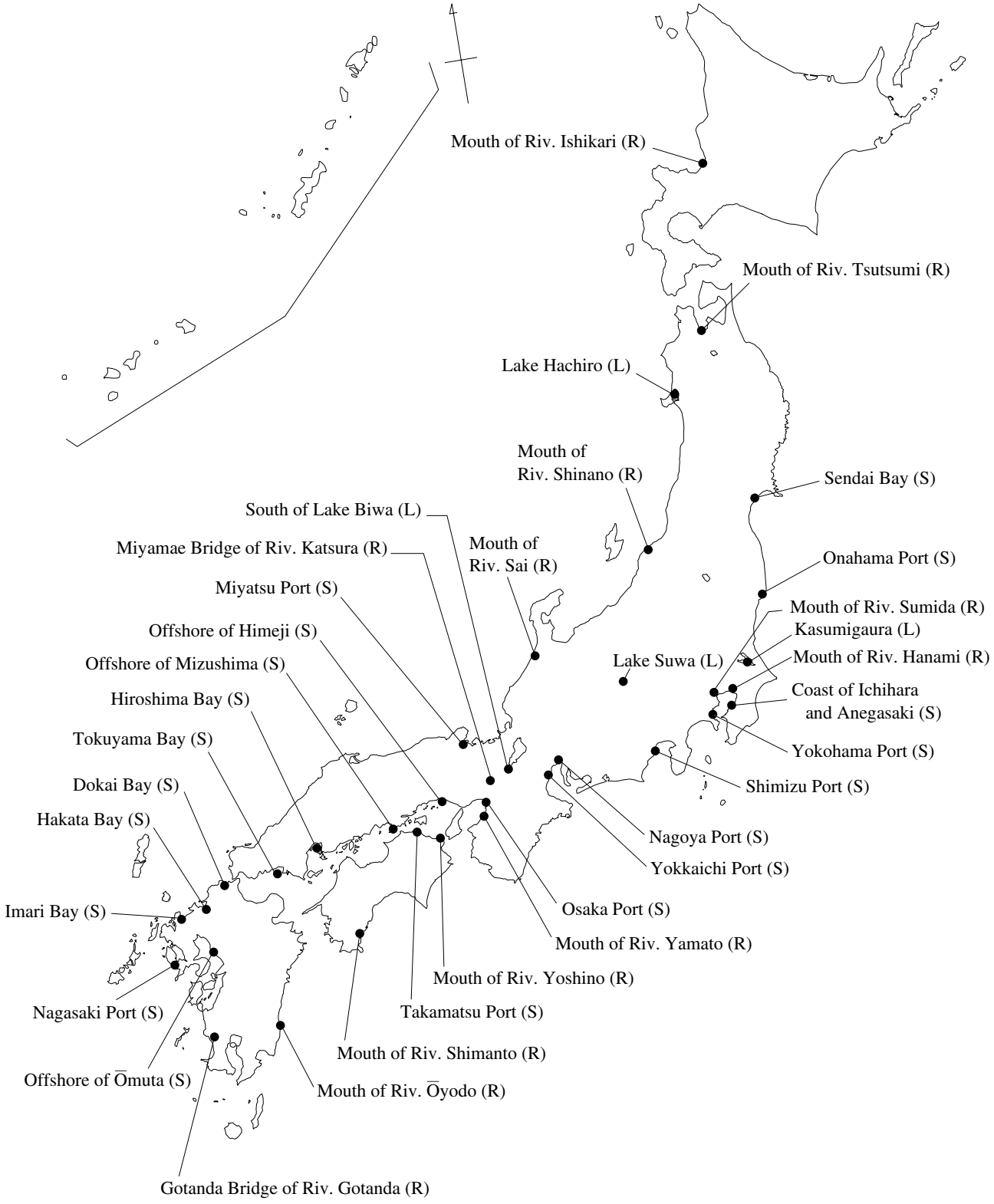


Figure 3-D Surveyed Areas for Air and Exposure Route of Designated Chemical Substances (FY2000)

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

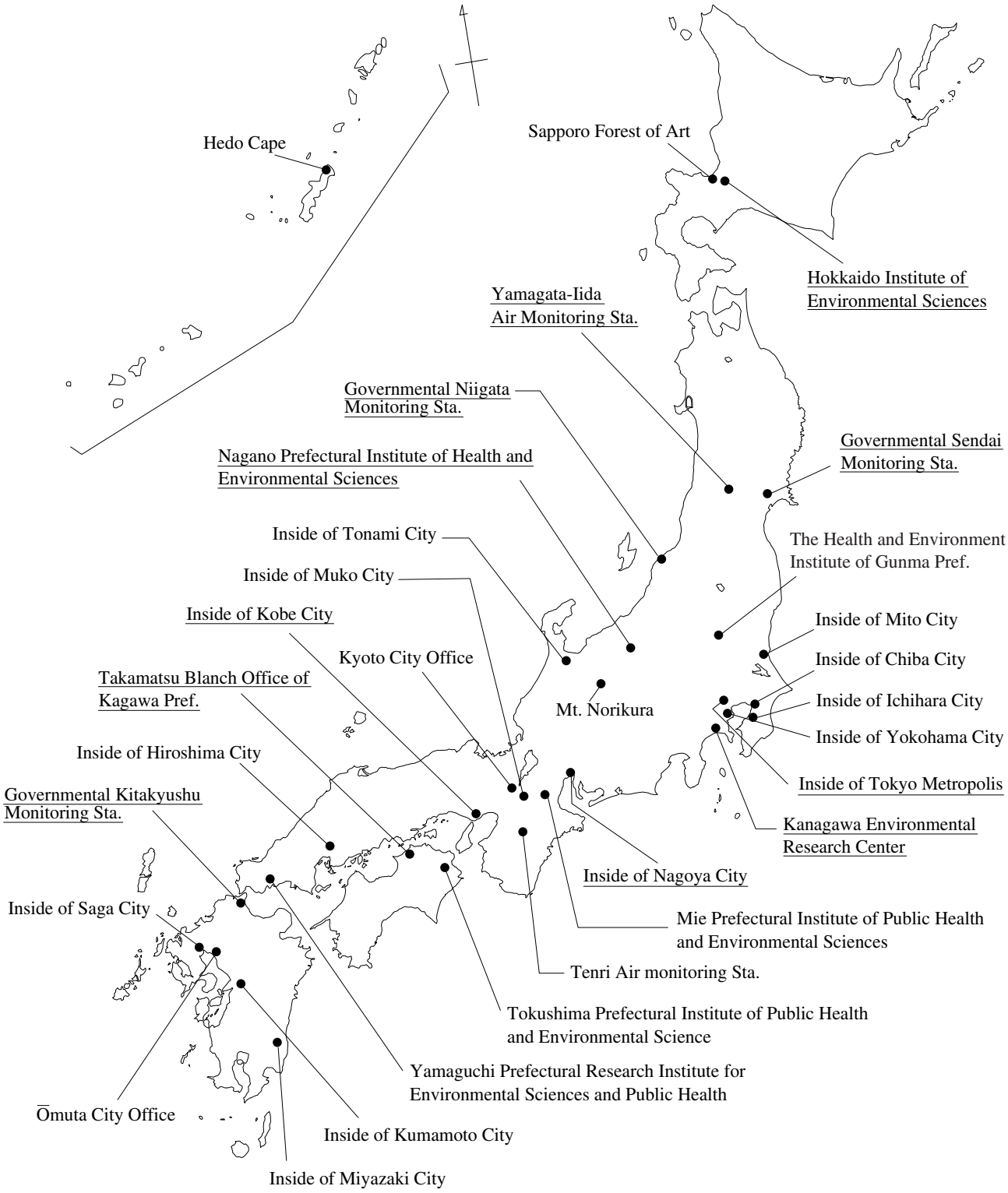


Table 3-1 Characteristics of Species Subject to Wildlife Monitoring

Species	Characteristics of species	Sampling areas	Object of investigation	Notes
Chum salmon *(Oncorhynchus keta)*	1. Distributed in Hokkaido, Kamchatka Peninsula, and North America, etc. 2. Hatches in fresh water, grows up in the north seas, returns to fresh water for spawning 3. Bioaccumulation of chemical substances is medium	Offshore of Kushiro in Hokkaido	To grasp the pollution level on a global level	
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	Yamada Bay in Iwate Prefecture	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	Pacific Ocean (offshore of Joban)	To grasp the pollution level around the Japanese archipelago	
Cod *(Gadus macrocephalus)*	1. Distributed in Shimane in the Japan Sea, and north of Aomori in the Pacific Ocean 2. Lives at a depth of about 150 m in the southern most areas	Sea of Japan (offshore of Tohoku)	To grasp the pollution level in specific areas	
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	Tokyo Bay, Osaka Bay, Seto Inland Sea, Offshore of San-in, Mouth of the River Shimanto, West Coast of Satsuma Peninsula, Surrounding of Shūgen Island	To grasp the pollution level in specific areas	7 areas with different levels of pollution were investigated

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

Species	Characteristics of species	Sampling areas	Object of investigation	Notes
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	
Common mussel *(Mytilus edulis galloprovincialis)*	1. Distributed world wide, excluding tropical zones 2. Sticks on the rocks of inner bays and bridge piers	Miura Peninsula in Kanagawa Prefecture, Yamada Bay in Iwate Prefecture, Noto Peninsula in Ishikawa Prefecture, Ise Bay (Nagoya Port), Coast of Shimane Peninsula	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)	Near Naruto Channels	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 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.

2. PCBs

(1) Surveyed substances

PCBs	Coplanar PCBs	IUPAC No.
Mono-CBs	3,3',4,4'-TetraCB	(#77)
Di-CBs	3,4,4',5-TetraCB	(#81)
Tri-CBs	2,3,3',4,4'-PentaCB	(#105)
Tetra-CBs	2,3,4,4',5-PentaCB	(#114)
Penta-CBs	2,3',4,4',5-PentaCB	(#118)
Hexa-CBs	2',3,4,4',5-PentaCB	(#123)
Hepta-CBs	3,3',4,4',5-PentaCB	(#126)
Octa-CBs	2,3,3',4,4',5-HexaCB	(#156)
Nona-CBs	2,3,3',4,4',5'-HexaCB	(#157)
Deca-CB	2,3',4,4',5,5'-HexaCB	(#167)
Total-PCBs	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: 36 areas (See Fig. 4-1)

- Surface water: 28 areas
- Bottom sediment: 36 areas
- Wildlife: 35 areas

Air: 17 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). There are also Table 4-3 (surface water), Table 4-4 (bottom sediment), Table 4-5 (fish) and Table 4-6 (air) on CD-ROM.

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 95 to 8,400 pg/ℓ in surface water, 42 to 750,000 pg/g-dry in bottom sediment, 3,800 to 350,000 pg/g-wet in wildlife, and 91 to 2,300 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 FY2000 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 such as the ratio of unintentional formation and behavior in the environment by investigating the composition of PCBs in the environment.

3. Brominated dioxins (PBDDs, PBDFs)

The purpose of the survey is to grasp the status of the persistence of brominated dioxins in the general environment.

Following is a summary of the results of the FY2000 survey.

(1) Surveyed substances

PBDD (5 species): 2,3,7,8-Tetra-BrDD; 1,2,3,7,8-Penta-BrDD; 1,2,3,4,7,8-Hexa-BrDD; 1,2,3,6,7,8-Hexa-BrDD; 1,2,3,7,8,9-Hexa-BrDD

PBDF (4 species): 2,3,7,8-Tetra-BrDF; 1,2,3,7,8-Penta-BrDF; 2,3,4,7,8-Penta-BrDF; 1,2,3,4,7,8-Hexa-BrDF

(2) Surveyed media

Bottom sediment

(3) Surveyed areas

Same as the area for PCB-bottom sediment (Fig. 4-1)

(4) Analytical method

High resolution (mass resolution: 10,000) SIM method using gas chromatography/mass spectrometer.

◯ Detection limit of PBDDs/PBDFs

	Minimum detection amount	Detection limit
		Bottom sediment (dry base)
Tetra brominated compounds	0.1 pg	0.5 pg/g
Penta brominated compounds	0.2 pg	1 pg/g
Hexa brominated compounds	1 pg	5 pg/g

(5) Survey results

Survey results are shown in Table 4-2.

2,3,7,8-Tetra-BrDD was detected offshore of Mizushima (Okayama prefecture) and 2,3,7,8-Tetra-BrDF was detected at the mouth of the Sumida River (Tokyo metropolis), offshore of Mizushima (Okayama prefecture), Kawasaki Port (Kawasaki city), Osaka Port (Osaka city) and Dokai Bay (Kitakyushu city).

(6) Evaluation of the survey results

In this survey, although brominated dioxins were detected in the bottom sediment of the general environment, the existing amounts are small compared with those of chlorinated dioxins. However, as the related information on brominated dioxins is limited, efforts must be made to improve the sensitivity of analysis and to grasp the status of their persistence, as well as to collect and analyze information on the toxicity and exposure of brominated dioxins.

Figure 4-1 Locations of the Follow-up Survey of the Status of Pollution by Unintentionally Formed Chemical Substances (Aquatic System, FY2000)

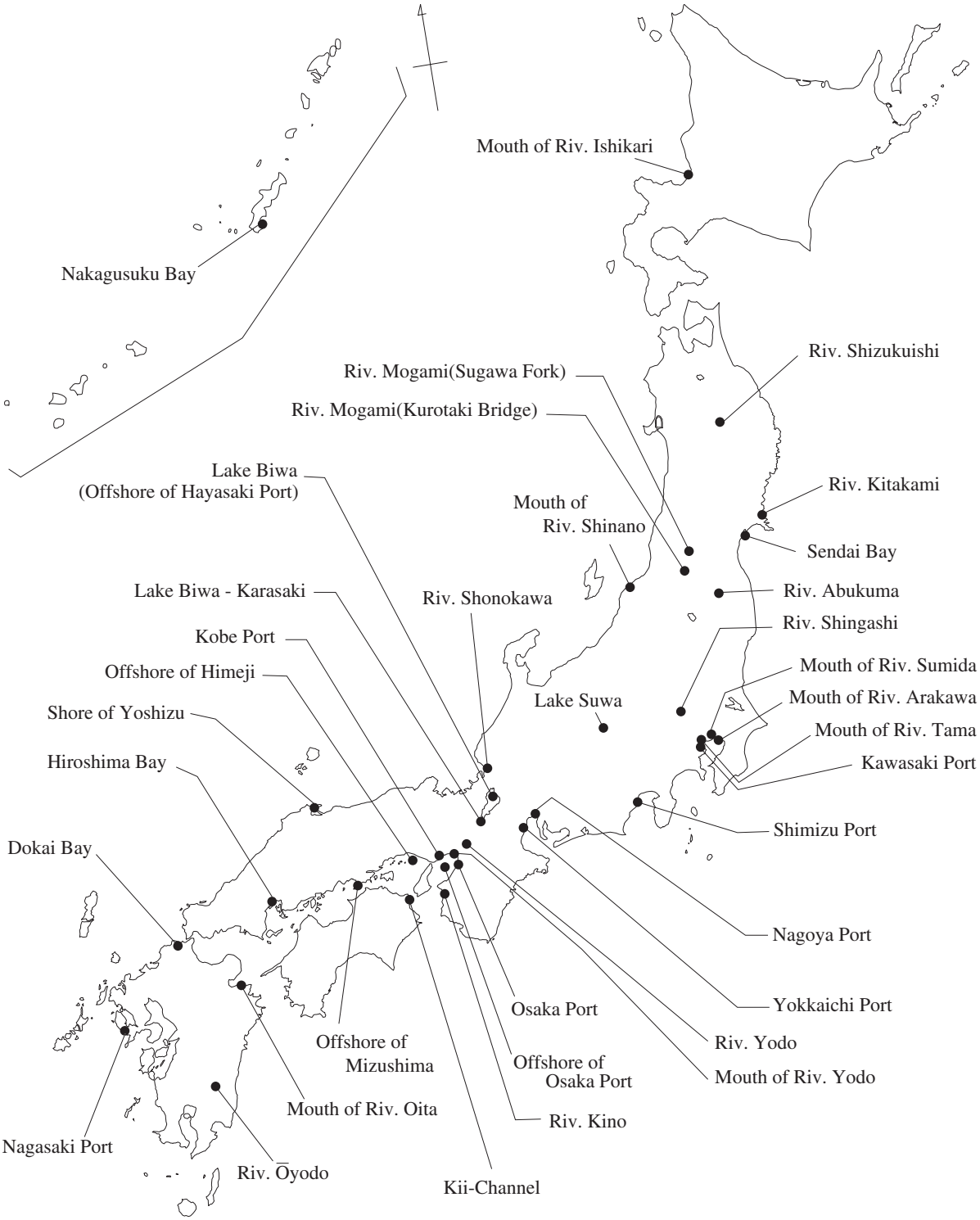


Figure 4-2 Locations of the Follow-up Survey of the Status of Pollution by Unintentionally Formed Chemical Substances (Air, FY2000)

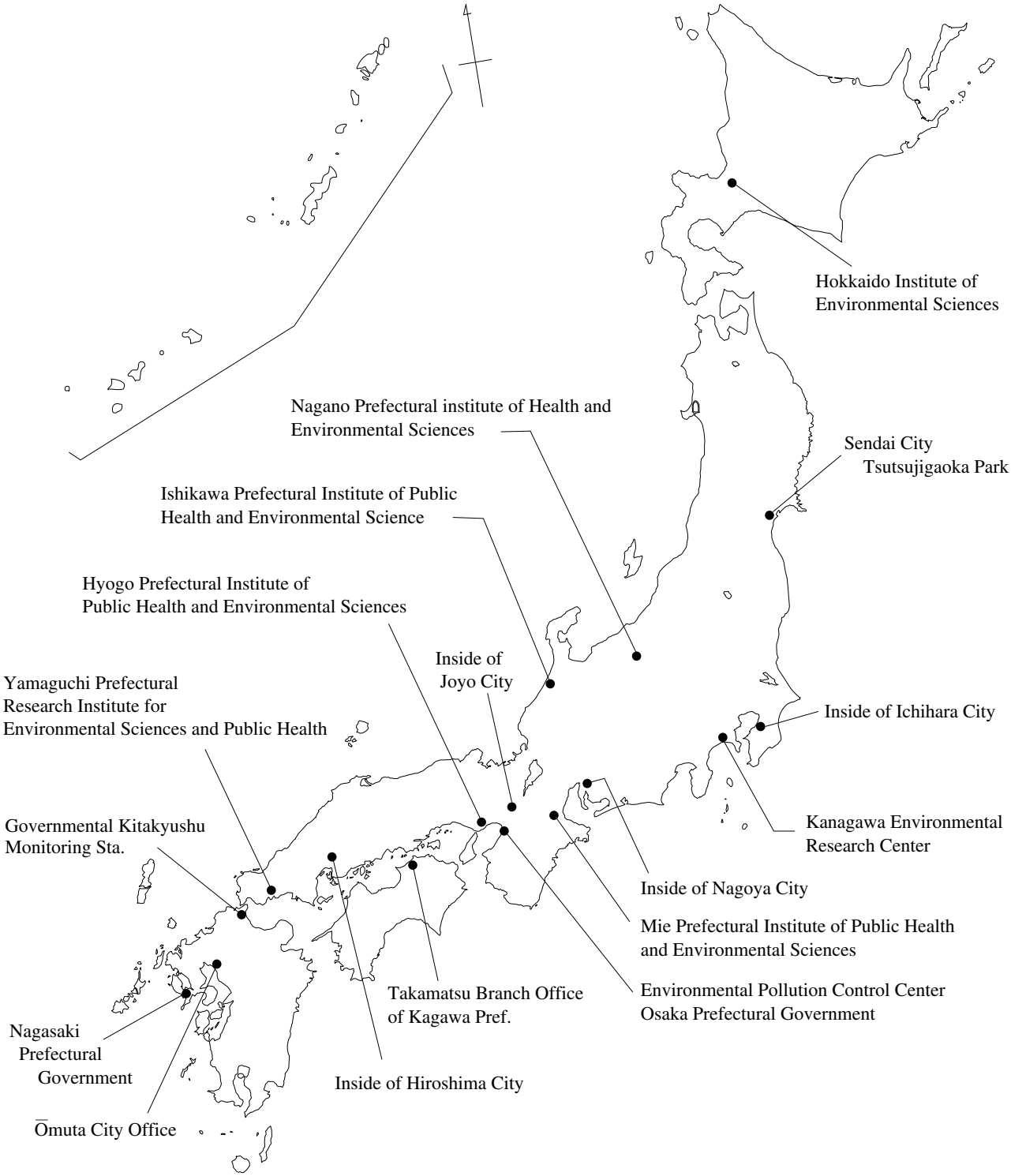


Table 4-1 Survey Results of PCBs (Summary, FY2000)

Substance		Surface water (pg/ℓ)												Wildlife(pg/g-wet)						
		River 6 areas			Lake 3 areas			Estuary 6 areas			Sea 13 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)	0.8	1.6	5.3	1.2	1.6	2.2	1	5.3	17	0.4	2.7	8.4	5	32	280	1.7	72	680	11
3,4,4',5-TetraCB	(#81)	ND	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND	4	20	0.7	9.9	39	1.2
2,3,3',4,4'-PentaCB	(#105)	1.1	4.2	13	0.4	5.1	7.2	1.5	10	30	0.2	4.3	16	100	450	3800	32	980	5200	72
2,3,4,4',5-PentaCB	(#114)	ND	0.2	0.9	ND	0.3	0.5	ND	0.75	2	ND	ND	1.1	8.8	36	350	2.1	84	410	4.2
2,3',4,4',5-PentaCB	(#118)	3	10	34	1	14	17	3.5	34	100	0.7	13	53	310	1380	9100	150	2600	11000	230
2',3,4,4',5-PentaCB	(#123)	ND	ND	0.9	ND	ND	ND	ND	0.6	1.8	ND	ND	0.9	5.7	27	180	2.9	56	370	4.5
3,3',4,4',5-PentaCB	(#126)	ND	ND	0.4	ND	ND	ND	ND	0.15	0.5	ND	ND	0.5	1.9	7.8	17	0.7	10	59	1.6
2,3,3',4,4',5-HexaCB	(#156)	ND	1.2	2.6	ND	1.4	2.1	0.5	2.2	8.1	ND	1.1	3.6	33	130	1200	9.3	180	1600	17
2,3,3',4,4',5'-HexaCB	(#157)	ND	0.5	1.1	ND	0.4	0.7	ND	0.9	3	ND	0.6	1.4	10	40	290	1.9	86	780	6
2,3',4,4',5,5'-HexaCB	(#167)	ND	0.5	1.1	ND	0.6	0.7	ND	1	3.6	ND	0.6	1.6	17	70	430	15	150	1100	15
3,3',4,4',5,5'-HexaCB	(#169)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3	ND	ND	9.3	ND	2	88	ND
2,2',3,3',4,4',5-HeptaCB	(#170)	0.3	0.93	2.5	0.17	1.2	1.3	0.36	2.2	8.1	0.1	1.8	3.1	40	180	660	41	570	3900	8.5
2,2',3,4,4',5,5'-HeptaCB	(#180)	ND	1.8	4.6	ND	2.1	2.6	ND	4.4	18	ND	4	8.7	110	460	1400	140	1700	14000	51
2,3,3',4,4',5,5'-HeptaCB	(#189)	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND	0.4	2	12	49	0.59	20	170	ND
MonoCBs		2.6	8.5	15	4.2	4.7	8.9	ND	6.2	19	3	6.1	13	0.94	2	19	ND	4	110	2.6
DiCBs		11	56	130	34	40	52	15	90	930	21	74	470	4.1	36	1100	10	190	3300	110
TriCBs		27	62	200	26	42	95	32	342	3800	30	170	1200	210	860	13000	110	6200	44000	460
TetraCBs		40	74	280	19	74	120	36	600	2700	24	210	710	490	3000	26000	550	14000	95000	1100
PentaCBs		29	87	280	8.9	130	130	26	300	720	8.6	110	370	1500	5800	53000	880	20000	80000	1700
HexaCBs		9.8	48	130	2.4	77	81	14	120	360	2.6	54	160	2100	8000	52000	810	22000	86000	2600
HeptaCBs		0.61	5.8	17	0.17	6.6	9.1	0.56	18	58	0.1	15	33	580	2400	6200	140	8100	51000	880
OctaCBs		ND	0.25	2.6	ND	ND	0.6	ND	1.5	7.1	ND	1.4	6.7	48	180	810	18	800	10000	23
NonaCBs		ND	ND	3.5	ND	1.3	51	ND	ND	1.6	ND	ND	13	5.2	25	94	6.9	54	400	ND
DecaCB		ND	ND	3.7	ND	ND	ND	ND	0.45	1	ND	ND	0.7	3.1	22	49	ND	20	150	0.5
TotalPCBs		160	300	910	95	430	490	130	1600	8400	110	750	2800	5000	20000	130000	3800	83000	350000	6900

Table 4-1 Survey Results of PCBs (Summary, FY2000,continued)

Substance		Bottom sediment (pg/g-dry)												Air(pg/m³)		
		River 9 areas			Lake 3 areas			Estuary 8 areas			Sea 16 areas			17 areas		
		min.	med.	max.	min.	med.	max.	min.	med.	max.	min.	med.	max.	min.	med.	max.
3,3',4,4'-TetraCB	(#77)	0.6	2.5	1.1	100	160	160	4.5	440	5900	2.3	140	5300	0.14	0.59	5.7
3,4,4',5-TetraCB	(#81)	ND	ND	ND	4.8	8.5	11	ND	16	72	ND	7.6	200	ND	0.08	0.53
2,3,3',4,4'-PentaCB	(#105)	ND	8	2	250	450	460	15	860	5700	5	560	14000	0.21	1	27
2,3,4,4',5-PentaCB	(#114)	ND	0.6	ND	21	26	29	0.9	56	420	ND	26	970	0.03	0.12	1.7
2,3',4,4',5-PentaCB	(#118)	3	20	5	680	970	1000	35	2800	16000	16	1700	32000	0.74	3.6	78
2',3,4,4',5-PentaCB	(#123)	ND	2.1	21	12	21	22	ND	50	320	ND	28	700	0.02	0.12	1.2
3,3',4,4',5-PentaCB	(#126)	ND	0.8	8.7	9.7	12	14	ND	15	89	ND	8.6	130	0.02	0.078	0.24
2,3,3',4,4',5-HexaCB	(#156)	ND	8.8	150	93	110	170	3.7	220	1300	2.1	190	3700	0.04	0.18	3.5
2,3,3',4,4',5'-HexaCB	(#157)	ND	3.2	48	30	31	45	1.4	69	400	1	76	1300	ND	0.055	1.1
2,3',4,4',5,5'-HexaCB	(#167)	ND	4	62	38	41	57	1.8	89	530	1	97	1600	0.02	0.09	1.8
3,3',4,4',5,5'-HexaCB	(#169)	ND	ND	8.3	2.8	2.8	2.9	ND	5.8	21	ND	5.2	180	0.005	0.018	0.06
2,2',3,3',4,4',5-HeptaCB	(#170)	ND	14	190	110	130	140	5	280	1900	5	410	10000	0.04	0.18	2.5
2,2',3,4,4',5,5'-HeptaCB	(#180)	ND	32	430	210	240	300	11	580	4200	13	1000	30000	0.09	0.44	8.3
2,3,3',4,4',5,5'-HeptaCB	(#189)	ND	1	9.6	8.5	9.7	11	ND	16	85	ND	18	340	ND	0.022	0.056
MonoCBs		ND	8.9	77	38	48	110	1.5	220	2300	1.1	99	1400	0.01	5.5	47
DiCBs		1.6	90	1600	340	440	720	19	3700	22000	29	1300	21000	9.2	64	160
TriCBs		8.4	300	3400	2000	2500	2700	91	20000	110000	52	4400	150000	22	180	590
TetraCBs		8.9	740	4700	3100	3100	5100	150	31000	200000	66	7600	260000	18	88	450
PentaCBs		15	490	5200	4700	5200	5400	200	17000	110000	94	10000	200000	9.9	49	650
HexaCBs		8.6	270	4800	3200	3500	4400	120	9200	52000	120	8300	140000	3.6	16	310
HeptaCBs		ND	110	1500	820	940	1100	31	2200	15000	50	3700	100000	0.59	2.3	43
OctaCBs		ND	20	310	170	200	230	4.9	480	3400	9.6	980	29000	0.08	0.38	3.6
NonaCBs		ND	3.6	30	30	32	53	ND	69	360	ND	80	2500	0.018	0.098	0.42
DecaCB		ND	3.8	18	18	24	36	1.2	26	380	ND	49	760	0.01	0.08	0.54
TotalPCBs		42	2000	22000	15000	17000	18000	610	120000	520000	540	46000	750000	91	410	2300

Table 4-2 Survey Results of Brominated Dioxins (Bottom Sediment, FY2000)

(unit: pg/g-dry)

Substance	Hokkaido Mouth of Riv. Ishikari	Iwate Pref. Riv. Shizukuishi	Miyagi Pref. Sendai Bay	Miyagi Pref. Riv. Kitakami	Yamagata Pref. Riv. Mogami (Kurotaki Bridge)	Yamagata Pref. Riv.Mogami (Sugawa)	Fukushima Pref. Riv. Abukuma	Saitama Pref. Riv. Shingashi	Tokyo Metropolis Mouth of Riv. Arakawa	Tokyo Metropolis Mouth of Riv. Sumida	Niigata Pref. Downstream of Riv. Shinano	Fukui Pref. Riv. Shonokawa
2,3,7,8-TetraBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PentaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-/ 1,2,3,6,7,8-HexaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HexaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,7,8-TetraBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND	ND
1,2,3,7,8-PentaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PentaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HexaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Lower Detection Limit: tetra-brominated compounds 0.5 pg/g; penta-brominated compounds 1 pg/g; hexa-brominated compounds 5 pg/g

Substance	Nagano Pref. Laka Suwa	Shizuoka Pref. Shimizu Port	Aichi Pref Nagoya Port	MiePref. Yokkaichi Port	Shiga Pref. Lake Biwa Offshore of Hamaotsu	Shiga Pref. Lake Biwa Offshore of Karasaki (center)	Osaka Pref. Riv. Yodo	Hyogo Pref. Offshore of Himeji	Wakayama Pref. Mouth of Riv. Inokawa	Tottori Pref. Yoshizujisa-ki	Okayama Pref. Offshore of Mizushima	Hiroshima Pref. Hiroshima Bay
2,3,7,8-TetraBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.0	ND
1,2,3,7,8-PentaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-/ 1,2,3,6,7,8-HexaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HexaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,7,8-TetraBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	ND
1,2,3,7,8-PentaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PentaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HexaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Lower Detection Limit: tetra-brominated compounds 0.5 pg/g; penta-brominated compounds 1 pg/g; hexa-brominated compounds 5 pg/g

Table 4-2 Survey Results of Brominated Dioxins (Bottom sediment, FY2000, continued)

(unit: pg/g-dry)

Substance	Tokushima Pref. Kii Channel	Nagasaki Pref. Nagasxxaki Port	Ooita Pref. Mouth of Riv. Oita	Miyazaki Pref. Riv. Oyodo	Okinawa Pref. Nakagusuku Bay	Kawasaki Pref. Mouth of Riv. Tamagawa	Kawasaki City Kawasaki Port	Osaka City Osaka Port	Osaka City Mouth of Riv. Yodo	Osaka City Out of Osaka Port	Kobe City Kobe Port	Kitakyushu City Dokai Bay
2,3,7,8-TetraBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PentaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-/ 1,2,3,6,7,8-HexaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HexaBrDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,7,8-TetraBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9
1,2,3,7,8-PentaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PentaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HexaBrDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Lower Detection Limit: tetra-brominated compounds 0.5 pg/g; penta-brominated compounds 1 pg/g; hexa-brominated compounds 5 pg/g

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 and so on, have been designated as Class 1 Specified Chemical Substances (as of the end of March 2003).

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, 676 substances including chloroform and 1,2-DCE have been designated as Designated Chemical Substances (as of the end of March 2003). 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 March 2003).

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).

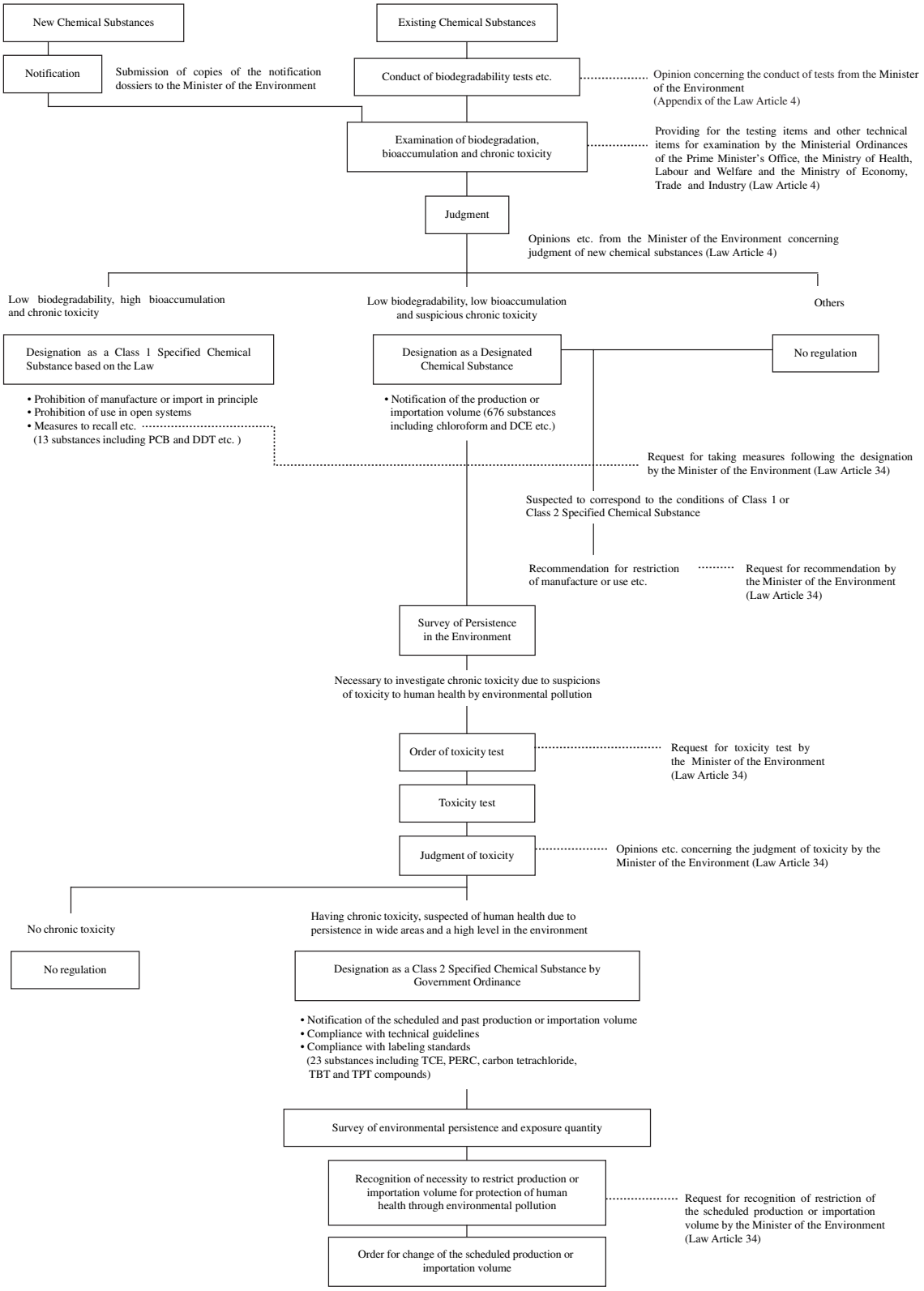
[4] To request that the Ministers of Health, Labour and Welfare and Economy, Trade and Industry (Article 34, No. 2) order toxicity tests concerning Designated Chemical Substances (Article 24, Clause 1).

[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).

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 March, 2003.

Appendix B

Surveyed Chemical Substances and Detected Levels in the Environment (A Cumulative List for Fiscal Years 1974–2000) [Extraction]

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

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

Surveyed Chemical Substances and their Detected Levels in the Environment (A Cumulative List for Fiscal Year 1974 - 2000)

Surveyed Chemical Substances and their Detected Levels in the Environment (A Cumulative List for Fiscal Year 1974 - 2000)

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 20degreeC 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 - 2000)

#	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).

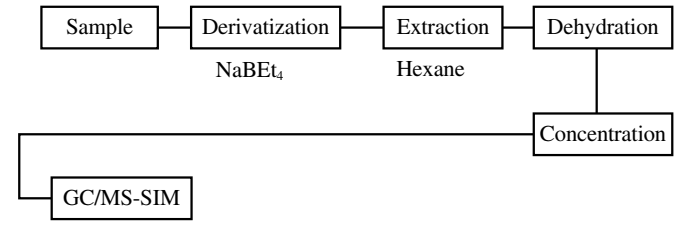
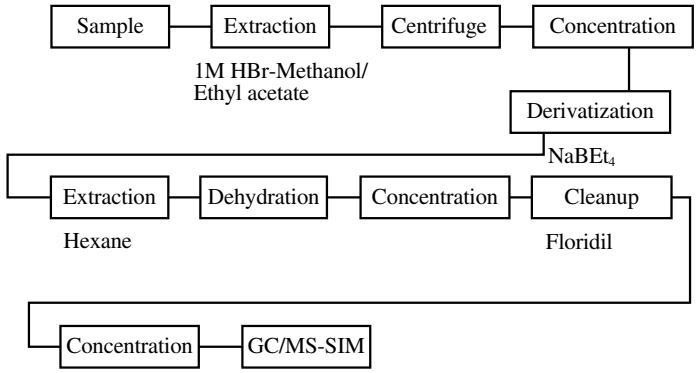
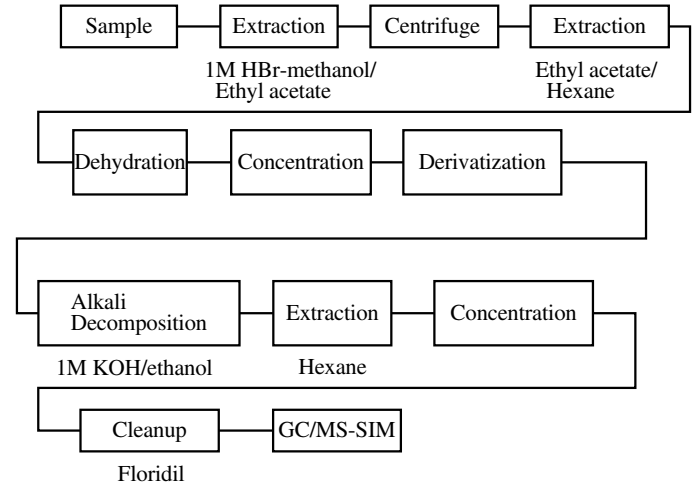
Appendix D

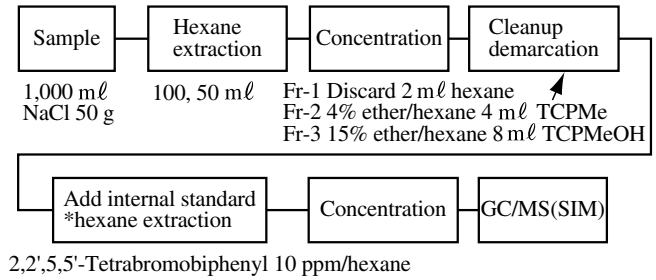
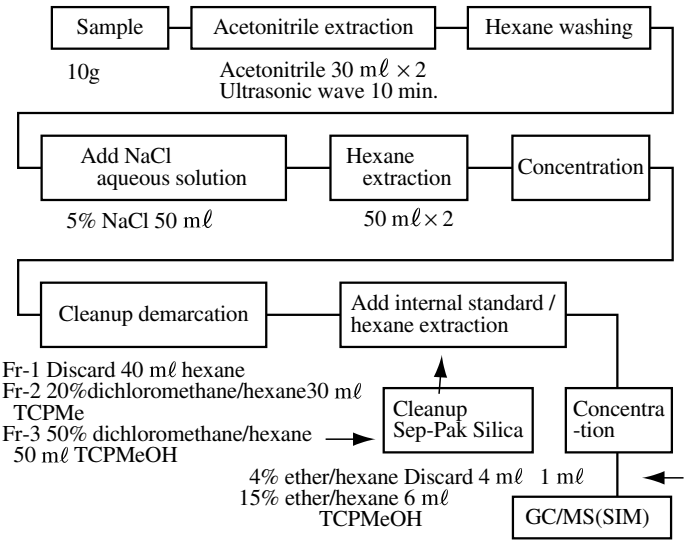
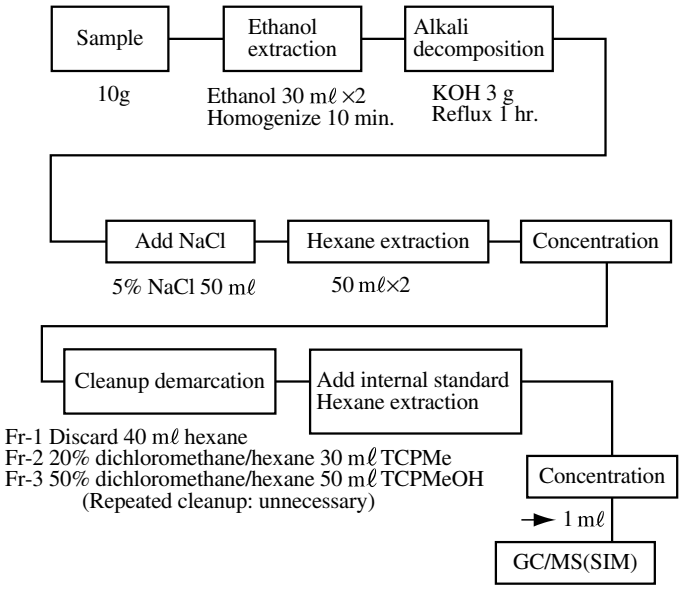
Summary of Analytical Methods in General Inspection Survey

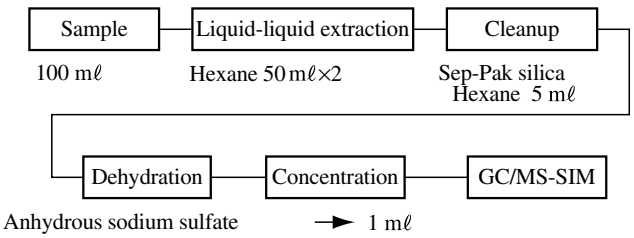
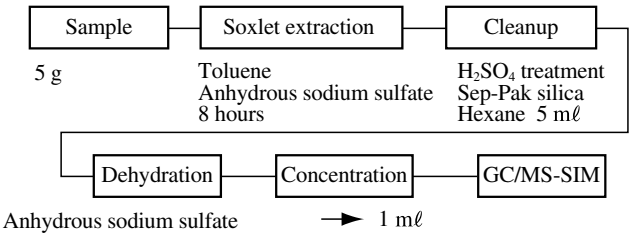
Appendix D Summary of Analytical Method in General Inspection Survey

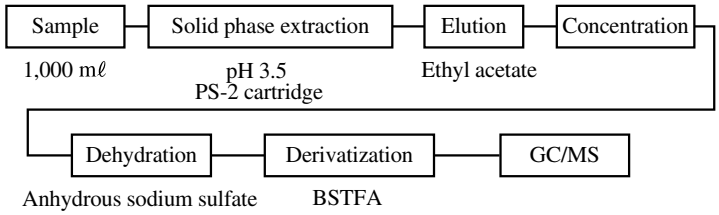
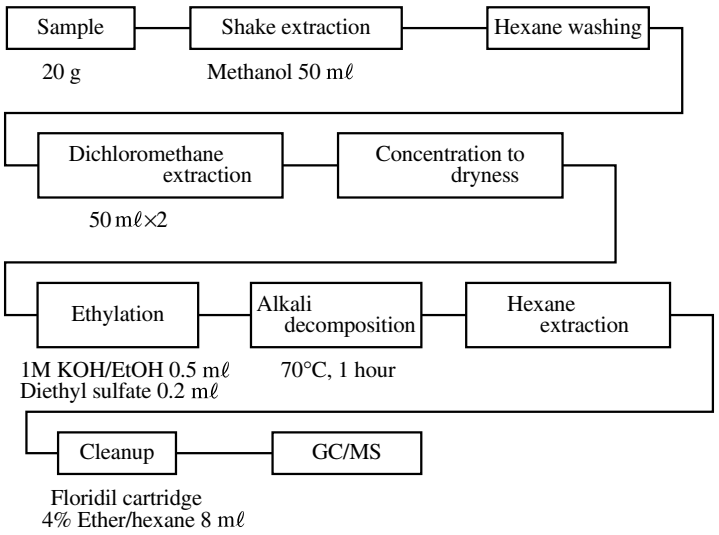
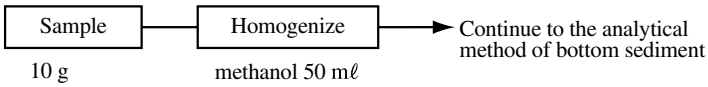
Target Chemical Substances for Environmental Survey (Auqatic System)

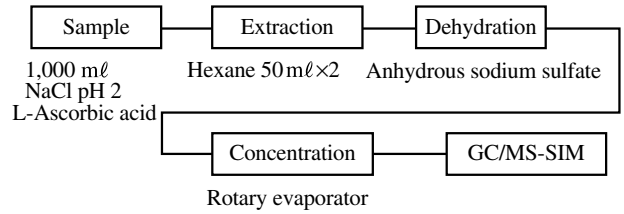
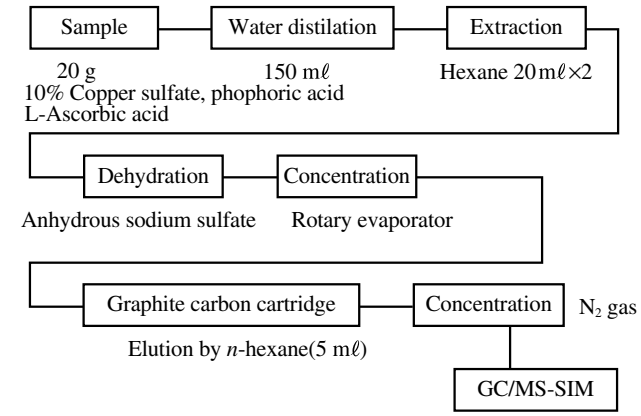
Substances	Analytical Method / Flow Chart	Remarks
(1) *p*-Ethyl *p*-hydroxybenzoate (2) Isopropyl *p*-hydroxybenzoate (3) *n*-Propyl *p*-hydroxybenzoate (4) Isobutyl *p*-hydroxybenzoate (5) *n*-butyl *p*-hydroxybenzoate	**Surface water** sample → solvent extraction → dehydration/ concentration 500 mℓ NaCl 15 g 2N HCl (pH approx.3) Ethyl acetate 100, 50 mℓ Na_2SO_4(anhydrate) * → TMS derivatization → GC/MS BSTFA 200µℓ **Bottom sediment** sample → extraction (twice) → centrifuge 10 g Methanol 25 mℓ Shake 5 min. Ultrasonic wave 10 min. 3,000 rpm 10 min. ** → pure water → hexane wash → extraction 450 mℓ 10%Na_2CO_3 pH approx.11 NaCl 15 g Hexane 100 mℓ 2N HCl pH approx.3 Ethyl acetate 100, 50 mℓ dehydration / concentration → solvent tranfer → silica cartridge Anhydrous sodium sulfate Dissolve in hexane after drying 2%acetone/hexane washing 10%acetone/hexane elution concentration → Continue on *(surface water) **Wildlife** sample → extraction(twice) → centrifuge 5 g Methanol 25 mℓ Homogenize 5 min. 3,000 rpm 10 min. Continue on **(bottom sediment)	GC/MS Column: PTE-5 Column length: 30 m Column I.D.: 0.32 mm Film thickness: 0.25 µm Detection Limit: Surface water (µg/ℓ) (1) 0.027 (2) 0.018 (3) 0.014 (4) 0.023 (5) 0.027 Bottom sediment (ng/g-dry) (1) 1.5 (2) 2.1 (3) 2.3 (4) 2.3 (5) 2.3 Wildlife (µng/g-wet) (1) 1.9 (2) 1.6 (3) 2.3 (4) 2.6 (5) 2.9

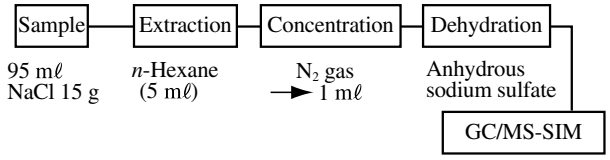
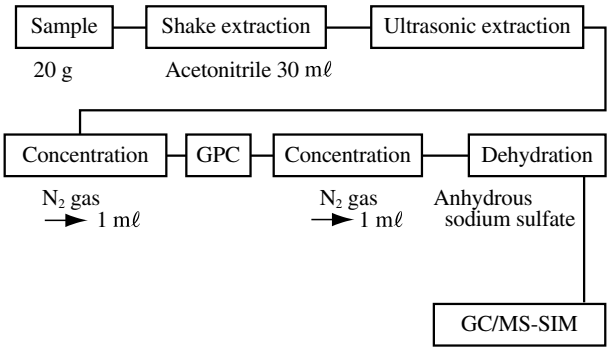
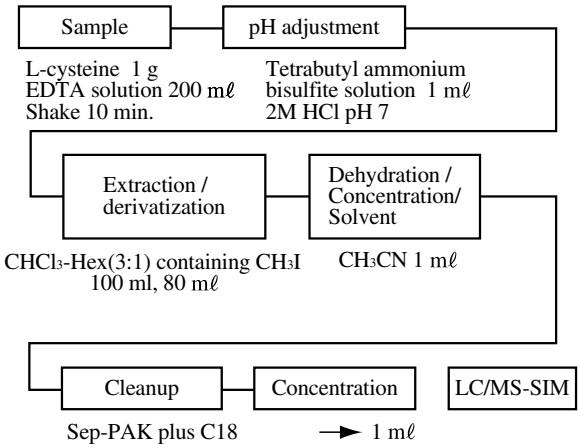
Substance	Analytical Method / Flow Chrt	Remarks
(6) Dioctyltin compounds	**Surface water**  **Bottom sediment**  **Wildlife**  	GC/MS-SIM Column: HP-5 ms Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection Limit: Surface water (6) 0.0059 µg/ℓ Bottom sediment (6) 6.1 ng/g-dry Wildlife (6) 0.64 ng/g-wet

Substance	Analytical Method / Flow Chart	Remarks
(7) Tris(4-chlorophenyl) methanol(TCPMOH) (8) Tris(4-chlorophenyl) methane(TCPMe)	**Surface water**  2,2',5,5'-Tetrabromobiphenyl 10 ppm/hexane **Bottom sediment**  **Wildlife**  	GC/MS-SIM Column: Ultra-2 Column length: 25 m Column I.D.: 0.32 mm Film thickness: 0.52 µm Detection Limit: Surface water (µg/ℓ) (7) 0.0033 (8) 0.0052 Bottom sediment (ng/g-dry) (7) 1.7 (8) 3.2 Wildlife (ng/g-wet) (7) 0.44 (8) 0.97

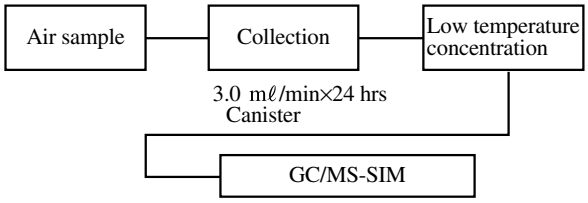
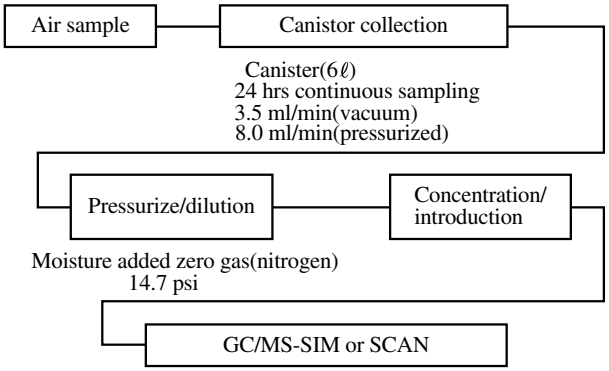
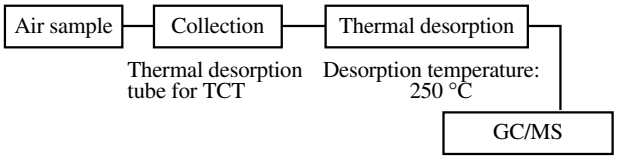
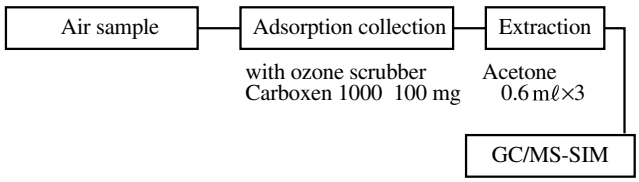
Substance	Anallytical Method / Flow Chart	Remarks
(9) 1,3,5-Tri-*tert*- Butylbenzene (10) Hexabromobenzene	**Surface water**  **Bottom sediment / Wildlife**  	GC/MS-SIM Dimethylsiloxane (e.g.:J&W DB-1) Column length: 30 m Column I.D.: 0.25 µm Film thickness: 0.25 µm Detection Limit: Surface water (µg/ℓ) (9) 0.00031 (10) 0.0064 Bottom sediment (ng/gdry) (9) 0.30 (10) 4.8 Wildlife (ng/g-wet) (9) 0.43 (10) 3.2

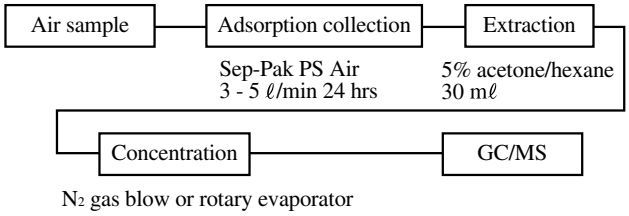
Substance	Analytical Method / Flow Chart	Remarks
(11) Tetrabromo bisphenol A	**Surface water**  **Bottom sediment**  **Wildlife**  	GC/MS-SIM Column: HP-5 Trace Analysis Column length: 30 m Column I.D.: 0.25 mm Film thickness: 0.25 µm Detection Limit: Surface water (µg/ℓ) (11) 0.090 Bottom sediment (ng/g-dry) (11) 5.5 Wildlife (ng/g-wet) (11) 20

Substance	Analytical Method / Flow Chart	Remarks
(12) 2-*tert*-Butyl-4-methoxyphenol	**Surface water**  **Bottom sediment**  	GC/MS-SIM Column: Ultra-2 Column length: 25 m Column I.D.: 0.32 mm Film thickness: 0.52 µm Detection Limit: Surface water (12) 0.016 µg/ℓ Bottom sediment (12) 0.92 ng/g-dry

Substance	Analytical Metod / Flow Chart	Remarks
(13) Butyl bengyl phthalate	**Surface water**  **Bottom sediment**  	GC/MS-SIM Column: DBI Column I.D.: 0.25 mm Detection Limit: Surface water (13) 0.14 µg/ℓ Bottom sediment (13) 15 ng/g-dry
(14) Manganese ethylene-1,2-bisdithiocarbamate group, agricultural chemicals (Maneb+Zineb+Manzeb)	**Surface water**  	LC/MS-SIM Column: Inertsil ODS-80A Column:length: 250 mm Column I.D.: 1.5 mm Detection Limit: Surface water (14) 0.043 µg/ℓ

Target Chemical Substances of Environmental Survey (Air)

Substance	Analytical Method / Flow Chart	Remarks
(1) 1,4-Dioxane		GC/MS Column:HP-VOC Column length: 60 m Column I.D.: 0.32 mm Film thickness: 1.8 µm Detection Limit: (1) 0.0068 µg/m³
(2) Isobutyl acetate (3) Ethyl acetate (4) Vinyl acetate (5) Butyl acetate		Canister collection GC/MS-SIM Column: AQUATIC 60 m × 0.25 mm Film thickness: 1.0 µm Detection Limit: (µg/m³) (2) 0.070 (3) 0.040 (4) 0.12 (5) 0.088
(6) α-Methylstyrene (7) *cis*-β-Methylstyrene + *o*-Methylstyrene + *p*-Methylstyrene (8) *m*-Methylstyrene (9) *trans*-β-Methylstyrene		GC/MS-SIM Column: Cp-Xylenes 50 m × 0.32 mm Film thickness: 0.25 µm Detection Limit: (ng/m³) (6) 0.59 (7) 0.60 (8) 0.74 (9) 0.67
(10) 2-Methoxyethanol (11) 2-Eethoxyethanol (12) 2-Butoxyethanol		GC/MS Column: JEOL 30 m × 0.25 mm Film thickness: 0.5 µm Detection Limit: (ng/m³) (10) 6.1 (11) 2.3 (12) 2.2

Substance	Analytical Method / Flow Chart	Remarks
(13) Hexabromobenzene		GC/MS Column: HP Ultra 2 Column length: 25 m Column I.D.: 0.20 mm Film thickness: 0.33 µm
(14) Polychlorinated Terphenyl