Chapter 3 Results of the Environmental Monitoring in FY 2009

1. Purpose of the monitoring

Environmental Monitoring is aimed at conducting an annual survey of the environmental persistence of target chemicals listed in the Stockholm Convention on Persistent Organic Pollutants (hereinafter, the Stockholm Convention), and the possible candidate chemicals, and highly persistent chemicals among the Specified Chemical Substances and Monitored Chemical Substances under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances (Law No. 117 of 1973) (hereinafter, the Chemical Substances Control Law), whose change in persistence in the environment must be understood.

*POPs: persistent organic pollutants

2. Target chemicals

In the FY 2009 Environmental Monitoring, usual 15 chemicals (groups) which added Hexachlorohexanes*, Hexabromobiphenyls, Polybromodiphenyl ethers (Br_4～Br_{10})**, Perfluorooctane sulfonic acid (PFOS) and Pentachlorobenzene which were adopted to be POPs in the Stockholm Convention at fourth meeting of the Conference of the Parties held from 4 to 8 May 2009, to initial 10 chemicals (groups) included in the Stockholm Convention (except for Polychlorinated-*p*-dioxin and Polychlorinated dibenzofuran) (hereinafter, POPs), and 2 chemicals (groups), namely, Perfluorooctanoic acid (PFOA) and Tetrachlorobenzenes, were designated as target chemicals. The combinations of target chemicals and the monitoring media are given below.

* In the COP4, *α*-HCH、*β*-HCH and *γ*-HCH (synonym:Lindane) were adopted to be POPs among HCHs, but in this Environmental Monitoring, HCHs which were able to include *δ*-HCH were designated as target chemicals.

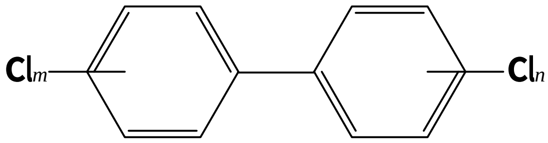
** In the COP4, Tetrabromodiphenyl ethers, Pentabromodiphenyl ethers, Hexabromodiphenyl ethers and Heptabromodiphenyl ethers were adopted to be POPs among Polybromodiphenyl ethers but in this Environmental Monitoring, Polybromodiphenyl ethers(Br_4～Br_{10}) which were able to include Octabromodiphenyl ethers , Nonabromodiphenyl ethers and Decabromodiphenyl ether were designated as target chemicals.

No	Name	Monitored media			
		Surface water	Sediment	Wildlife	Air
[1]	Polychlorinated biphenyls (PCBs)	○	○	○	○
	[1-1] Monochlorobiphenyls				
	[1-2] Dichlorobiphenyls				
	[1-3] Trichlorobiphenyls				
	[1-4] Tetrachlorobiphenyls				
	[1-4-1] 3,3',4,4'-Tetrachlorobiphenyl(#77)				
	[1-4-2] 3,4,4',5-Tetrachlorobiphenyl(#81)				
	[1-5] Pentachlorobiphenyls				
	[1-5-1] 2,3,3',4,4'-Pentachlorobiphenyl(#105)				
	[1-5-2] 2,3,4,4',5-Pentachlorobiphenyl(#114)				
	[1-5-3] 2,3',4,4'-5-Pentachlorobiphenyl(#118)				
	[1-5-4] 2',3,4,4',5-Pentachlorobiphenyl(#123)				
	[1-5-5] 3,3',4,4',5-Pentachlorobiphenyl(#126)				
	[1-6] Hexachlorobiphenyls				
	[1-6-1] 2,3,3',4,4',5-Hexachlorobiphenyl(#156)				
	[1-6-2] 2,3,3',4,4',5'-Hexachlorobiphenyl(#157)				
	[1-6-3] 2,3',4,4',5,5'-Hexachlorobiphenyl(#167)				
	[1-6-4] 3,3',4,4',5,5'-Hexachlorobiphenyl(#169)				
	[1-7] Heptachlorobiphenyls				
	[1-7-1] 2,2',3,3',4,4',5-Heptachlorobiphenyl(#170)				
	[1-7-2] 2,2',3,4,4',5,5'-Heptachlorobiphenyl(#180)				
	[1-7-3] 2,3,3',4,4',5,5'-Heptachlorobiphenyl(#189)				
	[1-8] Octachlorobiphenyls				
	[1-9] Nonachlorobiphenyls				
	[1-10] Decachlorobiphenyl				
[2]	Hexachlorobenzene	○	○	○	○
[3]	Aldrin	○	○	○	○
[4]	Dieldrin	○	○	○	○
[5]	Endrin	○	○	○	○
[6]	DDTs	○	○	○	○
	[6-1] *p,p'*-DDT				
	[6-2] *p,p'*-DDE				
	[6-3] *p,p'*-DDD				
	[6-4] *o,p'*-DDT				
	[6-5] *o,p'*-DDE				
	[6-6] *o,p'*-DDD				
[7]	Chlordanes	○	○	○	○
	[7-1] *cis*-Chlordane				
	[7-2] *trans*-Chlordane				
	[7-3] Oxychlordane				
	[7-4] *cis*-Nonachlor				
	[7-5] *trans*-Nonachlor				
[8]	Heptachlors	○	○	○	○
	[8-1] Heptachlor				
	[8-2] *cis*-Heptachlor epoxide				
	[8-3] *trans*-Heptachlor epoxide				
[9]	Toxaphenes	○	○	○	○
	[9-1] 2-endo,3-exo,5-endo,6-exo,8,8,10,10-octachlorobornane (Parlar-26)				
	[9-2] 2-endo,3-exo,5-endo,6-exo,8,8,9,10,10-nonachlorobornane (Parlar-50)				
	[9-3] 2,2,5,5,8,9,9,10,10-Nonachlorobornane (Parlar-62)				
[10]	Mirex	○	○	○	○
[11]	HCHs (Hexachlorohexanes)	○	○	○	○
	[11-1] α-HCH				
	[11-2] β-HCH				
	[11-3] γ-HCH (synonym:Lindane)				
	[11-4] δ-HCH				

No	Name	Monitored media			
		Surface water	Sediment	Wildlife	Air
[12]	Hexabromobiphenyls [12-1] 2,2',4,4',5,5'-Hexabromobiphenyl(#153) [12-2] 2,2',4,4',6,6'-Hexabromobiphenyl(#155) [12-3] 3,3',4,4',5,5'-Hexabromobiphenyl(#169)	○	○	○	
[13]	Polybromodiphenyl ethers(Br_4～Br_{10}) [13-1] Tetrabromodiphenyl ethers [13-1-1] 2,2',4,4'-Tetrabromodiphenyl ether(#47) [13-2] Pentabromodiphenyl ethers [13-2-1] 2,2',4,4',5-Pentabromodiphenyl ether(#99) [13-3] Hexabromodiphenyl ethers [13-3-1] 2,2',4,4',5,5'-Pentabromodiphenyl ether(#153) [13-3-2] 2,2',4,4',5,6'-Pentabromodiphenyl ether(#154) [13-4] Heptabromodiphenyl ethers [13-4-1] 2,2',3,3',4,5',6'-Pentabromodiphenyl ether(#175) [13-4-2] 2,2',3,4,4',5',6'-Pentabromodiphenyl ether(#183) [13-5] Octabromodiphenyl ethers [13-6] Nonabromodiphenyl ethers [13-7] Decabromodiphenyl ether	○	○		○
[14]	Perfluorooctane sulfonic acid (PFOS)	○	○	○	
[15]	Perfluorooctanoic acid (PFOA)	○	○	○	
[16]	Pentachlorobenzene				○
[17]	Tetrachlorobenzenes [17-1] 1,2,3,4-Tetrachlorobenzene [17-2] 1,2,3,5-Tetrachlorobenzene [17-3] 1,2,4,5-Tetrachlorobenzene				○

Chemical and physical properties of target chemicals of the Environmental Monitoring are as follows.

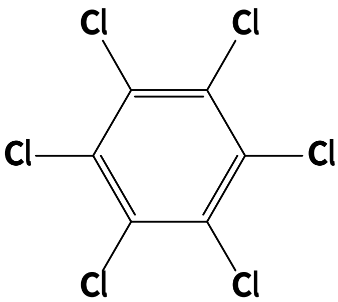
[1] (Polychlorinated biphenyls (PCBs))



i = m+n =1～10

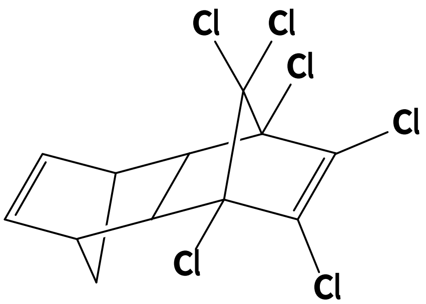
Molecular formula:	$C_{12}H_{(10-i)}Cl_i$(i = m+n =1～10)
CAS:	27323-18-8(Cl_1), 22512-42-9(Cl_2), 25323-68-6(Cl_3), 26914-33-0(Cl_4), 25429-29-2(Cl_5), 26601-64-9(Cl_6), 28655-71-2(Cl_7), 31472-83-0(Cl_8), 53742-07-7(Cl_9), 5051-24-3(Cl_{10})
ENCS:	No pertinence
MW:	188.65～498.66
mp:	Not specified
bp:	Not specified
SW:	Not specified
Specific gravity:	Not specified
logPow:	Not specified

[2] HCB (Hexachlorobenzene)



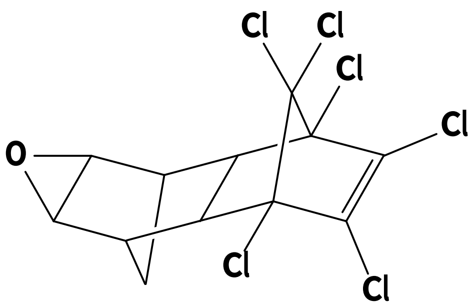
Molecular formula:	C_6Cl_6
CAS:	118-74-1
ENCS:	3-0076
MW:	284.78
mp:	231.8°C[1)]
bp:	323～326°C[1)]
SW:	0.0000096g/kg(25°C)[2)]
Specific gravity:	2.044(23°C)[1)]
logPow:	5.73[3)]

[3] Aldrin



Molecular formula:	$C_{12}H_8Cl_6$
CAS:	309-00-2
ENCS:	4-0303
MW:	364.91
mp:	104°C[1)]
bp:	145°C(0.27kPa)[4)]
SW:	0.0002g/kg(25°C)[2)]
Specific gravity:	1.6g/cm^3 [5)]
logPow:	6.50[3)]

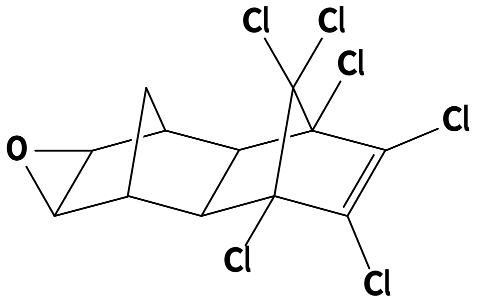
[4] Dieldrin



Molecular formula:	$C_{12}H_8Cl_6O$
CAS:	60-57-1
ENCS:	4-0299
MW:	380.91
mp:	176～177°C[1)]
bp:	330°C[5)]
SW:	0.00020g/kg(25°C)[2)]
Specific gravity:	1.75(25°C)[2)]
logPow:	5.40[3)]

(Abbreviations) CAS: CAS registry number, ENCS: registry number in the Existing and New Chemical Substances List, MW: molecular weight, mp: melting point, bp: boiling point, SW: solubility in water, logPow: *n*-octanol-water partition coefficient, kPa: kilopascal (1 atom 101.3kPa).

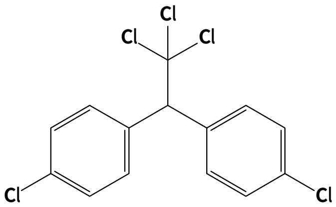
[5] Endrin



Molecular formula: $C_{12}H_8Cl_6O$
CAS: 72-20-8
ENCS: 4-0299
MW: 380.91
mp: 200°C[6]
bp: 245°C(Decomposition)[6]
SW: 0.00025g/kg[2]
Specific gravity: 1.7g/cm^3 [6]
logPow: 5.20[3]

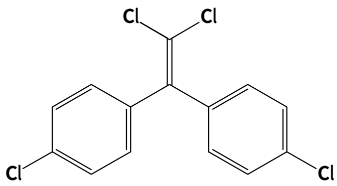
[6] DDTs

[6-1] *p,p'*-DDT



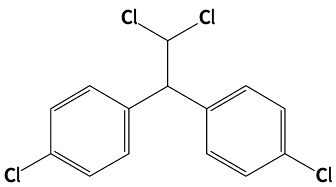
Molecular formula: $C_{14}H_9Cl_5$
CAS: 50-29-3
ENCS: 4-0910
MW: 354.49
mp: 108.5°C[2]
bp: 260°C[2]
SW: Insoluble[1]
Specific gravity: 1.6g/cm^3 [7]
logPow: 6.91[3]

[6-2] *p,p'*-DDE



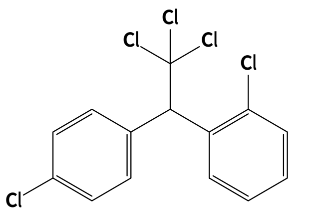
Molecular formula: $C_{14}H_8Cl_4$
CAS: 72-55-9
ENCS: No pertinence
MW: 318.03
mp: 89°C[2]
bp: 336°C[5]
SW: 0.12mg/L(25°C)[5]
Specific gravity: Uncertain
logPow: 6.51[3]

[6-3] *p,p'*-DDD



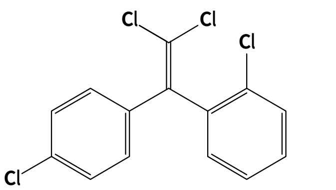
Molecular formula: $C_{14}H_{10}Cl_4$
CAS: 72-54-8
ENCS: No pertinence
MW: 320.04
mp: 109～110°C[1]
bp: 193°C(1mmHg)[2]
SW: 0.09mg/L(25°C)[5]
Specific gravity: Uncertain
logPow: 6.02[3]

[6-4] *o,p'*-DDT



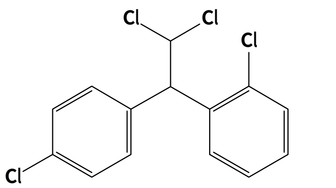
Molecular formula: $C_{14}H_9Cl_5$
CAS: 789-02-6
ENCS: No pertinence
MW: 354.49
mp: Uncertain
bp: Uncertain
SW: Uncertain
Specific gravity: Uncertain
logPow: Uncertain

[6-5] *o,p'*-DDE



Molecular formula: $C_{14}H_8Cl_4$
CAS: 3424-82-6
ENCS: No pertinence
MW: 318.03
mp: Uncertain
bp: Uncertain
SW: Uncertain
Specific gravity: Uncertain
logPow: Uncertain

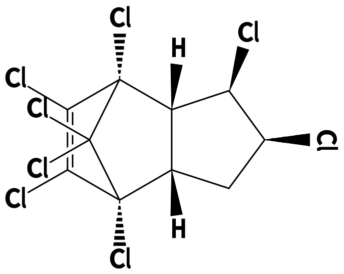
[6-6] *o,p'*-DDD



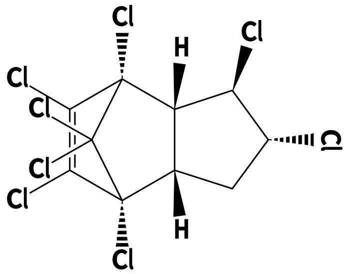
Molecular formula: $C_{14}H_{10}Cl_4$
CAS: 53-19-0
ENCS: No pertinence
MW: 320.04
mp: 76～78°C[1]
bp: Uncertain
SW: Uncertain
Specific gravity: Uncertain
logPow: Uncertain

[7] Chlordanes

[7-1] *cis*-Chlordane



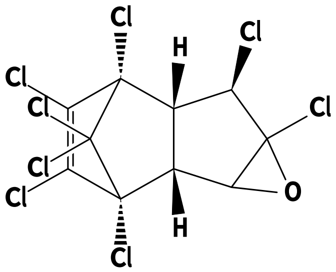
[7-2] *trans*-Chlordane



The following data are for both [7-1] and [7-2].

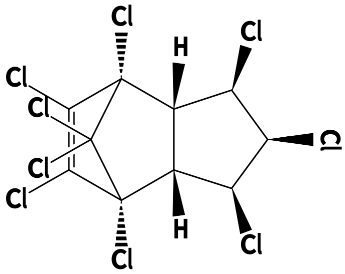
Molecular formula:	$C_{10}H_6Cl_8$
CAS:	5103-71-9(*cis*), 5103-74-2(*trans*)
ENCS:	4-637
MW:	409.78
mp:	106°C[1]
bp:	175°C(1mmHg)[1]
SW:	0.0006g/kg(25°C)[1]
Specific gravity:	1.59～1.63(25°C)[2]
logPow:	6.16[3]

[7-3] Oxychlordane



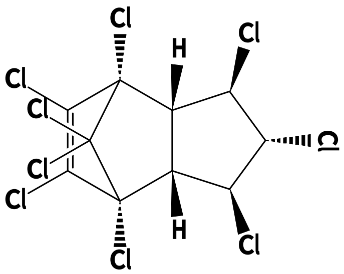
Molecular formula:	$C_{10}H_4Cl_8O$
CAS:	26880-48-8
ENCS:	No pertinence
MW:	423.76
mp:	100°C[1]
bp:	Uncertain
SW:	Uncertain
Specific gravity:	Uncertain
logPow:	4.76[3]

[7-4] *cis*-Nonachlor



Molecular formula:	$C_{10}H_5Cl_9$
CAS:	5103-73-1
ENCS:	No pertinence
MW:	444.22
mp:	Uncertain
bp:	Uncertain
SW:	Uncertain
Specific gravity:	Uncertain
logPow:	5.21[3]

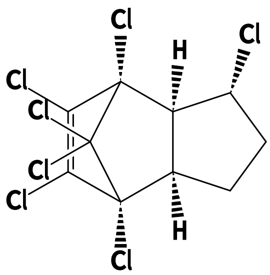
[7-5] *trans*-Nonachlor



Molecular formula:	$C_{10}H_5Cl_9$
CAS:	39765-80-5
ENCS:	No pertinence
MW:	444.22
mp:	Uncertain
bp:	Uncertain
SW:	Uncertain
Specific gravity:	Uncertain
logPow:	5.08[3]

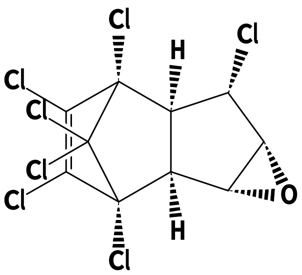
[8] Heptachlors

[8-1] Heptachlor

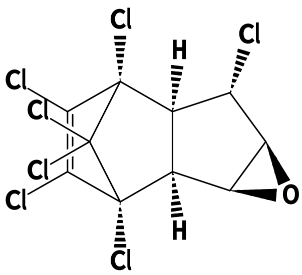


Molecular formula:	$C_{10}H_5Cl_7$
CAS:	76-44-8
ENCS:	4-637、9-1646
MW:	373.32
mp:	95～96°C[2]
bp:	Uncertain
SW:	0.00018g/kg(25°C)[1]
Specific gravity:	1.57(9°C)[1]
logPow:	6.10[3]

[8-2] *cis*-Heptachlor epoxide



[8-3] *trans*-Heptachlor epoxide

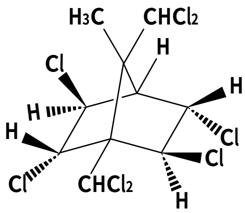


The following data are for both [8-2] and [8-3].

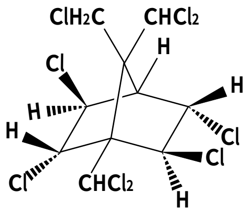
Molecular formula:	$C_{10}H_5Cl_7O$
CAS:	1024-57-3
ENCS:	No pertinence
MW:	389.32
mp:	160°C[1]
bp:	Uncertain
SW:	Uncertain
Specific gravity:	Uncertain
logPow:	5.40[3]

[9] Toxaphenes

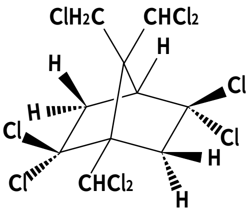
[9-1] 2-Endo,3-exo,5-endo,6-exo,8,8,10,10-octachlorobornane (Parlar-26)



[9-2] 2-Endo,3-exo,5-endo,6-exo,8,8,9,10,10-nonachlorobornane (Parlar-50)

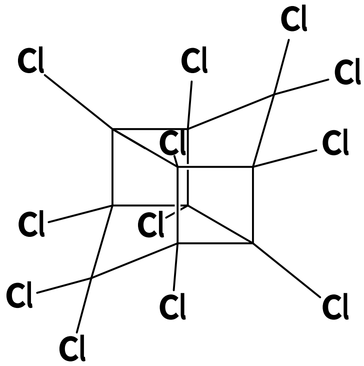


[9-3] 2,2,5,5,8,9,9,10,10-nonachlorobornane (Parlar-62)



Molecular formula: $C_{10}H_{10}Cl_8$([9-1]), $C_{10}H_9Cl_9$([9-2], [9-3])
CAS: 8001-35-2
ENCS: No pertinence
MW: 413.81(Cl_8), 448.26(Cl_9)
mp: 65～90°C[2)]
bp: Uncertain
SW: 3mg/L[2)]
Specific gravity: 1.630(25°C)[2)]
logPow: 6.44[2)]

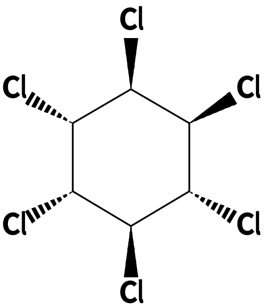
[10] Mirex



Molecular formula: $C_{10}Cl_{12}$
CAS: 2385-85-5
ENCS: No pertinence
MW: 545.54
mp: 485°C(Decomposition)[2)]
bp: Uncertain
SW: 0.000085g/kg(25°C)[1)]
Specific gravity: Uncertain
Molecular formula: 5.28[3)]

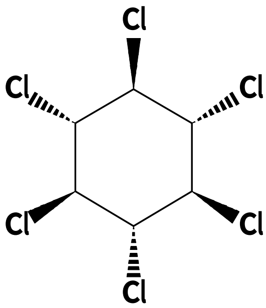
[11] HCHs(Hexachlorohexanes)

[11-1] α-HCH



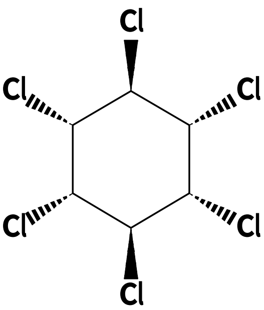
Molecular formula: $C_6H_6Cl_6$
CAS: 319-84-6
ENCS: 3-2250、9-1652
MW: 290.83
mp: 158°C[1)]
bp: 288°C[9)]
SW: 0.00018g/kg(25°C)[2)]
Specific gravity: 1.87(20°C)[10)]
Molecular formula: 3.80[3)]

[11-2] β-HCH



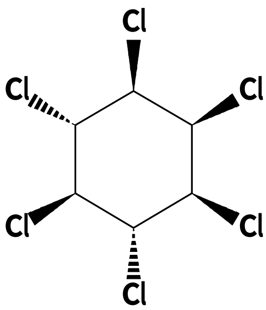
Molecular formula: $C_6H_6Cl_6$
CAS: 319-85-7
ENCS: 3-2250、9-1652
MW: 290.83
mp: 309°C[11)]
bp: 60°C(0.50mmHg)[1)]
SW: 0.0002g/kg(25°C)[2)]
Specific gravity: 1.87(20°C)[10)]
Molecular formula: 3.78[1)]

[11-3] γ-HCH (synonym:Lindane)



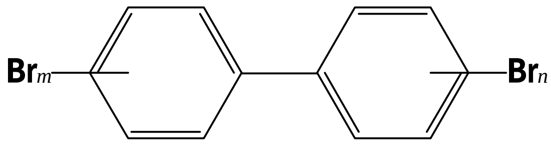
Molecular formula: $C_6H_6Cl_6$
CAS: 58-89-9
ENCS: 3-2250、9-1652
MW: 290.83
mp: 112.5°C[1)]
bp: 323.4°C[1)]
SW: 0.0078g/kg(25°C)[1)]
Specific gravity: 1.85(20°C)[10)]
Molecular formula: 3.72[3)]

[11-4] δ-HCH



Molecular formula: $C_6H_6Cl_6$
CAS: 319-86-8
ENCS: 3-2250、9-1652
MW: 290.83
mp: 141.5°C[1)]
bp: 60°C(0.36mmHg)[1)]
SW: Uncertain
Specific gravity: 1.87(20°C)[10)]
Molecular formula: 4.14[3)]

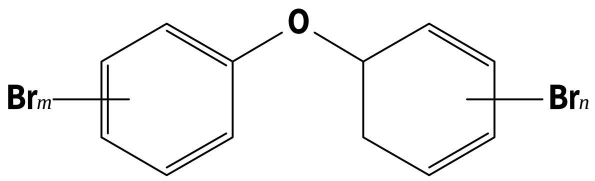
[12] Hexabromobiphenyls



m+n =6

Molecular formula:	$C_{12}H_4Br_6$
CAS:	36355-01-8
ENCS:	No pertinence
MW:	627.58
mp:	Not specified
bp:	Not specified
sw:	Not specified
Specific gravity:	Not specified
logPow:	Not specified

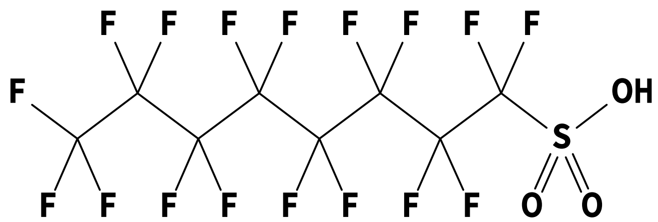
[13] Polybromodiphenyl ethers（Br_4～Br_{10}）



i = m+n =4～10

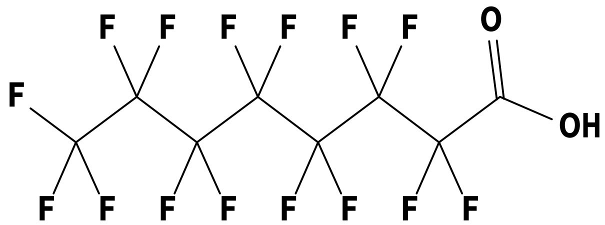
Molecular formula:	$C_{12}H_{(10-i)}Br_iO$（i = m+n =4～10）
CAS:	40088-47-9（Br_4）、32534-81-9（Br_5）、36483-60-0（Br_6）、68928-80-3（Br_7）、32536-52-0（Br_8）、63936-56-1（Br_9）、1163-19-5（Br_{10}）
ENCS:	3-61（Br_4）、3-2845（Br_6）
MW:	485.79～959.17
mp:	Not specified
bp:	Not specified
sw:	Not specified
Specific gravity:	Not specified
logPow:	Not specified

[14] Perfluorooctane sulfonic acid (PFOS)



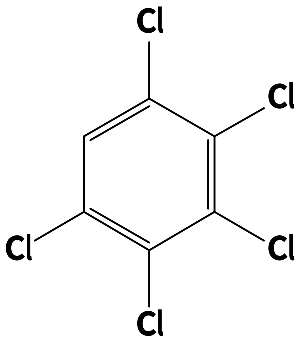
Molecular formula:	$C_8HF_{17}O_3S$
CAS:	1763-23-1
ENCS:	2-1595
MW:	500.13
mp:	>400°C（potassium salt）[12)]
bp:	Uncertain
sw:	519mg/L（20°C、potassium salt）[12)]
Specific gravity:	Uncertain
logPow:	Uncertain

[15] Perfluorooctanoic acid(PFOA)



Molecular formula:	$C_8HF_{15}O_2$
CAS:	335-67-1
ENCS:	2-1182、2-2659
MW:	414.07
mp:	54.3°C[1)]
bp:	192.4°C[1)]
sw:	9.5g/L（20°C）[13)]
Specific gravity:	1.79g/cm^3 [14)]
logPow:	6.3[14)]

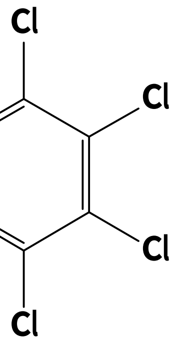
[16] Pentachlorobenzene



Molecular formula:	C_6HCl_5
CAS:	608-93-5
ENCS:	3-76
MW:	250.34
mp:	86°C[1]
bp:	277°C
sw:	0.00050g/kg（25°C）[1]
Specific gravity:	1.8342g/cm^3（16°C）[1]
logPow:	5.17[3]

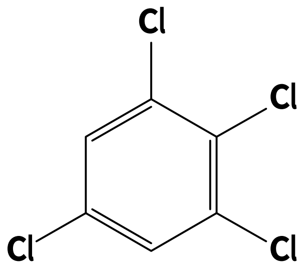
[17] Tetrachlorobenzenes

[17-1] 1,2,3,4-Tetrachlorobenzene



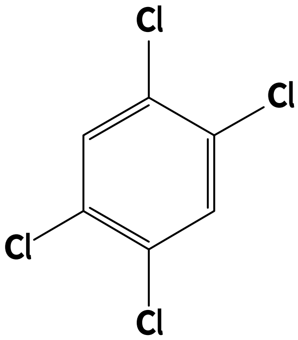
Molecular formula:	$C_6H_2Cl_4$
CAS:	634-66-2
ENCS:	3-76
MW:	215.89
mp:	47.5°C[1]
bp:	254°C[1]
sw:	0.007g/kg（25°C）[1]
Specific gravity:	Uncertain
logPow:	4.60[3]

[17-2] 1,2,3,5-Tetrachlorobenzene



Molecular formula:	$C_6H_2Cl_4$
CAS:	634-90-2
ENCS:	3-76
MW:	215.89
mp:	54.5°C[1]
bp:	246°C[1]
sw:	0.0035g/kg（25°C）[1]
Specific gravity:	Uncertain
logPow:	4.56[3]

[17-3] 1,2,4,5-Tetrachlorobenzene



Molecular formula:	$C_6H_2Cl_4$
CAS:	95-94-3
ENCS:	3-76
MW:	215.89
mp:	139.5°C[1]
bp:	244.5°C[1]
sw:	0.00060g/kg（25°C）[1]
Specific gravity:	1.858g/cm^3（22°C）[1]
logPow:	4.64[3]

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13) OECD, Perfluorooctanoic Acid & Ammonium Perfluorooctanoate, SIDS Initial Assessment Profile for 26th SIAM (2008)
14) IPCS, International Chemical Safety Cards, Perfkuorooctanoic acid, ICSC1613 (2005)

3. Monitored site and procedure

In the Environmental Monitoring (of surface water, sediment, wildlife, and air), the sampling of specimens was entrusted to prefectural governments and government-designated cities across Japan and the specimens sampled were analysed by private analytical laboratories.

(1) Organisations responsible for sampling

Local communities	Organisations responsible for sampling	Monitored media			
		Surface water	Sediment	Wildlife	Air
Hokkaido	Hokkaido Institute of Environmental Sciences	○	○	○	○
Sapporo City	Sapporo City Institute of Public Health				○
Aomori Pref.	Aomori Prefectural Institute of Public Health and Environment	○	○		
	Aomori Prefectural Government Sanpachi District Administration Office Management and Local Coordination Division Hachinohe Environmental Management Office			○	
Iwate Pref.	Research Institute for Environmental Sciences and Public Health of Iwate Prefecture	○	○	○	○
Miyagi Pref.	Miyagi Prefectural Institute of Public Health and Environment	○	○	○	○
Sendai City	Sendai City Institute of Public Health		○		
Akita Pref.	Akita Research Center for Public Health and Environment	○	○		
Yamagata Pref.	Environmental Science Research Center of Yamagata Prefecture	○	○		
Fukushima Pref.	Fukushima Prefectural Institute of Environmental Research	○	○		
Ibaraki Pref.	Ibaraki Kasumigaura Environmental Science Center	○	○	○	○
Tochigi Pref.	Tochigi Prefectural Institute of Public Health and Environmental Science	○	○		
Gunma Pref.	Gunma Prefectural Institute of Public Health and Environmental Sciences				○
Saitama Pref.	Center for Environmental Science in Saitama	○			
Chiba Pref.	Chiba Prefectural Environmental Research Center		○		○
Chiba City	Chiba City Institute of Health and Environment	○	○		
Tokyo Met.	Tokyo Metropolitan Research Institute for Environmental Protection	○	○	○	○
Kanagawa Pref.	Kanagawa Environmental Research Center				○
Yokohama City	Yokohama Environmental Science Research Institute	○	○	○	○
Kawasaki City	Kawasaki Municipal Research Institute for Environmental Protection	○	○	○	
Niigata Pref.	Niigata Prefectural Institute of Public Health and Environmental Sciences	○	○		○
Toyama Pref.	Toyama Prefectural Environmental Science Research Center	○	○		○
Ishikawa Pref.	Ishikawa Prefectural Institute of Public Health and Environmental Science	○	○	○	○
Fukui Pref.	Fukui Prefectural Institute of Public Health and Environmental Science	○	○		
Yamanashi Pref.	Yamanashi Institute for Public Health		○		○
Nagano Pref.	Nagano Environmental Conservation Research Institute	○	○		○
Gifu Pref.	Gifu Prefectural Research Institute for Health and Environmental Sciences				○
Shizuoka Pref.	Shizuoka Institute of Environment and Hygiene	○	○		
Aichi Pref.	Aichi Environmental Research Center	○	○		
Nagoya City	Nagoya City Environmental Science Research Institute			○	○
Mie Pref.	Mie Prefecture Health and Environment Research Institute	○	○		○
Shiga Pref.	Lake Biwa Environmental Research Institute	○	○	○	
Kyoto Pref.	Kyoto Prefectural Institute of Public Health and Environment	○	○		○
Kyoto City	Kyoto City Institute of Public Health and Environmental sciences	○	○		
Osaka Pref.	Research Institute of Environment, Agriculture and Fisheries, Osaka Prefectural Government	○	○	○	○
Osaka City	Osaka City Institute of Public Health and Environmental Sciences	○	○		
Hyogo Pref.	Water Quality Division, Agricultural Administration and Environment Bureau, Hyogo Prefectural Government	○	○	○	○
Kobe City	Environmental Conservation and Guidance Division, (Environment Bureau, Kobe city)	○	○		○
Nara Pref.	Nara Prefectural Institute for Hygiene and Environment		○		○
Wakayama Pref.	Wakayama Prefectural Research Center of Environment and Public Health	○	○		

Local communities	Organisations responsible for sampling	Monitored media			
		Surface water	Sediment	Wildlife	Air
Tottori Pref.	Tottori Prefectural Institute of Public Health and Environmental Science			○	
Shimane Pref.	Shimane Prefectural Institute of Public Health and Environmental Science			○	○
Okayama Pref.	Okayama Prefectural Institute for Environmental Science and Public Health	○	○		
Hiroshima Pref.	Hiroshima Prefectural Technology Research Institute Health and Environment Center	○	○		
Hiroshima City	Hiroshima City Institute of Public Health			○	○
Yamaguchi Pref.	Yamaguchi Prefectural Public Health and Environment	○	○		○
Tokushima Pref.	Tokushima Prefectural Institute of Public Health and Environmental Sciences	○	○	○	○
Kagawa Pref.	Kagawa Prefectural Research Institute for Environmental Sciences and Public Health	○	○	○	○
Ehime Pref.	Ehime Prefectural Institute of Public Health and Environmental Science		○		○
Kochi Pref.	Kochi Prefectural Environmental Research Center	○	○	○	
Fukuoka Pref.	Fukuoka Institute of Health and Environmental Science				○
Kitakyushu City	Kitakyushu City Institute of Environmental Sciences	○	○	○	
Fukuoka City	Fukuoka City Institute for Hygiene and the Environment		○		
Saga Pref.	Saga Prefectural Environmental Research Center	○	○		○
Nagasaki Pref.	Public Relations and Public Hearing Division, Policy Planning and Coordination Bureau	○	○		
Kumamoto Pref.	Kumamoto Prefectural Institute of Public Health and Environmental Science	○			○
Oita Pref.	Environmental Preservation Division, Life and Environment Department		○	○	
Miyazaki Pref.	Miyazaki Prefectural Institute for Public Health and Environment	○	○		○
Kagoshima Pref.	Kagoshima Prefectural Institute forEnvironmental Research and Public Health	○	○	○	○
Okinawa Pref.	Okinawa Prefectural Institute of Health and Environment	○	○	○	○

(Note) Organisations responsible for sampling are described by their official names in FY 2009.

(2) Monitored sites (areas)

Monitored sites (areas) are shown in Table 3-1-1 and Figure 3-1-1 for surface water, Table 3-1-2 and Figure 3-1-2 for sediment, Table 3-1-3 and Figure 3-1-3 for wildlife and Table 3-1-4 and Figure 3-1-4 for air. The breakdown is summarized as follows.

Monitored media	Numbers of local communities	Numbers of target chemicals (groups)	Numbers of monitored sites (or areas)	Numbers of samples at a monitored site (or area)
Surface water	43	15	49	1
Sediment	48	15	64	3
Wildlife (bivalves)	7	14	7	5
Wildlife (fish)	15	14	18	5
Wildlife (birds)	2	14	2	5
Air (warm season)	35	14	37	1※
Air (cold season)	35	14	37	1※
All media	59	17	121	

(Note) For target chemicals [16] Pentachlorobenzene and [17] Tetrachlorobenzenes, 3 specimens were sampled at each sites, in both warm and cold seasons.

Table 3-1-1 List of monitored sites (surface water) in the Environmental Monitoring in FY 2009

Local communities	Monitored sites	Sampling dates
Hokkaido	Suzuran-ohashi Bridge, Riv Tokachi(Obihiro City)	October 22, 2009
	Ishikarikakokyo Bridge, Mouth of Riv. Ishikari(Ishikari City)	October 15, 2009
Aomori Pref.	Lake Jusan	October 7, 2009
Iwate Pref.	Riv. Toyosawa(Hanamaki City)	October 7, 2009
Miyagi Pref.	Sendai Bay(Matsushima Bay)	September 16, 2009
Akita Pref.	Lake Hachiro	September 29, 2009
Yamagata Pref.	Mouth of Riv. Mogami(Sakata City)	October 22, 2009
Fukushima Pref.	Onahama Port	October 21, 2009
Ibaraki Pref.	Tonekamome-ohasi Bridge, Mouth of Riv. Tone(Kamisu City)	October 22, 2009
Tochigi Pref.	Riv. Tagawa(Utsunomiya City)	October 13, 2009
Saitama Pref.	Akigaseshusui of Riv. Arakawa	November 19, 2009
Chiba City	Mouth of Riv. Hanami(Chiba City)	November 16, 2009
Tokyo Met.	Mouth of Riv. Arakawa(Koto Ward)	November 9, 2009
	Mouth of Riv. Sumida(Minato Ward)	November 9, 2009
Yokohama City	Yokohama Port	November 12, 2009
Kawasaki City	Keihin Canal, Port of Kawasaki	October 29, 2009
Niigata Pref.	Lower Riv. Shinano(Niigata City)	November 4, 2009
Toyama Pref.	Hagiura-bashi Bridge, Mouth of Riv. Jintsu(Toyama City)	November 7, 2009
Ishikawa Pref.	Mouth of Riv. Sai(Kanazawa City)	September 30, 2009
Fukui Pref.	Mishima-bashi Bridge, Riv. Shono(Tsuruga City)	October 16, 2009
Nagano Pref.	Lake Suwa(center)	October 20, 2009
Shizuoka Pref.	Riv. Tenryu(Iwata City)	October 15, 2009
Aichi Pref.	Nagoya Port	November 9, 2009
Mie Pref.	Yokkaichi Port	October 27, 2009
Shiga Pref.	Lake Biwa(center, offshore of Karasaki)	October 21, 2009
Kyoto Pref.	Miyazu Port	October 14, 2009
Kyoto City	Miyamae-bashi Bridge, Miyamae Bridge, Riv. Katsura(Kyoto City)	October 29, 2009
Osaka Pref.	Mouth of Riv. Yamato(Sakai City)	November 19, 2009
Osaka City	Osaka Port	September 28, 2009
Hyogo Pref.	Offshore of Himeji	October 16, 2009
Kobe City	Kobe Port(center)	October 20, 2009
Wakayama Pref.	Kinokawa-ohashi Bridge, Mouth of Riv. Kinokawa(Wakayama City)	November 20, 2009
Okayama Pref.	Offshore of Mizushima	October 26, 2009
Hiroshima Pref.	Kure Port	November 4, 2009
	Hiroshima Bay	November 4, 2009
Yamaguchi Pref.	Tokuyama Bay	October 20, 2009
	Offshore of Ube	October 15, 2009
	Offshore of Hagi	October 16, 2009
Tokushima Pref.	Mouth of Riv. Yoshino(Tokushima City)	October 1, 2009
Kagawa Pref.	Takamatsu Port	October 20, 2009
Kochi Pref.	Mouth of Riv. Shimanto(Shimanto City)	September 28, 2009
Kitakyushu City	Dokai Bay	October 21, 2009
Saga Pref.	Imari Bay	November 16, 2009
Nagasaki Pref.	Omura Bay	November 24, 2009
Kumamoto Pref.	Riv. Midori(Uto City)	November 13, 2009
Miyazaki Pref.	Mouth of Riv. Oyodo(Miyazaki City)	November 6, 2009
Kagoshima Pref.	Riv. Amori(Kirishima City)	October 20, 2009
	Gotanda-bashi Bridge, Riv. Gotanda(Ichikikushikino City)	October 29, 2009
Okinawa Pref.	Naha Port	October 14, 2009

Figure 3-1-1 Monitored sites (surface water) in the Environmental Monitoring in FY 2009

Table 3-1-2 List of monitored sites (sediment) in the Environmental Monitoring in FY 2009

Local communities	Monitored sites	Sampling dates
Hokkaido	Onnenai-ohashi Bridge, Riv. Teshio(Bifuka Town)	October 21, 2009
	Suzuran-ohashi Bridge, Riv Tokachi(Obihiro City)	October 22, 2009
	Ishikarikakokyo Bridge, Mouth of Riv. Ishikari(Ishikari City)	October 15, 2009
	Tomakomai Port	September 11, 2009
Aomori Pref.	Lake Jusan	October 7, 2009
Iwate Pref.	Riv. Toyosawa(Hanamaki City)	October 7, 2009
Miyagi Pref.	Sendai Bay(Matsushima Bay)	September 16, 2009
Sendai City	Hirose-ohashi Bridge, Riv. Hirose(Sendai City)	November 19, 2009
Akita Pref.	Lake Hachiro	September 29, 2009
Yamagata Pref.	Mouth of Riv. Mogami(Sakata City)	October 22, 2009
Fukushima Pref.	Onahama Port	October 21, 2009
Ibaraki Pref.	Tonekamome-ohasi Bridge, Mouth of Riv. Tone(Kamisu City)	October 22, 2009
Tochigi Pref.	Riv. Tagawa(Utsunomiya City)	October 13, 2009
Chiba Pref.	Coast of Ichihara and Anegasaki	October 28, 2009
Chiba City	Mouth of Riv. Hanami(Chiba City)	November 16, 2009
Tokyo Met.	Mouth of Riv. Arakawa(Koto Ward)	November 9, 2009
	Mouth of Riv. Sumida(Minato Ward)	November 9, 2009
Yokohama City	Yokohama Port	November 12, 2009
Kawasaki City	Mouth of Riv. Tama(Kawasaki City)	October 29, 2009
	Keihin Canal, Port of Kawasaki	October 29, 2009
Niigata Pref.	Lower Riv. Shinano(Niigata City)	November 4, 2009
Toyama Pref.	Hagiura-bashi Bridge, Mouth of Riv. Jintsu(Toyama City)	November 17, 2009
Ishikawa Pref.	Mouth of Riv. Sai(Kanazawa City)	September 30, 2009
Fukui Pref.	Mishima-bashi Bridge, Riv. Shono(Tsuruga City)	October 16, 2009
Yamanashi Pref.	Senshu-bashi Bridge, Riv. Arakawa(Kofu City)	January 19, 2010
Nagano Pref.	Lake Suwa(center)	October 20, 2009
Shizuoka Pref.	Shimizu Port	October 20, 2009
	Riv. Tenryu(Iwata City)	October 15, 2009
Aichi Pref.	Kinuura Port	November 9, 2009
	Nagoya Port	November 9, 2009
Mie Pref.	Yokkaichi Port	October 27, 2009
	Toba Port	October 20, 2009
Shiga Pref.	Lake Biwa(center, offshore of Minamihira)	October 21, 2009
	Lake Biwa(center, offshore of Karasaki)	October 21, 2009
Kyoto Pref.	Miyazu Port	October 14, 2009
Kyoto City	Miyamae-bashi Bridge, Miyamae Bridge, Riv. Katsura(Kyoto City)	October 29, 2009
Osaka Pref.	Mouth of Riv. Yamato(Sakai City)	November 19, 2009
Osaka City	Osaka Port	September 28, 2009
	Outside Osaka Port	September 28, 2009
	Mouth of Riv. Yodo(Osaka City)	September 28, 2009
	Riv. Yodo(Osaka City)	October 6, 2009
Hyogo Pref.	Offshore of Himeji	October 16, 2009
Kobe City	Kobe Port(center)	October 20, 2009
Nara Pref.	Riv. Yamato(Ooji Town)	October 13, 2009
Wakayama Pref.	Kinokawa-ohashi Bridge, Mouth of Riv. Kinokawa(Wakayama City)	November 20, 2009
Okayama Pref.	Offshore of Mizushima	October 26, 2009
Hiroshima Pref.	Kure Port	November 4, 2009
	Hiroshima Bay	November 4, 2009
Yamaguchi Pref.	Tokuyama Bay	October 20, 2009
	Offshore of Ube	October 15, 2009
	Offshore of Hagi	October 16, 2009
Tokushima Pref.	Mouth of Riv. Yoshino(Tokushima City)	October 1, 2009
Kagawa Pref.	Takamatsu Port	October 20, 2009
Ehime Pref.	Niihama Port	October 28, 2009
Kochi Pref.	Mouth of Riv. Shimanto(Shimanto City)	September 28, 2009
Kitakyushu City	Dokai Bay	October 21, 2009

Local communities	Monitored sites	Sampling dates
Fukuoka City	Hakata Bay	November 19, 2009
Saga Pref.	Imari Bay	November 16, 2009
Nagasaki Pref.	Omura Bay	November 24, 2009
Oita Pref.	Mouth of Riv. Oita(Oita City)	November 27, 2009
Miyazaki Pref.	Mouth of Riv. Oyodo(Miyazaki City)	November 6, 2009
Kagoshima Pref.	Riv. Amori(Kirishima City)	October 20, 2009
	Gotanda-bashi Bridge, Riv. Gotanda(Ichikikushikino City)	October 29, 2009
Okinawa Pref.	Naha Port	October 14, 2009

Figure 3-1-2 Monitored sites (sediment) in the Environmental Monitoring in FY 2009

Table 3-1-3 List of monitored areas (wildlife) in the Environmental Monitoring in FY 2009

Local communities	Monitored sites	Sampling dates	Wildlife species	
Hokkaido	Offshore of Kushiro	October 7, 2009	Fish	Rock greenling (*Hexagrammos lagocephalus*)
			Fish	Chum salmon (*Oncorhynchus keta*)
	Offshore of Japan Sea(offshore of Iwanai)	December 10, 2009	Fish	Greenling (*Hexagrammos otakii*)
Aomori Pref.	Kabu Is.(Hachinohe City)	July 3 ~ July 10, 2009	Birds	Black-taild gull (*Larus crassirostris*)
Iwate Pref.	Yamada Bay	October 27, 2009	Bibalves	Blue mussel (*Mytilus galloprovincialis*)
		December 18, 2009	Fish	Greenling (*Hexagrammos otakii*)
	Suburb of Morioka City	August 7, 2009	Birds	Gray starling (*Sturnus cineraceus*)
Miyagi Pref.	Sendai Bay(Matsushima Bay)	December 8, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Ibaraki Pref.	Offshore of Joban	November 4, 2009	Fish	Pacific saury (*Cololabis saira*)
Tokyo Met.	Tokyo Bay	September 8, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Yokohama City	Yokohama Port	November 13, 2009	Bibalves	Blue mussel (*Mytilus galloprovincialis*)
Kawasaki City	Offshore of Ogishima Island, Port of Kawasaki	November 3, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Ishikawa Pref.	Coast of Noto Peninsula	October 14, 2009	Bibalves	Blue mussel (*Mytilus galloprovincialis*)
Nagoya City	Nagoya Port	August 26, 2009	Fish	Striped mullet (*Mugil cephalus*)
Shiga Pref.	Lake Biwa, Riv. Azumi (Takashima City)	April 13, 2009	Fish	Dace (*Tribolodon hakonensis*)
Osaka Pref.	Osaka Bay	August 25, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Hyogo Pref.	Offshore of Himeji	December 20, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Tottori Pref.	Nakaumi	October 18, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Shimane Pref.	Shichirui Bay, Shimane Peninsula	October 13, 2009	Bibalves	Blue mussel (*Mytilus galloprovincialis*)
Hiroshima City	Hiroshima Bay	November 9 ~ 13, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Tokushima Pref.	Naruto	October 5, 2009	Bibalves	Hard-shelled mussel (*Mytilus coruscus*)
Kagawa Pref.	Takamatsu Port	September 24, 2009	Bibalves	Hard-shelled mussel (*Mytilus coruscus*)
Kochi Pref.	Mouth of Riv. Shimanto(Shimanto City)	September 28, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Kitakyushu City	Dokai Bay	July 24, 2009	Bibalves	Purplish bifurcate mussel (*Septifer virgatus*)
Oita Pref.	Mouth of Riv. Oita(Oita City)	November 20, 2009	Fish	Sea bass (*Lateolabrax japonicus*)
Kagoshima Pref.	West Coast of Satsuma Peninsula	December 14, 2009 ～February 1, 2010	Fish	Sea bass (*Lateolabrax japonicus*)
Okinawa Pref.	Nakagusuku Bay	January 6, 2010	Fish	Okinawa seabeam (*Acanthopagrus sivicolus*)

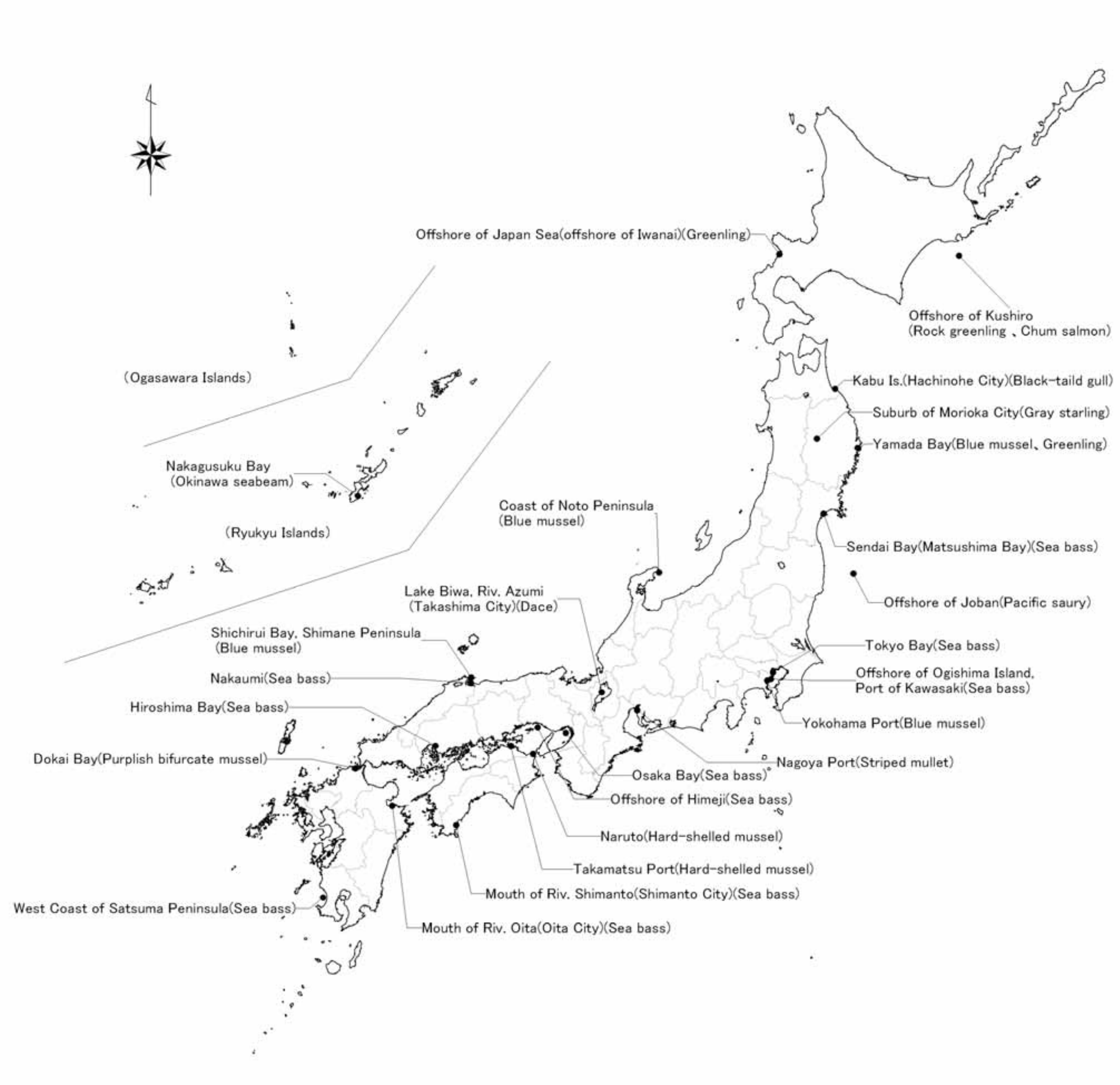

Figure 3-1-3 Monitored areas (wildlife) in the Environmental Monitoring in FY 2009

Table 3-1-4 List of monitored sites (air) in the Environmental Monitoring in FY 2008

Local communities	Monitored sites	Sampling dates (Warm season)	Sampling dates (Cold season)
Hokkaido	Oshima Subprefectural Office Building	September 28~ October 1, 2009	November 16〜19, 2009
Sapporo City	Sapporo Art Park(Sapporo City)	September 28~ October 1, 2009	November 17〜20, 2009
Iwate Pref.	Amihari Ski Area(Shizukuishi Town)	September 28~ October 1, 2009	November 16〜19, 2009
Miyagi Pref.	Miyagi Prefectural Institute of Public Health and Environment(Sendai City)	September 8〜15, 2009* or 8〜11, 2009**	December 7〜14, 2009* or 7〜10, 2009**
Ibaraki Pref.	Ibaraki Kasumigaura Environmental Science Center(Tsuchiura City)	September 4〜11, 2009* or 8〜11, 2009**	November 6〜13, 2009* or 10〜13, 2009**
Gunma Pref.	Gunma Prefectural Institute of Public Health and Environmental Sciences(Maebashi City)	September 4〜11, 2009* or 7〜10, 2009**	November 27〜December 4, 2009* or December 1〜4, 2009**
Chiba Pref.	Ichihara-Matsuzaki Air Quality Monitoring Station(Ichihara City)	September 29〜October2, 2009	November17〜20, 2009
Tokyo Met.	Tokyo Metropolitan Research Institute for Environmental Protection(Koto Ward)	September 9〜16, 2009* or 9〜12, 2009**	December9〜16, 2009* or 9〜12, 2009**
	Chichijima Island	September 26〜October 3, 2009* or September 26〜29, 2009**	November 27〜December 4, 2009* or November 27〜30, 2009**
Kanagawa Pref.	Kanagawa Environmental Research Center(Hiratsuka City)	September 28〜October 1, 2009* or September 29〜October 2, 2009**	November 9〜12, 2009
Yokohama City	Yokohama Environmental Science Research Institute(Yokohama City)	September 25〜October 2, 2009* or September 29〜October 2, 2009**	November 13〜20,2009* or November 17〜20, 2009**
Niigata Pref.	Oyama Air Quality Monitoring Station(Niigata City)	September 28〜October 1, 2009	December 7〜10, 2009
Toyama Pref.	Tonami Air Quality Monitoring Station(Tonami City)	September 7〜10, 2009	November 24〜27, 2009
Ishikawa Pref.	Ishikawa Prefectural Institute of Public Health and Environmental Science(Kanazawa City)	September 15〜18, 2009	November 30〜December 3, 2009
Yamanashi Pref.	Fujiyoshida Joint Prefectural GovernmentBuilding (Fujiyoshida City)	September 29〜October 2, 2009	November 24〜27, 2009
Nagano Pref.	Nagano Environmental Conservation Research Institute(Nagano City)	September 29〜October 6, 2009* or September 29〜October 2, 2009**	November 30〜December 7, 2009* or November 30〜December3, 2009**
Gifu Pref.	Gifu Prefectural Research Institute for Health and Environmental Sciences(Kakamigahara City)	September 15〜18, 2009* or October 5〜9, 2009**	November 16〜19, 2009
Nagoya City	Chikusa Ward Heiwa Park (Nagoya City)	September 28〜October 5, 2009* or September 28〜October 1, 2009**	December15〜22, 2009* or December15〜18, 2009**
Mie Pref.	Mie Prefecture Health and Environment Research Institute(Yokkaichi City)	September 1〜4, 2009	December 14〜17, 2009
Kyoto Pref.	Kyoto Prefecture Joyo Senior High School(Joyo City)	October 13〜16, 2009	December 14〜17, 2009
Osaka Pref.	Research Institute of Environment, Agriculture and Fisheries, Osaka Prefectural Government(Osaka City)	September 14〜17, 2009	December 7〜10, 2009
Hyogo Pref.	Hyogo Prefectural Environmental Research Center(Kobe City)	September 28〜October 1, 2009	November16〜19, 2009* or December 15〜18, 2009**
Kobe City	Fukiai Air Quality Monitoring Station(Kobe City)	September 7〜10, 2009* or September 28〜October 1, 2009**	November 9〜12, 2009
Nara Pref.	Tenri Air Quality Monitoring Station(Tenri City)	September 28〜October 1, 2009* or September 28〜30,2009 and October 1〜2, 2009**	November 9〜12, 2009
Shimane Pref.	Oki National Acid Rain Observatory(Okinoshima Town)	October 6〜9, 2009	December 1〜4, 2009

Hiroshima City	Hiroshima City Kokutaiji Junior High School(Hiroshima City)	September 7～10, 2009	November 16～19, 2009
Yamaguchi Pref.	Yamaguchi Prefectural Public Health and Environment(Yamaguchi City)	September 7～14, 2009* or September 7～10, 2009**	December 7～14, 2009* or December 7～10, 2009**
	Hagi City Government Building, Mishima Branch(Hagi City)	September 8～15, 2009* or September 8～11, 2009**	December 8～15, 2009* or December 8～11, 2009**
Tokushima Pref.	Tokushima Prefectural Institute of Public Health and Environmental Sciences(Tokushima City)	September 28～October 1, 2009	December 16～19, 2009
Kagawa Pref.	Takamatsu Joint Prefectural Government Building (Takamatsu City) Kagawa Prefectural Public Swimming Pool(Takamatsu City) as a reference site	September 10～17, 2009* or September 10～13, 2009**	November 25～December 2, 2009* or November 25～26, 2009 and November 27～29, 2009**
Ehime Pref.	Ehime Prefectural Government Nanyo Regional Office (Uwajima City)	September 29～October 2, 2009	November 14～17, 2009
Fukuoka Pref.	Omuta City Government Building(Omuta City)	October 5～8, 2009* or October 5～6, 2009 and October 7～9, 2009**	December 7～10, 2009
Saga Pref.	Saga Prefectural Environmental Research Center(Saga City)	September 8～15, 2009* or September 8～11, 2009**	December 10～17, 2009* or December 10～13, 2009**
Kumamoto Pref.	Kumamoto Prefectural Institute of Public Health and Environmental Science(Udo City)	September 28～October 1, 2009	December 14～17, 2009
Miyazaki Pref.	Miyazaki Prefectural Institute for Public Healthand Environment (Miyazaki City)	August 31～ September 7, 2009* or August31～September 3, 2009**	November 17～24, 2009* or November 17～20, 2009**
Kagoshima Pref.	Kagoshima Prefectural Institute for Environmental Research and Public Health(Kagoshima City)	September 28～October 1, 2009	November 30～December 3, 2009
Okinawa Pref.	Cape Hedo(Kunigami Village)	September 7～10, 2009	November 24～27, 2009

(Note) " * " means sampling dates for the target chemicals (except for [16] Pentachlorobenzene and [17] Tetrachlorobenzenes) with High volume air sampler or Middle volume air sampler. " ** " means sampling dates for the target chemicals [16] Pentachlorobenzene and [17] Tetrachlorobenzenes with Low volume air sampler.

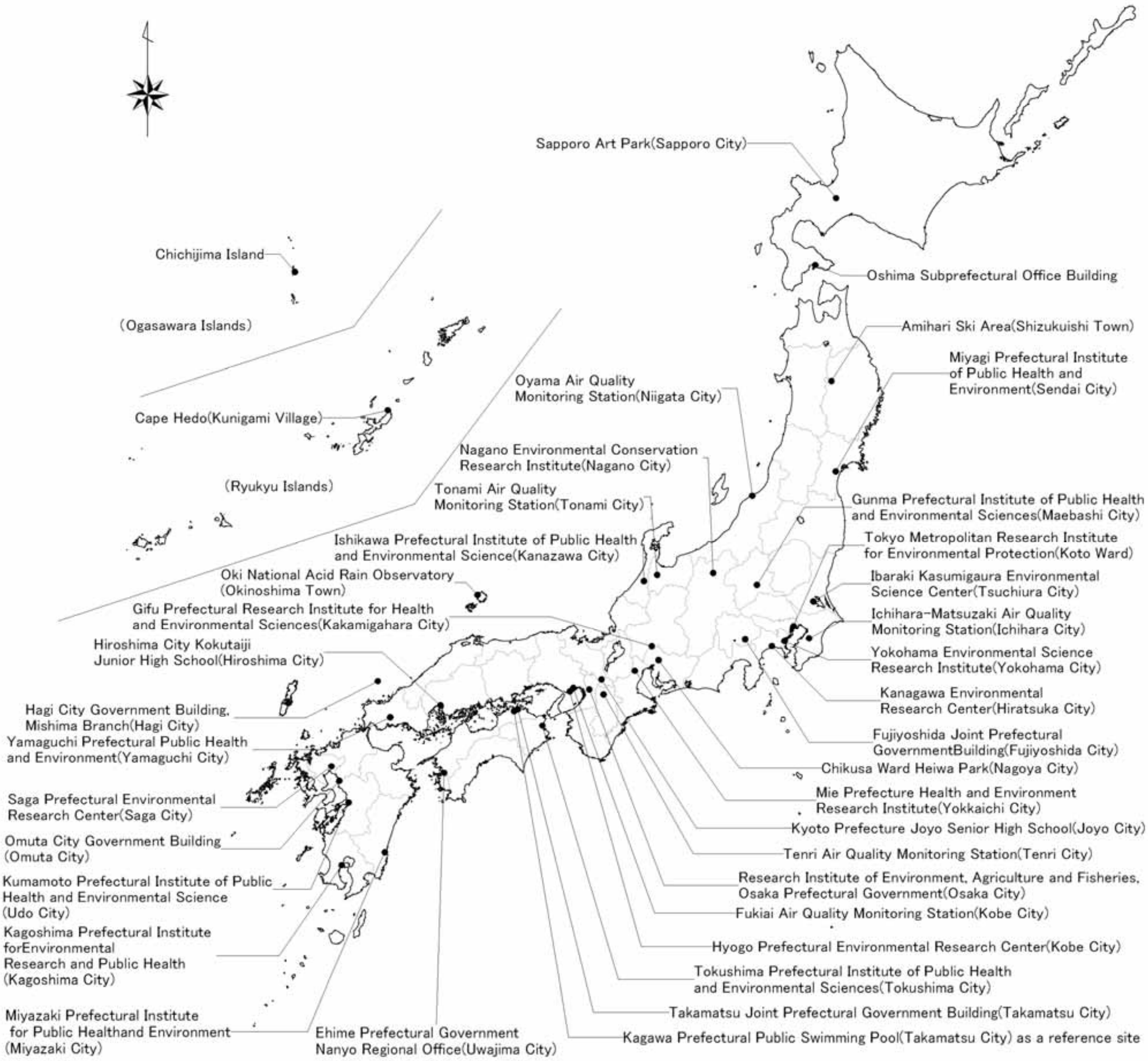

Figure 3-1-4 Monitored sites (air) in the Environmental Monitoring in FY 2009

(3) Target species

The species to be monitored among the wildlife media were selected considering the possibility of international comparison, as well as their significance and practicality as indicators: 3 bivalves (predominantly blue mussel), 8 fishes (predominantly sea bass), and 2 birds, namely, 13 species in total.

The properties of the species determined as targets in the FY 2009 monitoring are shown in Table 3-2. Moreover, Table 3-3 summarizes the outline of the samples used for analysis. Here, in the case of the black-tailed gull, prefledged juveniles (sacrificed) were used as samples.

(4) Sampling method of specimens

The sampling of specimens and the preparation of samples were carried out following the “Environmental Monitoring Instruction Manual” (No. 040309001, published on March 9th, 2004) by the Environment Health and Safety Division, Environmental Health Department, Ministry of the Environment of Japan (MOE).

Table 3-2 Properties of target species

Species		Properties	Monitored areas	Aim of monitoring	Notes
Bibalves	Blue mussel (*Mytilus galloprovincialis*)	① Distributed worldwide, excluding tropical zones ② Adheres to rocks in inner bays and to bridge piers	・Yamada Bay ・Yokohama Port ・Coast of Noto Peninsula • Shitirui Bay • Dokai Bay	Follow-up of the environmental fate and persistency in specific areas	Monitored in the 5 areas with different levels of persistency
	Hard-shelled mussel (*Mytilus coruscus*)	① Distributed in various areas of southern Hokkaido and southward ② Adheres to rocks where the current is fast (1-10 m/s)	・Naruto ・Takamatsu Port	Follow-up of the environmental fate and persistency in specific areas	
	Purplish bifurcate mussel (*Septifer virgatus*)	① Distributed in various areas of southern Hokkaido and southward ② Adheres to subtidal rocks	・Dokai Bay	Follow-up of the environmental fate and persistency in specific areas	
Fish	Greenling (*Hexagrammos otakki*)	① Distributed from Hokkaido to southern Japan, the Korean Peninsula, and China ② Lives in shallow seas of 5-50 m depth from sea level	・Offshore of Iwanai ・Yamada Bay	Follow-up of the environmental fate and persistency in specific areas	
	Rock greenling (*Hexagrammos lagocephalus*)	① Lives in cold-current areas of Hidaka and eastward (Hokkaido) ② Larger than the greenling and eats fish smaller than its mouth size at the sea bottom	・Offshore of Kushiro	Follow-up of the environmental fate and persistency in specific areas	
	Pacific saury (*Cololabis saira*)	① Distributed widely in northern Pacific Ocean ② Migrates around Japanese Archipelago; in Chishima in autumn and northern Kyushu in winter ③ Bioaccumulation of chemicals is said to be moderate	・Offshore of Joban	Follow-up of the environmental fate and persistency around the Japanese archipelago	
	Chum salmon (*Oncorhynchus keta*)	① Distributed in northern Pacific Ocean, Sea of Japan, Bering Sea, Sea of Okhotsk, the whole of the Gulf of Alaska, and part of the Arctic Ocean ② Runs the Tone River on the Pacific Ocean side and rivers in Yamaguchi Prefecture and northward on the Sea of Japan side in Japan ③ Bioaccumulation of chemicals is said to be moderate	・Offshore of Kushiro	Follow-up of the environmental fate and persistency on a global scale	
	Sea bass (*Lateolabrax japonicus*)	① Distributed around the shores of various areas in Japan, the Korean Peninsula, and the coastal areas of China ② Sometimes lives in a freshwater environment and brackish-water regions during its life cycle ③ Bioaccumulation of chemicals is said to be high	・Matsushima Bay ・Tokyo Bay ・Kawasaki Port ・Osaka Bay ・Offshore of Himeji ・Nakaumi ・Hiroshima Bay ・Mouth of Riv. Shimanto ・Mouth of Riv. Oita(Oita City) ・West Coast of Satsuma Peninsula	Follow-up of the environmental fate and persistency in specific areas	Monitored in the 10 areas with different levels of persistency
	Striped mullet (M*ugil cephalus*)	① Distributed widely in the worldwide tropical zones and subtropical zones ② Sometimes lives in a freshwater environment and brackish-water regions during its life cycle	・Nagoya Bay	Follow-up of the environmental fate and persistency in specific areas	

Species		Properties	Monitored areas	Aim of monitoring	Notes
	Okinawa seabeam (*Acanthopagrus sivicolus*)	① Distributed around Nansei Shoto (Ryukyu Islands) ② Lives in coral reefs and in bays into which rivers flow	・Kanagusuku Bay	Follow-up of the environmental fate and persistency in specific areas	
	Dace (*Tribolodon hakonensis*)	① Distributed widely in freshwater environments throughout Japan ② Preys mainly on insects	・Lake Biwa, Riv. Azumi (Takashima City)	Follow-up of the environmental fate and persistency in specific areas	
Birds	Gray starling (*Sturnus cineraceus*)	① Distributed widely in the Far East (Related species are distributed worldwide) ② Eats primarily insects	・Morioka City	Follow-up of the environmental fate and persistency in northern Japan	
	Black-taild gull (*Larus crassirostris*)	① Breeds mainly in the sea off Japan ② Breeds in groups at shore reefs and in grassy fields	・Kabu Is. (Hachinohe City)	Follow-up of the environmental fate and persistency in specific areas	

Table 3-3-1 Basic data of specimens (bivalves as wildlife) in the Environmental Monitoring in FY 2009

Bivalve species (Area)	No.	Sampling month	Sex	Number of animals	Weight (g) (Average)	Length (cm) (Average)	Water content (%)	Lipid content (%)
Blue mussel *Mytilus galloprovincialis* (Yamada Bay)	1	October, 2009	Uncertain	122	28.1～ 37.1 (32.8)	8.2～ 8.7 (8.4)	82.3	2.0
	2		Uncertain	154	25.8～ 38.2 (30.4)	7.8～ 8.1 (8.0)	82.4	2.2
	3		Uncertain	182	22.7～ 34.4 (28.2)	7.6～ 7.8 (7.7)	82.1	2.3
	4		Uncertain	242	18.6～ 31.4 (25.2)	7.3～ 7.5 (7.4)	82.6	2.2
	5		Uncertain	287	14.3～ 27.1 (21.5)	6.1～ 7.2 (6.8)	82.6	2.1
Blue mussel *Mytilus galloprovincialis* (Yokohama Port)	1	November, 2009	Uncertain	293	2.7～ 13.2 (7.4)	3.4～ 5.1 (4.2)	90.2	0.8
	2		Uncertain	238	4.7～ 15.3 (8.6)	3.2～ 5.1 (4.3)	89.6	0.7
	3		Uncertain	264	3.0～ 14.1 (7.5)	3.2～ 5.1 (4.1)	89.0	0.7
	4		Uncertain	231	2.9～ 19.0 (8.3)	3.1～ 6.0 (4.1)	89.8	0.7
	5		Uncertain	274	4.2～ 15.2 (7.5)	3.2～ 5.5 (4.1)	89.7	0.8
Blue mussel *Mytilus galloprovincialis* (Coast of Noto Peninsula)	1	October, 2009	Uncertain	90	53.4～ 129.8 (86.9)	6.4～ 9.4 (7.5)	75.2	2.4
	2		Uncertain	150	39.9～ 70.5 (55.3)	6.1～ 7.1 (6.7)	74.8	2.5
	3		Uncertain	200	26.7～ 50.4 (42.5)	5.5～ 6.3 (5.9)	75.7	2.6
	4		Uncertain	250	19.6～ 38.4 (28.3)	4.1～ 5.3 (4.8)	71.8	2.9
	5		Uncertain	300	11.3～ 23.7 (18.6)	3.5～ 5.1 (4.1)	71.3	2.7
Blue mussel *Mytilus galloprovincialis* (Shitirui Bay)	1	October, 2009	Uncertain	300	25.0～ 41.6 (31.1)	6.3～ 7.5 (6.9)	77.4	2.0
	2		Uncertain	280	20.6～ 37.3 (26.7)	5.8～ 7.3 (6.7)	77.4	2.1
	3		Uncertain	350	17.9～ 28.7 (22.2)	5.8～ 7.0 (6.3)	76.1	2.0
	4		Uncertain	400	14.6～ 25.6 (19.8)	5.4～ 6.6 (5.9)	77.0	1.9
	5		Uncertain	200	32.8～ 63.9 (44.2)	6.8～ 8.7 (7.9)	77.2	2.0
Hard-shelled mussel *Mytilus coruscus* (Naruto)	1	October, 2009	Mixed	32	219 ～ 421 (326)	13.0～ 17.0 (14.6)	71	1.4
	2		Mixed	27	254 ～ 512 (400)	14.0～ 17.5 (15.8)	70	1.3
	3		Mixed	27	387 ～ 600 (490)	14.0～ 18.5 (16.6)	77	1.0
	4		Mixed	23	385 ～ 633 (482)	15.0～ 18.0 (16.5)	78	1.0
	5		Mixed	24	374 ～ 593 (502)	15.5～ 19.5 (17.6)	71	0.9
Hard-shelled mussel *Mytilus coruscus* (Takamatsu Port)	1	September, 2009	Uncertain	30	78 ～ 326 (168)	8.7～ 14.0 (10.8)	51.7	2.3
	2		Uncertain	30	70 ～ 408 (178)	7.8～ 16.2 (11.0)	58.1	2.1
	3		Uncertain	30	52 ～ 393 (160)	7.9～ 14.6 (10.7)	48.4	1.8
	4		Uncertain	35	51 ～ 534 (213)	7.2～ 16.4 (11.3)	52.0	2.4
	5		Uncertain	35	67 ～ 335 (132)	7.8～ 14.2 (10.0)	53.9	2.5
Purplish bifurcate mussel *Septifer virgatus* (Dokai Bay)	1	July, 2009	Mixed	370	3.6～ 15.9 (8.6)	3.2～ 5.2 (4.1)	81.0	3.4

Table 3-3-2 Basic data of specimens (fish as wildlife) in the Environmental Monitoring in FY 2009

Fish species (Area)	No.	Sampling month	Sex	Number of animals	Weight (g) (Average)	Length (cm) (Average)	Water content (%)	Lipid content (%)
Rock greenling *Hexagrammos otakki* (Offshore of Kushiro)	1	October, 2009	Female	5	650 ～ 920 (802)	35 ～ 37 (36)	71.4	4.0
	2		Female	5	690 ～ 960 (858)	35 ～ 38 (37)	71.9	2.9
	3		Mixed	6	700 ～ 820 (762)	34 ～ 37 (35)	73.0	2.7
	4		Mixed	6	640 ～ 930 (782)	32 ～ 39 (35)	72.7	2.9
	5		Mixed	6	700 ～ 1,200 (880)	33 ～ 44 (37)	72.5	3.3
Chum salmon *Oncorhynchus keta* (Offshore of Kushiro)	1	October, 2009	Female	1	4,300 (4,300)	73 (73)	71.1	3.5
	2		Female	1	4,320 (4,320)	68 (68)	70.8	3.1
	3		Female	1	4,380 (4,380)	70 (70)	69.7	4.4
	4		Female	1	4,300 (4,300)	70 (70)	70.8	3.9
	5		Female	1	4,500 (4,500)	75 (75)	70.6	3.0
Greenling *Hexagrammos lagocephalus* (Offshore of Iwanai)	1	December, 2009	Mixed	8	470 ～ 620 (531)	35 ～ 37 (36)	77.0	4.3
	2		Mixed	7	450 ～ 1,080 (596)	34 ～ 45 (36)	78.6	1.7
	3		Mixed	8	490 ～ 1,050 (805)	33 ～ 45 (36)	78.2	1.9
	4		Mixed	8	400 ～ 1,180 (608)	33 ～ 46 (36)	77.8	2.2
	5		Mixed	8	450 ～ 750 (549)	34 ～ 40 (36)	78.5	1.6
Greenling *Hexagrammos lagocephalus* (Yamada Bay)	1	December, 2009	Uncertain	5	575.0～ 1,440.9 (837.5)	37.5～ 45.6 (39.6)	78.6	2.1
	2		Uncertain	6	576.6～ 741.7 (658.8)	35.0～ 37.5 (36.3)	76.8	2.4
	3		Uncertain	9	435.5～ 582.8 (506.6)	31.9～ 35.0 (34.1)	76.4	2.4
	4		Uncertain	12	321.6～ 479.4 (418.0)	29.9～ 31.9 (31.6)	74.8	3.1
	5		Uncertain	15	196.2～ 401.0 (326.4)	25.5～ 29.8 (28.8)	75.6	2.8
Sea bass *Lateolabrax japonicus* (Matsushima Bay)	1	December, 2009	Mixed	42	75.7～ 123 (92.6)	17.0～ 19.7 (18.0)	76.9	1.2
	2		Mixed	45	69.7～ 114 (89.5)	16.8～ 20.0 (18.1)	77.4	1.1
	3		Mixed	39	82.7～ 131 (101)	17.2～ 20.3 (18.9)	77.3	1.3
	4		Mixed	40	79.8～ 192 (98.6)	17.0～ 23.5 (18.4)	77.2	1.3
	5		Mixed	43	73.6～ 155 (92.3)	16.4～ 20.8 (18.2)	77.2	1.3
Pacific saury *Cololabis saira* (Offshore of Joban)	1	November, 2009	Mixed	70	45 ～ 90 (76)	20 ～ 27 (24)	65.7	11.6
	2		Mixed	54	90 ～ 119 (102)	25 ～ 28 (26)	62.9	15.2
	3		Mixed	34	103 ～ 186 (120)	25 ～ 32 (28)	61.6	16.5
	4		Mixed	30	140 ～ 196 (153)	28 ～ 32 (29)	59.2	17.2
	5		Mixed	40	51 ～ 173 (106)	21 ～ 31 (26)	61.0	16.3
Sea bass *Lateolabrax japonicus* (Tokyo Bay)	1	September, 2009	Mixed	3	1,446 ～ 1,687 (1,606)	44.2～ 49.5 (47.6)	73.2	3.7
	2		Mixed	3	1,538 ～ 1,601 (1,563)	45.0～ 47.8 (46.7)	73.8	3.6
	3		Mixed	4	1,260 ～ 1,354 (1,311)	44.8～ 45.8 (45.2)	75.2	2.8
	4		Mixed	5	913 ～ 1,234 (1,082)	37.6～ 42.2 (40.8)	73.8	2.8
	5		Mixed	6	943 ～ 1,293 (1,084)	37.0～ 43.6 (40.8)	75.2	2.6
Sea bass *Lateolabrax japonicus* (Kawasaki Port)	1	November, 2009	Female	13	350 ～ 480 (395)	28.0～ 31.0 (30.0)	77.8	1.4
	2		Female	11	400 ～ 580 (464)	31.5～ 34.8 (32.5)	74.3	1.5
	3		Female	9	460 ～ 750 (610)	34.9～ 39.5 (36.5)	70.6	1.1
	4		Male	13	340 ～ 540 (425)	28.5～ 34.0 (31.7)	73.6	2.0
	5		Male	8	500 ～ 710 (633)	34.0～ 37.5 (35.9)	74.2	2.3
Striped mullet *Mugil cephalus* (Nagoya Port)	1	August, 2009	Uncertain	5	1,009 ～ 1,100 (1,051)	39.2～ 40.4 (39.9)	71.5	4.1
	2		Uncertain	5	1,101 ～ 1,151 (1,126)	39.5～ 40.5 (40.2)	71.8	3.6
	3		Uncertain	5	1,153 ～ 1,221 (1,200)	40.3～ 42.5 (41.6)	73.8	3.2
	4		Uncertain	5	1,235 ～ 1,262 (1,248)	41.5～ 42.6 (42.1)	72.6	4.4
	5		Uncertain	5	1,305 ～ 1,818 (1,451)	42.0～ 48.5 (44.2)	71.7	5.4
Dace *Tribolodon hakonensis* (Lake Biwa, Riv. Azumi)	1	April, 2009	Female	20	150.9～ 316.7 (214.3)	22.3～ 29.2 (24.9)	75.7	3.1
	2		Male	25	153.4～ 274.5 (196.8)	22.1～ 26.5 (23.9)	75.1	3.4
	3		Female	20	131.0～ 246.4 (193.4)	22.1～ 27.5 (24.3)	76.1	3.2
	4		Male	26	148.9～ 255.6 (176.6)	21.7～ 25.9 (23.5)	74.8	3.8
	5		Female	20	156.3～ 297.8 (210.9)	22.8～ 27.0 (24.7)	75.9	2.9
Sea bass *Lateolabrax japonicus* (Osaka Bay)	1	August, 2009	Uncertain	6	850 ～ 1,042 (935)	33.0～ 40.0 (37.7)	71.4	3.7
	2		Uncertain	5	884 ～ 972 (932)	37.5～ 39.0 (38.2)	73.2	3.4
	3		Uncertain	5	714 ～ 845 (789)	34.5～ 37.0 (36.0)	73.4	3.8
	4		Uncertain	7	608 ～ 666 (644)	33.0～ 34.5 (33.7)	75.2	2.7
	5		Uncertain	6	521 ～ 712 (640)	30.0～ 35.0 (32.9)	72.5	2.7

Fish species (Area)	No.	Sampling month	Sex	Number of animals	Weight (g) (Average)	Length (cm) (Average)	Water content (%)	Lipid content (%)
Sea bass *Lateolabrax japonicus* (Offshore of Himeji)	1	December, 2009	Male	3	1,500 ～ 1,700 (1,600)	58 ～ 65 (61)	77.4	0.5
	2		Male	2	2,210 ～ 2,500 (2,360)	58 ～ 64 (61)	76.5	0.7
	3		Female	3	1,800 ～ 2,400 (2,070)	58 ～ 62 (60)	75.3	1.2
	4		Female	3	1,580 ～ 2,800 (2,330)	60 ～ 68 (63)	78.2	1.0
	5		Female	2	2,180 ～ 3,000 (2,590)	61 ～ 66 (64)	75.3	1.4
Sea bass *Lateolabrax japonicus* (Nakaumi)	1	October, 2009	Mixed	9	610 ～ 891 (753)	35.2～ 40.3 (37.7)	79.1	1.5
	2		Mixed	11	538 ～ 846 (700)	33.0～ 39.1 (36.1)	79.4	1.5
	3		Mixed	12	470 ～ 760 (597)	33.0～ 37.0 (34.6)	79.8	1.1
	4		Mixed	13	430 ～ 757 (567)	30.8～ 37.3 (34.0)	79.8	1.1
	5		Mixed	15	336 ～ 545 (471)	28.2～ 34.1 (31.9)	79.0	1.2
Sea bass *Lateolabrax japonicus* (Hiroshima Bay)	1	November, 2009	Male	9	454 ～ 647 (558)	30 ～ 36 (34)	77.6	1.6
	2		Female	6	457 ～ 645 (554)	30 ～ 36 (33)	77.9	1.4
	3		Female	5	458 ～ 751 (637)	33 ～ 37 (35)	76.5	1.7
	4		Female	6	470 ～ 788 (566)	32 ～ 37 (34)	77.9	1.4
	5		Female	5	583 ～ 769 (654)	34 ～ 39 (35)	78.8	1.3
Sea bass *Lateolabrax japonicus* (Mouth of Riv. Shimanto)	1	September, 2009	Mixed	9	51.7～ 569.2 (323.4)	14.0～ 31.4 (24.1)	77.0	1.9
	2		Mixed	15	78.5～ 367.3 (243.3)	16.0～ 26.5 (22.4)	77.8	1.2
	3		Mixed	13	76.2～ 307.8 (244.7)	16.7～ 26.5 (22.9)	77.9	1.0
	4		Mixed	13	61.1～ 323.7 (221.9)	15.0～ 24.0 (21.8)	77.4	1.2
	5		Mixed	17	133.5～ 236.0 (177.2)	18.5～ 23.0 (20.5)	77.5	1.4
Sea bass *Lateolabrax japonicus* (Mouth of Riv. Oita(Oita City))	1	November, 2009	Female	1	3,442	64.5	72.6	2.8
	2		Female	1	4,020	69.1	73.0	2.8
	3		Female	1	3,146	65.2	76.4	2.8
	4		Female	2	982 ～ 1,782 (1,382)	40.3～ 55.4 (47.8)	67.9	1.0
	5		Uncertain	2	1,085 ～ 1,526 (1,305)	45.5～ 51.5 (48.5)	73.3	1.0
Sea bass *Lateolabrax japonicus* (West Coast of Satsuma Peninsula)	1	December, 2009 ～ February, 2010	Male	4	947.0～ 1,223 (1,068)	44.0～ 47.0 (45.6)	79.3	0.6
	2		Mixed	8	374.3～ 841.2 (564.8)	30.5～ 41.0 (34.8)	78.3	1.0
	3		Mixed	10	337.6～ 395.8 (360.9)	26.7～ 29.5 (28.2)	78.0	0.8
	4		Mixed	10	311.8～ 381.1 (346.3)	26.5～ 29.0 (27.5)	77.7	0.9
	5		Mixed	12	255.0～ 320.4 (273.8)	23.8～ 26.9 (25.3)	76.9	1.4
Okinawa seabeam *Acanthopagrus sivicolus* (Nakagusuku Bay)	1	January, 2010	Female	3	892 ～ 999 (945)	30.2～ 32.0 (31.0)	76	1.8
	2		Female	3	1,020 ～ 1,224 (1,106)	31.7～ 33.7 (32.3)	76	2.0
	3		Male	3	969 ～ 1,270 (1,102)	31.1～ 34.8 (32.8)	75	2.3
	4		Female	3	1,239 ～ 1,360 (1,279)	32.5～ 34.3 (33.7)	76	1.6
	5		Female	3	1,367 ～ 1,534 (1,411)	34.5～ 37.7 (35.9)	75	1.8

Table 3-3-3 Basic data of specimens (birds as wildlife) in the Environmental Monitoring in FY 2009

Bird species (Area)	No.	Sampling month	Sex	Number of animals	Weight (g) (Average)	Length (cm) (Average)	Water content (%)	Lipid content (%)
Black-taild gull *Larus crassirostris* (Kabu Is (Hachinohe City))	1	July, 2009	Uncertain	61	256 ～ 565 (365)	15.5～ 23 (21)	62.4	3.5
	2		Uncertain	44	283 ～ 523 (392)	23 ～ 25 (24)	61.9	3.1
	3		Uncertain	37	319 ～ 577 (417)	25 ～ 30 (26)	61.4	3.6
	4		Uncertain	31	359 ～ 522 (442)	25 ～ 28 (28)	60.3	3.5
	5		Uncertain	30	334 ～ 582 (454)	28 ～ 33 (30)	64.0	3.9
Gray starling *Sturnus cineraceus* (Morioka City)	1	September, 2009	Male	65	77.5～ 106.1 (90.4)	13.0～ 14.0 (13.4)	69.2	3.4
	2		Male	50	44.3～ 98.6 (85.8)	10.7～ 13.0 (12.6)	70.1	3.1
	3		Female	40	71.8～ 104.4 (88.6)	12.8～ 13.7 (13.2)	69.7	3.0
	4		Female	61	45.4～ 98.7 (82.4)	10.1～ 13.0 (12.5)	69.4	3.1
	5		Uncertain	49	67.6～ 114.5 (85.2)	11.5～ 13.8 (12.9)	69.5	2.9

4. Summary of monitoring results

The detection ranges are shown in Table 3-4, and the detection limits are shown in Table 3-5.

The monitoring results in FY 2009 were statistically analyzed together with the previous monitoring results, accumulated over the past 8 years (or 7 years) as a result of successive measurements at the same site or area from FY 2002 (FY 2003 for some substances and media), in order to detect inter-annual trends of increase or decrease over the 8 years (or 7 years). The results of the analyses are shown in Table 3-6.

○Data were carefully handled on the basis of following points

・For surface water

In Hyogo Pref., 50L and 250L water samples were collected with a high volume sampling system, and only the data of the 250L sample were used.

・For air

At each monitored site, the first sampling was for the monitoring in the warm season (August 31, 2009～October 16, 2009) and the second was for that in the cold season (November 6, 2009～December 22, 2009).

In Kagawa Pref., monitoring was carried out at not only the Takamatsu Joint Prefectural Government Building but also at the location of the Kagawa Prefectural Public Swimming Pool (Takamatsu City) as a reference site.

○Method for regression analysis and testing

The procedures described below were applied in an attempt to analyze and test the monitoring results obtained since FY 2002 (FY 2003 for air) in order to identify statistically significant differences which indicate inter-annual trends.

Using the monitoring results between FY 2002～2009 (FY 2003～2009 for air) successively measured at the same site or area,

(1) Parametric analysis

1-(a) The inter-annual trend analyses and tests were not performed when measured concentrations of more than 50% of samples did not reach the detection limit (nd) in any FY.

1-(b) Normality was assessed by Kolmogorov-Smirnov testing on the logarithmically-transformed measured concentrations in each FY. When the p-value was 5% or under, normality was confirmed again excluding measured concentrations which were obtained as outliers by Grubbs's test for outlier.

1-(c) In the inter-annual trend analyses, the trend of increase or decrease was evaluated by examining a slope obtained from simple linear regression analysis (simple log-linear regression model); the slope was deemed to be significant when the significance level (p-value) of T-test on the slope was less than 5 %.

1-(d) In addition, the agreement between the simple log-linear regression model results and measurement results was evaluated based on Akaike's Information Criterion (AIC). AICs were calculated for both "slope model (simple log-linear regression model)" and "non-slope model (residuals from the mean value model)". From these AICs, posteriori probability was calculated. When this probability was more than 95%, the measurement results were deemed to be in agreement with the simple log-linear regression model.

1-(e) When significance was found in 1-(c) and agreement was in 1-(d), the concentrations were deemed to have an inter-annual trend of increase or decrease, based on the slope from the simple linear regression analysis.

(2) Nonparametric analysis

2-(a) In cases of parametric analysis, inter-annual trends of decrease (or increase) in 1-(e) were not found , nonparametric analysis was employed in the first-half period (FY2002 or FY2003～2005) and the second-half period (FY2006～2009). However, nonparametric analysis was regarded as unsuitable and further testing was not carried out when the number of samples were less than 10 in each FY.

2-(b) Levene testing was employed in the first-half and second-half periods to test the homoscedasticity. The homoscedasticity was deemed to be recognized when the level of significance (p-value) of Levene testing was more than 5%.

2-(c) The second-half period indicated a lower concentration when it was deemed by U-test (p-value: more than 5%) that there is a significant difference between the first-half and second-half periods and the average concentration in the second-half period was lower than the first half.

・When the concentrations were deemed to have an inter-annual trend of decrease (or increase) in parametric analysis, the evaluation of parametric analysis was preferentially regarded as the entire analysis regardless of the evaluation of nonparametric analysis.

・When the concentrations were not deemed to have an inter-annual trend of decrease (or increase) in parametric analysis, and the second-half period indicated lower concentration than the first-half period, the evaluation of nonparametric analysis was preferentially regarded as the entire analysis.

・When the concentrations were not deemed to have an inter-annual trend of decrease (or increase), and the second-half period did not indicate lower concentration than the first-half period, an inter-annual trend was deemed not found.

Table 3-4-1 List of the detection ranges in the Environmental Monitoring in FY 2009 (Part 1)

No.	Target chemicals	Surface water（pg/L）		Sediment（pg/g-dry）	
		Renge (Frepuency)	Av.	Renge (Frepuency)	Av.
[1]	PCBs	14～3,900 (48/48)	210	17～1,700,000 (64/64)	6,300
[2]	HCB	2.4～180 (49/49)	15	nd～34,000 (64/64)	130
[3]	Aldrin	nd～22 (32/49)	0.7	nd～540 (64/64)	7.0
[4]	Dieldrin	2.7～650 (49/49)	36	1.1～3,000 (64/64)	43
[5]	Endrin	nd～67 (39/49)	2.0	nd～11,000 (63/64)	7.8
[6]	DDTs	9.0～820 (49/49)	61	17～2,600,000 (64/64)	1,600
	[6-1] *p,p'*-DDT	0.81～440 (49/49)	9.2	1.9～2,100,000 (64/64)	180
	[6-2] *p,p'*-DDE	3.4～240 (49/49)	23	6.7～50,000 (64/64)	600
	[6-3] *p,p'*-DDD	1.4～140 (49/49)	14	3.9～300,000 (64/64)	450
	[6-4] *o,p'*-DDT	0.43～100 (49/49)	2.4	nd～100,000 (64/64)	32
	[6-5] *o,p'*-DDE	nd～140 (47/49)	1.3	nd～33,000 (64/64)	31
	[6-6] *o,p'*-DDD	0.44～41 (49/49)	4.4	0.5～24,000 (64/64)	100
[7]	Chlordanes	12～2,200 (49/49)	82	8.1～29,000 (64/64)	280
	[7-1] *cis*-chlordane	4.4～710 (49/49)	29	2.0～8,600 (64/64)	74
	[7-2] *trans*-chlordane	3.0～690 (49/49)	23	2.1～8,300 (64/64)	79
	[7-3] Oxychlordane	nd～19 (45/49)	2.0	nd～150 (45/64)	2
	[7-4] *cis*-Nonachlor	1.4～210 (49/49)	7.1	1.4～4,700 (64/64)	46
	[7-5] *trans*-Nonachlor	2.7～530 (49/49)	20	2.0～7,800 (64/64)	75
[8]	Heptachlors	nd～85 (49/49)	6.9	nd～330 (58/64)	4.1
	[8-1] heptachlor	nd～17 (20/49)	tr(0.5)	nd～65 (59/64)	1.4
	[8-2] *cis*-heptachlor epoxide	0.8～72 (49/49)	5.5	nd～290 (63/64)	2.3
	[8-3] *trans*-heptachlor epoxide	nd (0/49)	nd	nd (0/64)	nd
[9]	Toxaphenes				
	[9-1] Parlar-26	nd (0/49)	nd	nd (0/64)	nd
	[9-2] Parlar-50	nd (0/49)	nd	nd (0/64)	nd
	[9-3] Parlar-62	nd (0/49)	nd	nd (0/64)	nd
[10]	Mirex	nd～0.5 (8/49)	nd	nd～620 (49/64)	1.3
[11]	HCHs				
	[11-1] *α*-HCH	14～560 (49/49)	74	nd～6,300 (64/64)	100
	[11-2] *β*-HCH	18～1,100 (49/49)	150	2.4～10,000 (64/64)	160
	[11-3] *γ*-HCH（synonym:Lindane）	5.1～280 (49/49)	32	nd～3,800 (64/64)	32
	[11-4] *δ*-HCH	tr(0.7)～450 (49/49)	10	nd～5,000 (64/64)	31

(Note 1) “Av.” indicates the geometric mean calculated by assuming nd (below the detection limit) to be half the value of the detection limit.

(Note 2) “Range” is based on the concentrations of the samples and “Frequency” is based on the number of sites or areas. Therefore “range” can be shown as “nd～” even if a target chemical is detected in all sites or areas.

Table 3-4-2 List of the detection ranges in the Environmental Monitoring in FY 2009 (Part 2)

No.	Target chemicals	Surface water（pg/L）		Sediment（pg/g-dry）	
		Renge (Frepuency)	Av.	Renge (Frepuency)	Av.
[12]	Hexabromobiphenyls	nd (0/49)	nd	nd～12 (21/64)	nd
[13]	Polybromodiphenyl ethers（Br4～Br10）	nd～4,100 (28/49)	tr(390)	nd～1,100,000 (64/64)	6,200
	[13-1] Tetrabromodiphenyl ethers	nd～160 (44/49)	17	nd～1,400 (51/64)	tr(54)
	[13-2] Pentabromodiphenyl ethers	nd～87 (43/49)	11	nd～1,700 (57/64)	30
	[13-3] Hexabromodiphenyl ethers	nd～18 (26/49)	tr(0.9)	nd～2,600 (53/64)	17
	[13-4] Heptabromodiphenyl ethers	nd～40 (9/49)	nd	nd～16,000 (51/64)	23
	[13-5] Octabromodiphenyl ethers	nd～56 (37/49)	3.0	nd～110,000 (63/64)	140
	[13-6] Nonabromodiphenyl ethers	nd～500 (32/49)	tr(46)	nd～230,000 (64/64)	780
	[13-7] Decabromodiphenyl ether	nd～3,400 (26/49)	tr(310)	tr(30)～880,000 (64/64)	4,800
[14]	Perfluorooctane sulfonic acid (PFOS)	tr(26)～14,000 (49/49)	730	nd～1,900 (64/64)	69
[15]	Perfluorooctanoic acid(PFOA)	250～31,000 (49/49)	1,600	nd～500 (64/64)	24
[16]	Pentachlorobenzene				
[17]	Tetrachlorobenzenes				
	[17-1] 1,2,3,4-Tetrachlorobenzene				
	[17-2] 1,2,3,5-Tetrachlorobenzene				
	[17-3] 1,2,4,5-Tetrachlorobenzene				

(Note 1) “Av.” indicates the geometric mean calculated by assuming nd (below the detection limit) to be half the value of the detection limit.

(Note 2) “Range” is based on the concentrations of the samples and “Frequency” is based on the number of sites or areas. Therefore “range” can be shown as “nd～” even if a target chemical is detected in all sites or areas.

(Note 3) [grey box] means the medium was not monitored.

(Note 4) The target chemicals of the Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) monitoring survey were n-Perfluorooctane sulfonic acid and n-Perfluorooctanoic acid.

Table 3-4-3 List of the detection ranges in the Environmental Monitoring in FY 2009 (Part 3)

No.	Target chemicals	Wildlife（pg/g-wet）						Air（pg/m^3）			
		Bibalves		Fish		Birds		First (Warm season)		Second (Cold season)	
		Renge (Frepuency)	Av.	Renge (Frepuency)	Av.	Renge (Frepuency)	Av.	Renge (Frepuency)	Av.	Renge (Frepuency)	Av.
[1]	PCBs	780～62,000 (7/7)	6,800	840～290,000 (18/18)	11,000	3,900～9,500 (2/2)	5,800	43～1,400 (34/34)	200	20～380 (34/34)	85
[2]	HCB	12～200 (7/7)	36	29～30,000 (18/18)	180	400～1,500 (2/2)	830	78～210 (34/34)	110	59～150 (34/34)	87
[3]	Aldrin	nd～89 (6/7)	tr(1.1)	nd～3.1 (7/18)	nd	nd (0/2)	nd	nd～10 (10/25)	0.07	nd～1.8 (8/24)	tr(0.03)
[4]	Dieldrin	48～28,000 (7/7)	430	29～1,400 (18/18)	230	330～890 (2/2)	470	0.91～150 (37/37)	13	0.52～80 (37/37)	4.5
[5]	Endrin	tr(5)～1,400 (7/7)	39	nd～270 (18/18)	17	tr(3)～43 (2/2)	11	nd～3.4 (36/37)	0.49	nd～1.8 (36/37)	0.17
[6]	DDTs	430～21,000 (7/7)	1,600	380～29,000 (18/18)	3,200	4,400～220,000 (2/2)	30,000	1.9～180 (37/37)	12	1.1～130 (37/37)	4.6
	[6-1] *p,p'*-DDT	46～9,600 (7/7)	180	4～2,000 (18/18)	230	85～2,900 (2/2)	240	0.44～28 (37/37)	3.6	0.20～8.0 (37/37)	1.1
	[6-2] *p,p'*-DDE	150～6,400 (7/7)	820	260～20,000 (18/18)	2,100	4,300～220,000 (2/2)	29,000	0.87～130 (37/37)	4.9	0.60～100 (37/37)	2.1
	[6-3] *p,p'*-DDD	5.8～2,400 (7/7)	170	57～2,500 (18/18)	410	31～3,400 (2/2)	260	0.03～0.82 (37/37)	0.17	tr(0.02)～0.35 (37/37)	0.08
	[6-4] *o,p'*-DDT	17～2,500 (7/7)	54	2.4～470 (18/18)	58	tr(1.4)～12 (2/2)	5.4	0.33～14 (37/37)	2.3	0.20～3.7 (37/37)	0.80
	[6-5] *o,p'*-DDE	8～310 (7/7)	40	tr(1)～4,300 (18/18)	43	nd～tr(2) (2/2)	nd	0.098～6.7 (37/37)	0.51	0.072～23 (37/37)	0.27
	[6-6] *o,p'*-DDD	5～1,000 (7/7)	80	nd～760 (18/18)	60	3～13 (2/2)	6	0.04～0.90 (37/37)	0.20	tr(0.02)～0.28 (37/37)	0.08
[7]	Chlordanes	250～76,000 (7/7)	3,000	190～14,000 (18/18)	1,800	610～1,300 (2/2)	880	8.4～2,500 (37/37)	210	2.4～550 (37/37)	61
	[7-1] *cis*-chlordane	83～16,000 (7/7)	1,100	41～3,200 (18/18)	400	4～130 (2/2)	22	2.7～790 (37/37)	67	0.65～180 (37/37)	19
	[7-2] *trans*-chlordane	48～16,000 (7/7)	490	10～1,300 (18/18)	120	tr(3)～13 (2/2)	6	2.6～960 (37/37)	79	0.68～210 (37/37)	23
	[7-3] Oxychlordane	10～820 (7/7)	100	23～2,400 (18/18)	110	190～540 (2/2)	300	0.38～6.5 (37/37)	1.7	0.24～2.7 (37/37)	0.65
	[7-4] *cis*-Nonachlor	31～10,000 (7/7)	270	27～2,600 (18/18)	310	44～160 (2/2)	81	0.33～110 (37/37)	7.5	0.07～18 (37/37)	1.9
	[7-5] *trans*-Nonachlor	79～33,000 (7/7)	720	68～7,400 (18/18)	750	220～730 (2/2)	390	2.2～630 (37/37)	54	0.75～140 (37/37)	16
[8]	Heptachlors	tr(10)～400 (7/7)	68	nd～310 (18/18)	40	160～390 (2/2)	220	1.1～120 (37/37)	22	0.69～52 (37/37)	7.9
	[8-1] heptachlor	nd～120 (4/7)	tr(3)	nd～8 (11/18)	nd	nd (0/2)	nd	0.48～110 (37/37)	18	0.15～48 (37/37)	6.3
	[8-2] *cis*-heptachlor epoxide	10～380 (7/7)	58	4～310 (18/18)	40	160～390 (2/2)	220	0.37～16 (37/37)	2.5	0.42～3.8 (37/37)	1.0
	[8-3] *trans*-heptachlor epoxide	nd～24 (3/7)	nd	nd (0/18)	nd	nd (0/2)	nd	nd～0.18 (10/37)	nd	nd～tr(0.06) (1/37)	nd
[9]	Toxaphenes										
	[9-1] Parlar-26	nd～23 (7/7)	9	nd～690 (18/18)	23	nd～500 (2/2)	28	tr(0.11)～0.26 (37/37)	tr(0.18)	nd～0.27 (33/37)	tr(0.12)
	[9-2] Parlar-50	nd～31 (7/7)	9	nd～910 (18/18)	28	nd～620 (1/2)	29	nd～tr(0.1) (11/37)	nd	nd～tr(0.1) (1/37)	nd
	[9-3] Parlar-62	nd (0/7)	nd	nd～660 (8/18)	nd	nd～210 (1/2)	tr(43)	nd (0/37)	nd	nd (0/37)	nd
[10]	Mirex	tr(1.7)～21 (7/7)	6.0	tr(0.9)～37 (18/18)	8.2	32～79 (2/2)	49	0.049～0.48 (37/37)	0.12	0.030～0.18 (37/37)	0.058
[11]	HCHs										
	[11-1] *α*-HCH	9～2,200 (7/7)	27	tr(2)～830 (18/18)	37	34～56 (2/2)	43	19～340 (37/37)	58	7.8～400 (37/37)	21
	[11-2] *β*-HCH	27～1,600 (7/7)	56	tr(5)～970 (18/18)	94	870～4,200 (2/2)	1,600	0.96～28 (37/37)	5.6	0.31～24 (37/37)	1.8
	[11-3] *γ*-HCH （synonym:Lindane）	tr(3)～89 (7/7)	11	nd～180 (17/18)	14	tr(6)～21 (2/2)	11	2.9～65 (37/37)	17	1.5～55 (37/37)	5.6
	[11-4] *δ*-HCH	nd～700 (4/7)	tr(2)	nd～18 (13/18)	tr(3)	tr(3)～9 (2/2)	6	0.09～21 (37/37)	1.3	0.04～20 (37/37)	0.36

(Note 1) “Av.” indicates the geometric mean calculated by assuming nd (below the detection limit) to be half the value of the detection limit.

(Note 2) “Range” is based on the concentrations of the samples and “Frequency” is based on the number of sites or areas. Therefore “range” can be shown as “nd～” even if a target chemical is detected in all sites or areas.

Table 3-4-4 List of the detection ranges in the Environmental Monitoring in FY 2009 (Part 4)

No.	Target chemicals	Wildlife（pg/g-wet）						Air（pg/m³）			
		Bibalves		Fish		Birds		First (Warm season)		Second (Cold season)	
		Renge (Frepuency)	Av.	Renge (Frepuency)	Av.	Renge (Frepuency)	Av.	Renge (Frepuency)	Av.	Renge (Frepuency)	Av.
[12]	Hexabromobiphenyls	nd～tr(0.53) (1/7)	nd	nd～6.0 (12/18)	tr(0.49)	tr(1.2)～2.1 (2/2)	1.6				
[13]	Polybromodiphenyl ethers（Br4～Br10）							nd～43 (26/37)	tr(9.3)	nd～87 (30/37)	tr(13)
	[13-1] Tetrabromodiphenyl ethers							0.11～18 (37/37)	0.89	tr(0.04)～7.1 (37/37)	0.40
	[13-2] Pentabromodiphenyl ethers							nd～18 (33/37)	0.20	nd～10 (29/37)	0.19
	[13-3] Hexabromodiphenyl ethers							nd～2.0 (19/37)	tr(0.11)	nd～27 (24/37)	tr(0.20)
	[13-4] Heptabromodiphenyl ethers							nd～1.7 (17/37)	tr(0.1)	nd～20 (25/37)	tr(0.2)
	[13-5] Octabromodiphenyl ethers							nd～1.6 (23/37)	tr(0.2)	nd～7.1 (26/37)	0.3
	[13-6] Nonabromodiphenyl ethers							nd～3.0 (22/37)	tr(0.7)	nd～3.9 (27/37)	tr(1.0)
	[13-7] Decabromodiphenyl ether							nd～31 (28/37)	tr(7)	nd～45 (29/37)	tr(10)
[14]	Perfluorooctane sulfonic acid (PFOS)	nd～640 (5/7)	24	nd～15,000 (17/18)	210	37～890 (2/2)	270				
[15]	Perfluorooctanoic acid(PFOA)	nd～94 (7/7)	tr(20)	nd～490 (17/18)	tr(21)	tr(16)～58 (2/2)	29				
[16]	Pentachlorobenzene							20～210 (37/37)	63	tr(5.0)～120 (37/37)	25
[17]	Tetrachlorobenzenes							49～650 (37/37)	120	42～530 (37/37)	100
	[17-1] 1,2,3,4-Tetrachlorobenzene							21～480 (37/37)	58	26～380 (37/37)	55
	[17-2] 1,2,3,5-Tetrachlorobenzene							tr(4.1)～110 (37/37)	20	9.3～120 (37/37)	24
	[17-3] 1,2,4,5-Tetrachlorobenzene							21～150 (37/37)	39	tr(4.6)～120 (37/37)	21

(Note 1) “Av.” indicates the geometric mean calculated by assuming nd (below the detection limit) to be half the value of the detection limit.

(Note 2) “Range” is based on the concentrations of the samples and “Frequency” is based on the number of sites or areas. Therefore “range” can be shown as “nd～” even if a target chemical is detected in all sites or areas.

(Note 3) [grey box] means the medium was not monitored.

(Note 4) The target chemicals of the Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) monitoring survey were n-Perfluorooctane sulfonic acid and n-Perfluorooctanoic acid. However, the possibility cannot be ruled out that the concentration of branched Perfluorooctanoic acid, which has a branched carbon chain, was included in measured concentration as n-Perfluorooctanoic acid in a survey of wildlife.

Table 3-5-1 List of the quantification [detection] limits in the Environmental Monitoring in FY 2009 (Part 1)

No.	Target chemicals	Surface water (pg/L)	Sediment (pg/g-dry)	Wildlife (pg/g-wet)	Air (pg/m^3)
[1]	PCBs	*10 [*4]	*5.1 [*2.1]	*32 [*11]	*0.75 [*0.26]
[2]	HCB	0.5 [0.2]	1.8 [0.7]	4 [2]	0.6 [0.2]
[3]	Aldrin	0.7 [0.3]	0.5 [0.2]	2.1 [0.8]	0.04 [0.02]
[4]	Dieldrin	0.6 [0.2]	0.8 [0.3]	7 [2]	0.06 [0.02]
[5]	Endrin	0.7 [0.3]	1.6 [0.6]	7 [3]	0.09 [0.04]
[6]	DDTs	*2.2 [*0.9]	*4.5 [*1.8]	*18 [*6]	*0.24 [*0.09]
	[6-1] *p,p'*-DDT	0.15 [0.06]	1.0 [0.4]	3 [1]	0.07 [0.03]
	[6-2] *p,p'*-DDE	1.1 [0.4]	0.8 [0.3]	4 [1]	0.08 [0.03]
	[6-3] *p,p'*-DDD	0.4 [0.2]	0.4 [0.2]	2.4 [0.9]	0.03 [0.01]
	[6-4] *o,p'*-DDT	0.16 [0.06]	1.2 [0.5]	2.2 [0.8]	0.019 [0.008]
	[6-5] *o,p'*-DDE	0.22 [0.09]	0.6 [0.2]	3 [1]	0.016 [0.006]
	[6-6] *o,p'*-DDD	0.22 [0.09]	0.5 [0.2]	3 [1]	0.03 [0.01]
[7]	Chlordanes	*4.3 [*1.6]	*6 [*3]	*18 [*6]	*0.43 [*0.18]
	[7-1] *cis*-chlordane	1.1 [0.4]	0.7 [0.3]	4 [2]	0.16 [0.06]
	[7-2] *trans*-chlordane	0.8 [0.3]	1.7 [0.7]	4 [1]	0.12 [0.05]
	[7-3] Oxychlordane	1.1 [0.4]	2 [1]	4 [1]	0.04 [0.02]
	[7-4] *cis*-Nonachlor	0.3 [0.1]	1.0 [0.4]	3 [1]	0.04 [0.02]
	[7-5] *trans*-Nonachlor	1.0 [0.4]	0.9 [0.3]	3 [1]	0.07 [0.03]
[8]	Heptachlors	*2.0 [*0.8]	*3.2 [*1.3]	*16 [*6]	*0.21 [*0.07]
	[8-1] heptachlor	0.8 [0.3]	1.1 [0.4]	5 [2]	0.04 [0.01]
	[8-2] *cis*-heptachlor epoxide	0.5 [0.2]	0.7 [0.3]	3 [1]	0.03 [0.01]
	[8-3] *trans*-heptachlor epoxide	0.7 [0.3]	1.4 [0.6]	8 [3]	0.14 [0.05]
[9]	Toxaphenes				
	[9-1] Parlar-26	5 [2]	10 [4]	7 [3]	0.23 [0.09]
	[9-2] Parlar-50	7 [3]	12 [5]	8 [3]	0.3 [0.1]
	[9-3] Parlar-62	40 [20]	80 [30]	70 [20]	1.6 [0.6]
[10]	Mirex	0.4 [0.2]	1.0 [0.4]	2.1 [0.8]	0.015 [0.006]
[11]	HCHs				
	[11-1] α-HCH	1.2 [0.4]	1.1 [0.4]	5 [2]	0.12 [0.05]
	[11-2] β-HCH	0.6 [0.2]	1.3 [0.5]	6 [2]	0.09 [0.03]
	[11-3] γ-HCH (synonym:Lindane)	0.6 [0.2]	0.6 [0.2]	7 [3]	0.06 [0.02]
	[11-4] δ-HCH	0.9 [0.4]	1.2 [0.5]	5 [2]	0.04 [0.02]

(Note 1) Each quantification limit is shown above the corresponding [detection limit].
(Note 2) " * " means the quantification [detection] limit is the sum value of congeners.
(Note 3) The same quantification [detection] limit was employed for bivalves, fish and birds as wildlife for each target chemical.
(Note 4) The quantification [detection] limit for surface water offshore of Himeji was different from the value shown in the table.

Table 3-5-1 List of the quantification [detection] limits in the Environmental Monitoring in FY 2009 (Part 2)

No.	Target chemicals	Surface water（pg/L）	Sediment（pg/g-dry）	Wildlife（pg/g-wet）	Air（pg/m³）
[12]	Hexabromobiphenyls	*5.7 [*2.2]	*1.1 [*0.40]	*1.3 [*0.43]	
[13]	Polybromodiphenyl ethers（Br4～Br10）	*720 [*240]	*210 [*72]		*19 [*6.0]
	[13-1] Tetrabromodiphenyl ethers	8 [3]	69 [23]		0.11 [0.04]
	[13-2] Pentabromodiphenyl ethers	11 [4]	24 [8]		0.16 [0.06]
	[13-3] Hexabromodiphenyl ethers	1.4 [0.6]	5 [2]		0.22 [0.09]
	[13-4] Heptabromodiphenyl ethers	4 [2]	9 [4]		0.3 [0.1]
	[13-5] Octabromodiphenyl ethers	1.4 [0.6]	1.2 [0.5]		0.3 [0.1]
	[13-6] Nonabromodiphenyl ethers	91 [30]	9 [4]		1.8 [0.6]
	[13-7] Decabromodiphenyl ether	600 [200]	60 [20]		16 [5]
[14]	Perfluorooctane sulfonic acid (PFOS)	37 [14]	9.6 [3.7]	19 [7.4]	
[15]	Perfluorooctanoic acid(PFOA)	59 [23]	8.3 [3.3]	25 [9.9]	
[16]	Pentachlorobenzene				6.4 [2.5]
[17]	Tetrachlorobenzenes				*26 [*10]
	[17-1] 1,2,3,4-Tetrachlorobenzene				8.3 [3.2]
	[17-2] 1,2,3,5-Tetrachlorobenzene				8.8 [3.4]
	[17-3] 1,2,4,5-Tetrachlorobenzene				9.4 [3.7]

(Note 1) Each quantification limit is shown above the corresponding [detection limit].
(Note 2) " * " means the quantification [detection] limit is the sum value of congeners.
(Note 3) The same quantification [detection] limit was employed for bivalves, fish and birds as wildlife for each target chemical.
(Note 4) [grey box] means the medium was not monitored.

Table 3-6-1 Results of inter-annual trend analysis from FY2002 to FY2009 (surface water)

No	Name	Surface water				
			River area	Lake area	Mouth area	Sea area
[1]	PCBs	↘	—	↘	⏋	↘
[2]	HCB	X	—	—	—	↘
[3]	Aldrin	X	—	X	X	X
[4]	Dieldrin	—	—	—	—	—
[5]	Endrin	↘	—	—	⏋	↘
[6]	DDTs					
	[6-1] *p,p'*-DDT	—	—	—	—	—
	[6-2] *p,p'*-DDE	—	—	—	—	—
	[6-3] *p,p'*-DDD	—	—	—	—	—
	[6-4] *o,p'*-DDT	↘	—	↘	↘	↘
	[6-5] *o,p'*-DDE	X	X	—	—	↘
	[6-6] *o,p'*-DDD	—	—	—	—	—
[7]	Chlordanes					
	[7-1] *cis*-chlordane	↘	—	—	⏋	⏋
	[7-2] *trans*-chlordane	↘	—	—	—	—
	[7-3] Oxychlordane	⏋	—	X	↘	—
	[7-4] *cis*-Nonachlor	—	—	—	—	—
	[7-5] *trans*-Nonachlor	↘	—	—	—	—
[8]	Heptachlors					
	[8-1] heptachlor	X	X	X	X	X
	[8-2] *cis*-heptachlor epoxide	↘	—	—	—	—
	[8-3] *trans*-heptachlor epoxide	X	X	X	X	X
[9]	Toxaphenes					
	[9-1] Parlar-26	X	X	X	X	X
	[9-2] Parlar-50	X	X	X	X	X
	[9-3] Parlar-62	X	X	X	X	X
[10]	Mirex	X	X	X	X	X
[11]	HCHs					
	[11-1] α-HCH	—	—	—	—	—
	[11-2] β-HCH	⏋	—	↘	—	—
	[11-3] γ-HCH（synonym:Lindane）	↘	—	↘	↘	↘
	[11-4] δ-HCH	X	—	—	—	X

(Note 1) When the posteriori probability from AICs was more than 95%, the measurement results were deemed to be in agreement with the simple log-linear regression model.

(Note 2) "↘": An inter-annual trend of decrease was found.

"⏋": Statistically significant differences between the first-half and second-half periods were found.

"—": An inter-annual trend was not found.

"X": This analysis approach was regarded as unsuitable because "measured concentrations of more than 50% of samples did not reach the detection limit (nd) in an FY or more," "measured concentrations did not show a normal distribution in an FY or more," "the number of samples was less than 10 in each FY," or "measured concentrations did not show a homoscedasticity in an FY or more."

(Note 3) The classification of monitored sites with area are shown in Table 3-7

Table 3-6-2 Results of inter-annual trend analysis from FY2002 to FY2009 (sediment)

No	Name	Sediment	River area	Lake area	Mouth area	Sea area
[1]	PCBs	—	—	—	—	—
[2]	HCB	—	—	—	—	—
[3]	Aldrin	⏋	X	—	⏋	↘
[4]	Dieldrin	↘	⏋	—	—	—
[5]	Endrin	—	X	—	—	—
[6]	DDTs					
	[6-1] *p,p'*-DDT	↘	—	—	—	↘
	[6-2] *p,p'*-DDE	—	—	—	—	—
	[6-3] *p,p'*-DDD	—	—	—	—	—
	[6-4] *o,p'*-DDT	↘	—	—	—	⏋
	[6-5] *o,p'*-DDE	—	—	—	—	—
	[6-6] *o,p'*-DDD	—	—	—	—	—
[7]	Chlordanes					
	[7-1] *cis*-chlordane	⏋	⏋	⏋	—	⏋
	[7-2] *trans*-chlordane	⏋	—	—	—	⏋
	[7-3] Oxychlordane	—	—	X	X	X
	[7-4] *cis*-Nonachlor	—	—	—	—	—
	[7-5] *trans*-Nonachlor	⏋	—	—	—	⏋
[8]	Heptachlors					
	[8-1] heptachlor	X	X	X	X	X
	[8-2] *cis*-heptachlor epoxide	X	—	—	⏋	⏋
	[8-3] *trans*-heptachlor epoxide	X	X	X	X	X
[9]	Toxaphenes					
	[9-1] Parlar-26	X	X	X	X	X
	[9-2] Parlar-50	X	X	X	X	X
	[9-3] Parlar-62	X	X	X	X	X
[10]	Mirex	⏋	X	—	X	⏋
[11]	HCHs					
	[11-1] α-HCH	—	—	—	—	—
	[11-2] β-HCH	⏋	—	—	—	—
	[11-3] γ-HCH（synonym:Lindane）	↘	↘	—	—	—
	[11-4] δ-HCH	↘	⏋	—	⏋	—

(Note 1) When the posteriori probability from AICs was more than 95%, the measurement results were deemed to be in agreement with the simple log-linear regression model.

(Note 2) "↘": An inter-annual trend of decrease was found.

"⏋": Statistically significant differences between the first-half and second-half periods were found.

"—": An inter-annual trend was not found.

"X": This analysis approach was regarded as unsuitable because "measured concentrations of more than 50% of samples did not reach the detection limit (nd) in an FY or more," "measured concentrations did not show a normal distribution in an FY or more," "the number of samples was less than 10 in each FY," or "measured concentrations did not show a homoscedasticity in an FY or more."

(Note 3) The classification of monitored sites with area are shown in Table 3-7

Table 3-6-3 Results of inter-annual trend analysis from FY2002 to FY2009 (wildlife)

No	Name	Bivalves	Fish	Birds	
				Black-tailed gull	Gray starling
[1]	PCBs	—	—	↘	↘
[2]	HCB	X	X	—	↘
[3]	Aldrin	X	X	X	X
[4]	Dieldrin	—	—	↘	↘
[5]	Endrin	X	┐_	↘	X
[6]	DDTs				
	[6-1] *p,p'*-DDT	—	—	↘	—
	[6-2] *p,p'*-DDE	—	—	—	—
	[6-3] *p,p'*-DDD	—	—	↘	—
	[6-4] *o,p'*-DDT	↘	X	↘	—
	[6-5] *o,p'*-DDE	┐_	┐_	↘	X
	[6-6] *o,p'*-DDD	—	┐_	↘	↘
[7]	Chlordanes				
	[7-1] *cis*-chlordane	—	┐_	↘	↘
	[7-2] *trans*-chlordane	—	┐_	↘	X
	[7-3] Oxychlordane	┐_	↘	↘	↘
	[7-4] *cis*-Nonachlor	—	—	↘	↘
	[7-5] *trans*-Nonachlor	—	—	↘	↘
[8]	Heptachlors				
	[8-1] heptachlor	X	X	X	X
	[8-2] *cis*-heptachlor epoxide	—	—	↘	—
	[8-3] *trans*-heptachlor epoxide	X	X	X	X
[9]	Toxaphenes				
	[9-1] Parlar-26	X	X	↘	X
	[9-2] Parlar-50	X	X	↘	X
	[9-3] Parlar-62	X	X	↘	X
[10]	Mirex	—	X	↘	↘
[11]	HCHs				
	[11-1] *α*-HCH	↘	—	↘	↘
	[11-2] *β*-HCH	—	X	—	↘
	[11-3] *γ*-HCH（synonym:Lindane）	↘	X	—	↘
	[11-4] *δ*-HCH	X	—	↘	↘

(Note 1) When the posteriori probability from AICs was more than 95%, the measurement results were deemed to be in agreement with the simple log-linear regression model.

(Note 2) "↘": An inter-annual trend of decrease was found.

"┐_": Statistically significant differences between the first-half and second-half periods were found.

"—": An inter-annual trend was not found.

"X": This analysis approach was regarded as unsuitable because "measured concentrations of more than 50% of samples did not reach the detection limit (nd) in an FY or more," "measured concentrations did not show a normal distribution in an FY or more," "the number of samples was less than 10 in each FY," or "measured concentrations did not show a homoscedasticity in an FY or more."

Table 3-6-4 Results of inter-annual trend analysis from FY2002 to FY2009 (air)

No	Name	Air	
		Warm season	Cold season
[1]	PCBs	—	—
[2]	HCB	—	—
[3]	Aldrin	—	—
[4]	Dieldrin	—	—
[5]	Endrin	—	—
[6]	DDTs		
	[6-1] *p,p'*-DDT	—	↘
	[6-2] *p,p'*-DDE	—	┐└
	[6-3] *p,p'*-DDD	—	↘
	[6-4] *o,p'*-DDT	↘	↘
	[6-5] *o,p'*-DDE	↘	↘
	[6-6] *o,p'*-DDD	—	↘
[7]	Chlordanes		
	[7-1] *cis*-chlordane	—	—
	[7-2] *trans*-chlordane	—	—
	[7-3] Oxychlordane	—	↘
	[7-4] *cis*-Nonachlor	—	—
	[7-5] *trans*-Nonachlor	—	—
[8]	Heptachlors		
	[8-1] heptachlor	┐└	┐└
	[8-2] *cis*-heptachlor epoxide	—	—
	[8-3] *trans*-heptachlor epoxide	—	X
[9]	Toxaphenes		
	[9-1] Parlar-26	X	X
	[9-2] Parlar-50	X	X
	[9-3] Parlar-62	X	X
[10]	Mirex	—	X

(Note 1) When the posteriori probability from AICs was more than 95%, the measurement results were deemed to be in agreement with the simple log-linear regression model.

(Note 2) " ↘ ": An inter-annual trend of decrease was found.

" ┐└ ": Statistically significant differences between the first-half and second-half periods were found.

"—": An inter-annual trend was not found.

"X": This analysis approach was regarded as unsuitable because "measured concentrations of more than 50% of samples did not reach the detection limit (nd) in an FY or more," "measured concentrations did not show a normal distribution in an FY or more," "the number of samples was less than 10 in each FY," or "measured concentrations did not show a homoscedasticity in an FY or more."

Table 3-7 The classification of monitored sites with area at inter-annual trend analysis.

Classification	Local Communities	Monitored sites	Monitored media	
			Surface water	Sediment
River area	Hokkaido	Onnenai-ohashi Bridge, Riv. Teshio(Bifuka Town)		○
		Suzuran-ohashi Bridge, Riv Tokachi(Obihiro City)	○	○
	Iwate Pref.	Riv. Toyosawa(Hanamaki City)	○	○
	Sendai City	Hirose-ohashi Bridge, Riv. Hirose(Sendai City)		○
	Tochigi Pref.	Riv. Tagawa(Utsunomiya City)	○	○
	Niigata Pref.	Lower Riv. Shinano(Niigata City)	○	○
	Fukui Pref.	Mishima-bashi Bridge, Riv. Shono(Tsuruga City)	○	○
	Yamanashi Pref.	Senshu-bashi Bridge, Riv. Arakawa(Kofu City)		○
	Kyoto City	Miyamae-bashi Bridge, Miyamae Bridge, Riv. Katsura(Kyoto City)	○	○
	Osaka City	Riv. Yodo(Osaka City)		○
	Nara Pref.	Riv. Yamato(Ooji Town)		○
	Kagoshima Pref.	Riv. Amori(Kirishima City)	○	○
		Gotanda-bashi Bridge, Riv. Gotanda(Ichikikushikino City)	○	○
Lake area	Aomori Pref.	Lake Jusan	○	○
	Akita Pref.	Lake Hachiro	○	○
	Nagano Pref.	Lake Suwa(center)	○	○
	Shiga Pref.	Lake Biwa(center, offshore of Minamihira)		○
		Lake Biwa(center, offshore of Karasaki)	○	○
River mouth area	Hokkaido	Ishikarikakokyo Bridge, Mouth of Riv. Ishikari(Ishikari City)	○	○
	Yamagata Pref.	Mouth of Riv. Mogami(Sakata City)	○	○
	Ibaraki Pref.	Tonekamome-ohasi Bridge, Mouth of Riv. Tone(Kamisu City)	○	○
	Chiba City	Mouth of Riv. Hanami(Chiba City)	○	○
	Tokyo Met.	Mouth of Riv. Arakawa(Koto Ward)	○	○
		Mouth of Riv. Sumida(Minato Ward)	○	○
	Kawasaki City	Mouth of Riv. Tama(Kawasaki City)		○
	Toyama Pref.	Hagiura-bashi Bridge, Mouth of Riv. Jintsu(Toyama City)	○	○
	Ishikawa Pref.	Mouth of Riv. Sai(Kanazawa City)	○	○
	Shizuoka Pref.	Riv. Tenryu(Iwata City)	○	○
	Osaka Pref.	Mouth of Riv. Yamato(Sakai City)	○	○
	Wakayama Pref.	Kinokawa-ohashi Bridge, Mouth of Riv. Kinokawa(Wakayama City)	○	○
	Tokushima Pref.	Mouth of Riv. Yoshino(Tokushima City)	○	○
	Kochi Pref.	Mouth of Riv. Shimanto(Shimanto City)	○	○
	Kumamoto Pref.	Riv. Midori(Uto City)	○	
	Oita Pref.	Mouth of Riv. Oita(Oita City)		○
	Miyazaki Pref.	Mouth of Riv. Oyodo(Miyazaki City)	○	○
Sea area	Hokkaido	Tomakomai Port		○
	Miyagi Pref.	Sendai Bay(Matsushima Bay)	○	○
	Fukushima Pref.	Onahama Port	○	○
	Chiba Pref.	Coast of Ichihara and Anegasaki		○
	Yokohama City	Yokohama Port	○	○
	Kawasaki City	Keihin Canal, Port of Kawasaki	○	○
	Shizuoka Pref.	Shimizu Port		○
	Aichi Pref.	Kinuura Port		○
		Nagoya Port	○	○
	Mie Pref.	Yokkaichi Port	○	○
		Toba Port		○
	Kyoto Pref.	Miyazu Port	○	○
	Osaka City	Osaka Port	○	○
		Outside Osaka Port		○
		Mouth of Riv. Yodo(Osaka City)		○
	Hyogo Pref.	Offshore of Himeji	○	○
	Kobe City	Kobe Port(center)	○	○
	Okayama Pref.	Offshore of Mizushima	○	○
	Hiroshima Pref.	Kure Port	○	○
		Hiroshima Bay	○	○
	Yamaguchi Pref.	Tokuyama Bay	○	○
		Offshore of Ube	○	○
		Offshore of Hagi	○	○
	Kagawa Pref.	Takamatsu Port	○	○
	Ehime Pref.	Niihama Port		○
	Kitakyushu City	Dokai Bay	○	○
	Fukuoka City	Hakata Bay		○
	Saga Pref.	Imari Bay	○	○
	Nagasaki Pref.	Omura Bay	○	○
	Okinawa Pref.	Naha Port	○	○

(Note) There are monitored sites which were classified in the area unlike these names by the situations.

The high-sensitivity analysis of POPs and HCHs was conducted in FY 2009, following the monitoring in FY 2002, 2003, 2004, 2005, 2006, 2007 and 2008. Except for cases of trans-Heptachlor epoxide and Toxaphenes in surface water and sediment, toxaphenes (Parlar-62) in wildlife (bivalves), heptachlors (*trans*-heptachlor epoxide) in wildlife (fish), aldrin, heptachlors (heptachlor and *trans*-heptachlor epoxide) in wildlife (birds), and toxaphenes (Parlar-62) in air, all chemicals were detected.

The monitoring results for each chemical (group) are described below.

[1] PCBs

・ History and state of monitoring

Polychlorinated biphenyls (PCBs) had been used as insulating oil, etc. and were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in June 1974, since the substances are persistent, highly accumulative in living organisms, and chronically toxic.

In previous monitoring series, the substances were monitored in wildlife (bivalves, fish and birds) during the period of FY 1978～2001 under the framework of "the Wildlife Monitoring." Under the framework of "The Follow-up Survey of the Status of Pollution by Unintentionally Formed Chemicals," sediment and wildlife (fish) were the monitored media in FY 1996 and FY 1997, and surface water, sediment, wildlife (fish) and air were the monitored media in FY 2000 and FY 2001.

Under the framework of the Environmental Monitoring, the substances in surface water, sediment, wildlife (bivalves, fish and birds) and air have been monitored since FY 2002.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 49 sites and, excluding 1 site which concentration was treated as invalid, it was detected at all 48 valid sites adopting the detection limit of 4pg/L, and the detection range was 14～3,900 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from a lake area and sea area were identified as statistically significant, the second-half period indicated lower concentration than the first-half period in specimens from a river mouth area as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

Stocktaking of the detection of PCBs (total amount) in surface water during FY2002~2009

PCBs (total amount)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	460	330	11,000	60	*7.4 [2.5]	114/114	38/38
	2003	530	450	3,100	230	*9.4 [2.5]	36/36	36/36
	2004	630	540	4,400	140	*14 [5.0]	38/38	38/38
	2005	520	370	7,800	140	*10 [3.2]	47/47	47/47
	2006	240	200	4,300	15	*9 [3]	48/48	48/48
	2007	180	140	2,700	12	*7.6 [2.9]	48/48	48/48
	2008	260	250	4,300	27	*7.8 [3.0]	48/48	48/48
	2009	210	170	3,900	14	*10 [4]	48/48	48/48

(Note) " * " indicates the sum value of the Quantification [Detection] limits of each congener.

< Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 2.1pg/g-dry, and the detection range was 17～1,700,000 pg/g-dry.

Stocktaking of the detection of PCBs (total amount) in sediment during FY2002~2009

PCBs (total amount)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	9,200	11,000	630,000	39	*10 [3.5]	189/189	63/63
	2003	8,200	9,500	5,600,000	39	*10 [3.2]	186/186	62/62
	2004	7,300	7,600	1,300,000	38	*7.9 [2.6]	189/189	63/63
	2005	7,500	7,100	690,000	42	*6.3 [2.1]	189/189	63/63
	2006	7,600	6,600	690,000	36	*4 [1]	192/192	64/64
	2007	6,100	6,800	820,000	19	*4.7 [1.5]	192/192	64/64
	2008	7,400	8,900	630,000	22	*3.3 [1.2]	192/192	64/64
	2009	6,300	7,100	1,700,000	17	*5.1 [2.1]	192/192	64/64

(Note) * indicates the sum value of the Quantification [Detection] limits of each congener.

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 11pg/g-wet, and the detection range was 780～62,000 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 11pg/g-wet, and the detection range was 840～290,000 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 11pg/g-wet, and the detection range was 3,900～9,500 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from black-tailed gulls and gray starlings were identified as statistically significant.

Stocktaking of the detection of PCBs (total amount) in wildlife (bivalves, fish and birds) during FY2002~2009

PCBs (total amount)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	10,000	28,000	160,000	200	*25 [8.4]	38/38	8/8
	2003	11,000	9,600	130,000	1,000	*50 [17]	30/30	6/6
	2004	7,700	11,000	150,000	1,500	*85 [29]	31/31	7/7
	2005	8,200	13,000	85,000	920	*69 [23]	31/31	7/7
	2006	6,400	8,600	77,000	690	*42 [14]	31/31	7/7
	2007	6,900	11,000	66,000	980	*46 [18]	31/31	7/7
	2008	6,600	8,600	69,000	870	*47 [17]	31/31	7/7
	2009	6,800	11,000	62,000	780	*32 [11]	31/31	7/7
Fish (pg/g-wet)	2002	14,000	8,100	550,000	1,500	*25 [8.4]	70/70	14/14
	2003	11,000	9,600	150,000	870	*50 [17]	70/70	14/14
	2004	15,000	10,000	540,000	990	*85 [29]	70/70	14/14
	2005	13,000	8,600	540,000	800	*69 [23]	80/80	16/16
	2006	12,000	9,000	310,000	990	*42 [14]	80/80	16/16
	2007	11,000	6,200	530,000	790	*46 [18]	80/80	16/16
	2008	11,000	9,100	330,000	1,200	*47 [17]	85/85	17/17
	2009	11,000	12,000	290,000	840	*32 [11]	90/90	18/18
Birds (pg/g-wet)	2002	11,000	14,000	22,000	4,800	*25 [8.4]	10/10	2/2
	2003	18,000	22,000	42,000	6,800	*50 [17]	10/10	2/2
	2004	8,900	9,400	13,000	5,900	*85 [29]	10/10	2/2
	2005	10,000	9,700	19,000	5,600	*69 [23]	10/10	2/2
	2006	11,000	9,800	48,000	5,600	*42 [14]	10/10	2/2
	2007	7,500	7,800	15,000	3,900	*46 [18]	10/10	2/2
	2008	8,800	7,400	56,000	3,000	*47 [17]	10/10	2/2
	2009	5,800	5,700	9,500	3,900	*32 [11]	10/10	2/2

(Note) “ * ” indicates the sum value of the Quantification [Detection] limits of each congener.

<Air>

The presence of the substance in air in the warm season was monitored at 37 sites and, excluding 3 sites whose concentrations were treated as invalid, it was detected at all 34 valid sites adopting the detection limit of 0.26pg/m^3, and the detection range was 43～1,400 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites and, excluding 3 sites whose concentrations were treated as invalid, it was detected at all 34 valid sites adopting the detection limit of 0.26pg/m^3, and the detection range was 20～380 pg/m^3.

Stocktaking of the detection of PCBs (total amount) in air during FY2002~2009

PCBs (total amount)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	**2002	100	100	880	16	*99 [33]	102/102	34/34
	2003 Warm season	260	340	2,600	36	*6.6 [2.2]	35/35	35/35
	2003 Cold season	110	120	630	17		34/34	34/34
	2004 Warm season	240	250	3,300	25	*2.9 [0.98]	37/37	37/37
	2004 Cold season	130	130	1,500	20		37/37	37/37
	2005 Warm season	190	210	1,500	23	*0.38 [0.14]	37/37	37/37
	2005 Cold season	66	64	380	20		37/37	37/37
	2006 Warm season	170	180	1,500	21	*0.8 [0.3]	37/37	37/37
	2006 Cold season	82	90	450	19		37/37	37/37
	2007 Warm season	250	290	980	37	*0.37 [0.13]	24/24	24/24
	2007 Cold season	72	76	230	25		22/22	22/22
	2008 Warm season	200	170	960	52	*0.8 [0.3]	22/22	22/22
	2008 Cold season	93	86	1,500	21		36/36	36/36
	2009 Warm season	200	190	1,400	43	*0.75 [0.26]	34/34	34/34
	2009 Cold season	85	78	380	20		34/34	34/34

(Note 1) “ * ” indicates the sum value of the Quantification [Detection] limits of each congener.

(Note 2) In 2002, there was a technical problem in the measuring method for lowly chlorinated congeners, and therefore the values are shown just as reference.

[2] Hexachlorobenzene

・ History and state of monitoring

Hexachlorobenzene had been used as pesticidal material and was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in August 1979.

In previous monitoring series, the substance was monitored in wildlife (bivalves, fish and birds) during the period of FY 1978～1996 and in FY 1998, FY 2000 and FY 2001 under the framework of "the Wildlife Monitoring." Under the framework of "the Surface Water/Sediment Monitoring," the substance in surface water and sediment was monitored during the period of FY 1986～1998 and FY 1986～2001, respectively.

Under the framework of the Environmental Monitoring, the substance in surface water, sediment, wildlife (bivalves, fish and birds) and air has been monitored since FY 2002.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.2pg/L, and the detection range was 2.4～180 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from a sea area was identified as statistically significant.

Stocktaking of the detection of Hexachlorobenzene in surface water during FY2002~2009

HCB	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	36	28	1,400	9.8	0.6 [0.2]	114/114	38/38
	2003	29	24	340	11	5 [2]	36/36	36/36
	2004	30	tr(29)	180	tr(11)	30 [8]	38/38	38/38
	2005	21	17	210	tr(6)	15 [5]	47/47	47/47
	2006	16	tr(12)	190	nd	16 [5]	46/48	46/48
	2007	17	14	190	tr(4)	8 [3]	48/48	48/48
	2008	16	13	480	4	3 [1]	48/48	48/48
	2009	15	17	180	2.4	0.5 [0.2]	49/49	49/49

< Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.7pg/g-dry, and none of the detected concentrations exceeded 34,000pg/g-dry.

Stocktaking of the detection of Hexachlorobenzene in sediment during FY2002~2009

HCB	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2002	210	200	19,000	7.6	0.9 [0.3]	189/189	63/63
	2003	140	120	42,000	5	4 [2]	186/186	62/62
	2004	130	100	25,000	tr(6)	7 [3]	189/189	63/63
	2005	160	130	22,000	13	3 [1]	189/189	63/63
	2006	170	120	19,000	10	2.9 [1.0]	192/192	64/64
	2007	120	110	65,000	nd	5 [2]	191/192	64/64
	2008	140	97	29,000	4.4	2.0 [0.8]	192/192	64/64
	2009	130	120	34,000	nd	1.8 [0.7]	190/192	64/64

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 12～200 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 29～30,000 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 400～1,500 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from gray starlings was identified as statistically significant.

Stocktaking of the detection of Hexachlorobenzene in wildlife (bivalves, fish and birds) during FY2002~2009

HCB	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	23	22	330	2.4	0.18 [0.06]	38/38	8/8
	2003	44	27	660	tr(21)	23 [7.5]	30/30	6/6
	2004	30	31	80	14	14 [4.6]	31/31	7/7
	2005	38	28	450	19	11 [3.8]	31/31	7/7
	2006	35	28	340	11	3 [1]	31/31	7/7
	2007	27	22	400	11	7 [3]	31/31	7/7
	2008	30	24	240	13	7 [3]	31/31	7/7
	2009	36	32	200	12	4 [2]	31/31	7/7
Fish (pg/g-wet)	2002	140	180	910	19	0.18 [0.06]	70/70	14/14
	2003	170	170	1,500	28	23 [7.5]	70/70	14/14
	2004	220	210	1,800	26	14 [4.6]	70/70	14/14
	2005	170	160	1,700	29	11 [3.8]	80/80	16/16
	2006	170	220	1,400	25	3 [1]	80/80	16/16
	2007	150	140	1,500	17	7 [3]	80/80	16/16
	2008	160	210	1,500	25	7 [3]	85/85	17/17
	2009	180	180	30,000	29	4 [2]	90/90	18/18
Birds (pg/g-wet)	2002	1,000	1,200	1,600	560	0.18 [0.06]	10/10	2/2
	2003	1,700	2,000	4,700	790	23 [7.5]	10/10	2/2
	2004	970	1,300	2,200	410	14 [4.6]	10/10	2/2
	2005	980	1,100	2,500	400	11 [3.8]	10/10	2/2
	2006	960	1,100	2,100	490	3 [1]	10/10	2/2
	2007	940	1,100	2,000	420	7 [3]	10/10	2/2
	2008	850	1,100	2,500	240	7 [3]	10/10	2/2
	2009	830	910	1,500	400	4 [2]	10/10	2/2

<Air>

The presence of the substance in air in the warm season was monitored at 37 sites and, excluding 3 sites whose concentrations were treated as invalid, it was detected at all 34 valid sites adopting the detection limit of 0.2pg/m^3, and the detection range was 78～210 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites and, excluding 3 sites whose concentrations were treated as invalid, it was detected at all 34 valid sites adopting the detection limit of 0.2pg/m^3, and the detection range was 59～150 pg/m^3.

Stocktaking of the detection of Hexachlorobenzene in air during FY2002~2009

HCB	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2002	99	93	3,000	57	0.9 [0.3]	102/102	34/34
	2003 Warm season	150	130	430	81	2.3 [0.78]	35/35	35/35
	2003 Cold season	94	90	320	64		34/34	34/34
	2004 Warm season	130	130	430	47	1.1 [0.37]	37/37	37/37
	2004 Cold season	98	89	390	51		37/37	37/37
	2005 Warm season	88	90	250	27	0.14 [0.034]	37/37	37/37
	2005 Cold season	77	68	180	44		37/37	37/37
	2006 Warm season	83	89	210	23	0.21 [0.07]	37/37	37/37
	2006 Cold season	65	74	170	8.2		37/37	37/37
	2007 Warm season	110	100	230	72	0.09 [0.03]	24/24	24/24
	2007 Cold season	77	72	120	55		22/22	22/22
	2008 Warm season	120	110	260	78	0.22 [0.08]	22/22	22/22
	2008 Cold season	87	83	160	58		36/36	36/36
	2009 Warm season	110	110	210	78	0.6 [0.2]	34/34	34/34
	2009 Cold season	87	87	150	59		34/34	34/34

[3] Aldrin

- History and state of monitoring

Aldrin had been used as a soil insecticide until FY 1971 when the application of the substance was substantially stopped. Its registration under the Agricultural Chemicals Regulation Law was expired in FY 1975. It was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in October 1981.

In previous monitoring series until FY 2001, the substance was monitored in wildlife (bivalves, fish and birds) during the period of FY 1978～1989 and FY 1991 to FY 2001 under the framework of "the Wildlife Monitoring."

Under the framework of the Environmental Monitoring, the substance in surface water, sediment, wildlife (bivalves, fish and birds) and air has been monitored since FY 2002.

- Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 49 sites, and it was detected at 32 of the 49 valid sites adopting the detection limit of 0.3pg/L, and none of the detected concentrations exceeded 22pg/L.

Stocktaking of the detection of aldrin in surface water during FY2002~2009

Aldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	0.69	0.90	18	nd	0.6 [0.2]	93/114	37/38
	2003	0.9	0.9	3.8	nd	0.6 [0.2]	34/36	34/36
	2004	tr(1.5)	tr(1.8)	13	nd	2 [0.4]	33/38	33/38
	2005	tr(0.6)	tr(0.7)	5.7	nd	0.9 [0.3]	32/47	32/47
	2006	nd	nd	4.4	nd	1.7 [0.6]	18/48	18/48
	2007	tr(0.6)	tr(0.6)	9.5	nd	1.0 [0.3]	34/48	34/48
	2008	tr(0.8)	tr(0.7)	21	nd	1.4 [0.6]	26/48	26/48
	2009	0.7	0.9	22	nd	0.7 [0.3]	32/49	32/49

<Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.2pg/g-dry, and none of the detected concentrations exceeded 540pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from a sea area was identified as statistically significant and the second-half period indicated lower concentration than the first-half period in specimens from a river area as statistically significant. In addition, the second-half period also indicated lower concentration than the first-half period in specimens from overall areas as statistically significant.

Stocktaking of the detection of aldrin in sediment during FY2002~2009

Aldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	12	12	570	nd	6 [2]	149/189	56/63
	2003	17	18	1,000	nd	2 [0.6]	178/186	60/62
	2004	9	10	390	nd	2 [0.6]	170/189	62/63
	2005	7.5	7.1	500	nd	1.4 [0.5]	173/189	62/63
	2006	9.1	9.3	330	nd	1.9 [0.6]	184/192	64/64
	2007	6.6	6.7	330	nd	1.8 [0.6]	172/192	60/64
	2008	5	6	370	nd	3 [1]	153/192	56/64
	2009	7.0	7.8	540	nd	0.5 [0.2]	180/192	64/64

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at 6 of the 7 valid areas adopting the detection limit of 0.8pg/g-wet, and none of the detected concentrations exceeded 89 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at 7 of the 18 valid areas adopting the detection limit of 0.8pg/g-wet, and none of the detected concentrations exceeded 3.1 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was not detected at all 18 valid areas adopting the detection limit of 0.8pg/g-wet.

Stocktaking of the detection of aldrin in wildlife (bivalves, fish and birds) during FY2002~2009

Aldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	tr(1.7)	nd	34	nd	4.2 [1.4]	12/38	4/8
	2003	tr(1.6)	tr(0.85)	51	nd	2.5 [0.84]	15/30	3/6
	2004	tr(1.7)	tr(1.6)	46	nd	4 [1.3]	16/31	4/7
	2005	nd	nd	84	nd	3.5 [1.2]	11/31	3/7
	2006	nd	nd	19	nd	4 [2]	11/31	3/7
	2007	nd	nd	26	nd	5 [2]	5/31	2/7
	2008	nd	nd	20	nd	5 [2]	5/31	3/7
	2009	tr(1.1)	tr(0.8)	89	nd	2.1 [0.8]	16/31	6/7
Fish (pg/g-wet)	2002	nd	nd	tr(2.0)	nd	4.2 [1.4]	1/70	1/14
	2003	nd	nd	tr(1.9)	nd	2.5 [0.84]	16/70	7/14
	2004	nd	nd	tr(2.4)	nd	4 [1.3]	5/70	2/14
	2005	nd	nd	6.4	nd	3.5 [1.2]	11/80	5/16
	2006	nd	nd	tr(2)	nd	4 [2]	2/80	2/16
	2007	nd	nd	tr(2)	nd	5 [2]	2/80	2/16
	2008	nd	nd	tr(2)	nd	5 [2]	1/85	1/17
	2009	nd	nd	3.1	nd	2.1 [0.8]	22/90	7/18
Birds (pg/g-wet)	2002	nd	nd	nd	nd	4.2 [1.4]	0/10	0/2
	2003	nd	nd	nd	nd	2.5 [0.84]	0/10	0/2
	2004	nd	nd	nd	nd	4 [1.3]	0/10	0/2
	2005	nd	nd	nd	nd	3.5 [1.2]	0/10	0/2
	2006	nd	nd	nd	nd	4 [2]	0/10	0/2
	2007	nd	nd	nd	nd	5 [2]	0/10	0/2
	2008	nd	nd	nd	nd	5 [2]	0/10	0/2
	2009	nd	nd	nd	nd	2.1 [0.8]	0/10	0/2

<Air>

The presence of the substance in air in the warm season was monitored at 37 sites and, excluding 12 sites whose concentrations were treated as invalid, it was detected at 10 of the 25 valid sites adopting the detection limit of 0.02pg/m^3, and none of the detected concentrations exceeded 10pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites and, excluding 13 sites whose concentrations were treated as invalid, it was detected at 8 of the 24 valid sites adopting the detection limit of 0.02pg/m^3, and none of the detected concentrations exceeded 1.8pg/m^3.

In addition, it has also been noted that there were some problems on collection of Aldrin because of the low recovery rate of stable isotope ($^{13}C_{12}$-Aldrin) added in order to identify the recovery rate during air sampling. Therefore, samples whose recovery rate was 50 % were recognized as undetectable in calculation of FY 2008 and 2009.

Stocktaking of the detection of aldrin in air during FY2002~2009

Aldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	tr(0.030)	nd	3.2	nd	0.060 [0.020]	41/102	19/34
	2003 Warm season	1.5	1.9	28	nd	0.023 [0.0077]	34/35	34/35
	2003 Cold season	0.55	0.44	6.9	0.030		34/34	34/34
	2004 Warm season	tr(0.12)	nd	14	nd	0.15 [0.05]	15/37	15/37
	2004 Cold season	tr(0.08)	nd	13	nd		14/37	14/37
	2005 Warm season	0.33	0.56	10	nd	0.08 [0.03]	29/37	29/37
	2005 Cold season	tr(0.04)	nd	1.8	nd		9/37	9/37
	2006 Warm season	0.30	0.35	8.5	nd	0.14 [0.05]	31/37	31/37
	2006 Cold season	tr(0.05)	nd	1.1	nd		16/37	16/37
	2007 Warm season	0.58	0.48	19	nd	0.05 [0.02]	35/36	35/36
	2007 Cold season	0.14	0.15	2.1	nd		34/36	34/36
	2008 Warm season	0.27	0.30	9.4	tr(0.02)	0.04 [0.02]	25/25	25/25
	2008 Cold season	0.09	0.08	1.3	nd		22/25	22/25
	2009 Warm season	0.07	nd	10	nd	0.04 [0.02]	10/25	10/25
	2009 Cold season	tr(0.03)	nd	1.8	nd		8/24	8/24

[4] Dieldrin

・ History and state of monitoring

Dieldrin was used as a pesticide and its application culminated during the period of 1955～1964. The substance had been used as termitecides as a Soil-Residue-Prone Pesticide under the Agricultural Chemicals Regulation Law in 1971, but its registration under the Agricultural Chemicals Regulation Law was expired in FY 1975. It had been used for termite control and was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in October 1981.

In previous monitoring series until FY 2001, the substance was monitored in wildlife (bivalves, fish and birds) during the period of FY 1978～1996, FY 1998 and FY 1999 under the framework of "the Wildlife Monitoring." Under the framework of "the Surface Water/Sediment Monitoring," the substance in surface water and sediment was monitored during the period of FY 1986～1998 and FY 1986～2001, respectively.

Under the framework of the Environmental Monitoring, the substance in surface water, sediment, wildlife (bivalves, fish and birds) and air has been monitored since FY 2002.

・ Monitoring results

< Surface Water>

The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.2pg/L, and the detection range was 2.7～650 pg/L.

Stocktaking of the detection of dieldrin in surface water during FY2002~2009

Dieldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	41	41	940	3.3	1.8 [0.6]	114/114	38/38
	2003	57	57	510	9.7	0.7 [0.3]	36/36	36/36
	2004	55	51	430	9	2 [0.5]	38/38	38/38
	2005	39	49	630	4.5	1.0 [0.34]	47/47	47/47
	2006	36	32	800	6	3 [1]	48/48	48/48
	2007	38	36	750	3.1	2.1 [0.7]	48/48	48/48
	2008	36	37	450	3.6	1.5 [0.6]	48/48	48/48
	2009	36	32	650	2.7	0.6 [0.2]	49/49	49/49

< Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.3pg/g-dry, and the detection range was 1.1～3,000 pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from the overall areas was also identified as statistically significant.

Stocktaking of the detection of dieldrin in sediment during FY2002~2009

Dieldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	63	51	2,300	4	3 [1]	189/189	63/63
	2003	59	56	9,100	nd	4 [2]	184/186	62/62
	2004	58	62	3,700	tr(1.9)	3 [0.9]	189/189	63/63
	2005	56	55	4,200	tr(2)	3 [1]	189/189	63/63
	2006	54	54	1,500	tr(1.7)	2.9 [1.0]	192/192	64/64
	2007	42	40	2,700	tr(1.2)	2.7 [0.9]	192/192	64/64
	2008	42	43	2,900	tr(0.7)	1.2 [0.5]	192/192	64/64
	2009	43	47	3,000	1.1	0.8 [0.3]	192/192	64/64

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 48～28,000 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 29～1,400 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 330～890 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from black-tailed gulls and gray starlings were identified as statistically significant.

Stocktaking of the detection of dieldrin in wildlife (bivalves, fish and birds) during FY2002~2009

Dieldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	490	390	190,000	tr(7)	12 [4]	38/38	8/8
	2003	410	160	78,000	46	4.8 [1.6]	30/30	6/6
	2004	510	270	69,000	42	31 [10]	31/31	7/7
	2005	320	140	39,000	34	9.4 [3.4]	31/31	7/7
	2006	340	120	47,000	30	7 [3]	31/31	7/7
	2007	300	110	77,000	37	9 [3]	31/31	7/7
	2008	310	150	24,000	47	9 [3]	31/31	7/7
	2009	430	230	28,000	48	7 [2]	31/31	7/7
Fish (pg/g-wet)	2002	280	270	2,400	46	12 [4]	70/70	14/14
	2003	210	200	1,000	29	4.8 [1.6]	70/70	14/14
	2004	240	230	2,800	tr(23)	31 [10]	70/70	14/14
	2005	220	250	1,400	21	9.4 [3.4]	80/80	16/16
	2006	220	220	1,400	19	7 [3]	80/80	16/16
	2007	240	210	1,900	23	9 [3]	80/80	16/16
	2008	230	240	1,300	15	9 [3]	85/85	17/17
	2009	230	190	1,400	29	7 [2]	90/90	18/18
Birds (pg/g-wet)	2002	1,200	1,100	1,700	820	12 [4]	10/10	2/2
	2003	1,300	1,400	2,200	790	4.8 [1.6]	10/10	2/2
	2004	590	610	960	370	31 [10]	10/10	2/2
	2005	810	740	1,800	500	9.4 [3.4]	10/10	2/2
	2006	700	690	1,300	440	7 [3]	10/10	2/2
	2007	710	710	910	560	9 [3]	10/10	2/2
	2008	620	620	1,300	260	9 [3]	10/10	2/2
	2009	470	420	890	330	7 [2]	10/10	2/2

<Air>

The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.91～150 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.52～80 pg/m^3.

Stocktaking of the detection of dieldrin in air during FY2002~2009

Dieldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	5.6	5.4	110	0.73	0.60 [0.20]	102/102	34/34
	2003 Warm season	19	22	260	2.1	2.1 [0.70]	35/35	35/35
	2003 Cold season	5.7	5.2	110	tr(0.82)		34/34	34/34
	2004 Warm season	17	22	280	1.1	0.33 [0.11]	37/37	37/37
	2004 Cold season	5.5	6.9	76	0.81		37/37	37/37
	2005 Warm season	14	12	200	1.5	0.54 [0.24]	37/37	37/37
	2005 Cold season	3.9	3.6	50	0.88		37/37	37/37
	2006 Warm season	15	14	290	1.5	0.3 [0.1]	37/37	37/37
	2006 Cold season	4.5	4.2	250	0.7		37/37	37/37
	2007 Warm season	19	22	310	1.3	0.18 [0.07]	36/36	36/36
	2007 Cold season	4.5	3.7	75	0.96		36/36	36/36
	2008 Warm season	14	16	220	1.6	0.24 [0.09]	37/37	37/37
	2008 Cold season	4.9	3.8	72	0.68		37/37	37/37
	2009 Warm season	13	13	150	0.91	0.06 [0.02]	37/37	37/37
	2009 Cold season	4.5	4.0	80	0.52		37/37	37/37

[5] Endrin

・ History and state of monitoring

Endrin was used as an insecticide and a rodenticide, but its registration under the Agricultural Chemicals Regulation Law was expired in FY 1975. It was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in October 1981.

In previous monitoring series until FY 2001, the substance was monitored in wildlife (bivalves, fish and birds) during the periods of FY 1978～1989 and FY 1991～1993 under the framework of "the Wildlife Monitoring".

Under the framework of the Environmental Monitoring, the substance in surface water, sediment, wildlife (bivalves, fish and birds) and air has been monitored since FY 2002.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 49 sites, and it was detected at 39 of the 49 valid sites adopting the detection limit of 0.3pg/L, and none of the detected concentrations exceeded 67pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from a sea area was identified as statistically significant, the second-half period indicated lower concentration than the first-half period in specimens from a river mouth area as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

Stocktaking of the detection of endrin in surface water during FY2002~2009

Endrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	tr(4.7)	tr(5.5)	31	nd	6.0 [2.0]	101/114	36/38
	2003	5.7	6.0	78	0.7	0.7 [0.3]	36/36	36/36
	2004	7	7	100	tr(0.7)	2 [0.5]	38/38	38/38
	2005	4.0	4.5	120	nd	1.1 [0.4]	45/47	45/47
	2006	3.1	3.5	26	nd	1.3 [0.4]	44/48	44/48
	2007	3.5	3.4	25	nd	1.9 [0.6]	46/48	46/48
	2008	3	4	20	nd	3 [1]	45/48	45/48
	2009	2.0	2.3	67	nd	0.7 [0.3]	39/49	39/49

<Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at 63 of the 64 valid sites adopting the detection limit of 0.6pg/g-dry, and none of the detected concentrations exceeded 11,000pg/g-dry.

Stocktaking of the detection of endrin in sediment during FY2002~2009

Endrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	9	10	19,000	nd	6 [2]	141/189	54/63
	2003	11	11	29,000	nd	5 [2]	150/186	53/62
	2004	13	13	6,900	nd	3 [0.9]	182/189	63/63
	2005	10	11	19,000	nd	2.6 [0.9]	170/189	61/63
	2006	11	10	61,000	nd	4 [1]	178/192	63/64
	2007	9	9	61,000	nd	5 [2]	151/192	55/64
	2008	8.7	11	38,000	nd	1.9 [0.7]	168/192	61/64
	2009	7.8	8.4	11,000	nd	1.6 [0.6]	168/192	63/64

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 3pg/g-wet, and the detection range was tr(5)～1,400 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 270 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 3pg/g-wet, and the detection range was tr(3)～43 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from black-tailed gulls was identified as statistically significant and the second-half period indicated lower concentration than the first-half period in specimens from a fish as statistically significant.

Stocktaking of the detection of endrin in wildlife (bivalves, fish and birds) during FY2002~2009

Endrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	44	27	12,000	nd	18 [6]	35/38	7/8
	2003	36	21	5,000	6.3	4.8 [1.6]	30/30	6/6
	2004	54	25	4,600	tr(5.7)	12 [4.2]	31/31	7/7
	2005	30	19	2,100	nd	17 [5.5]	27/31	7/7
	2006	37	15	3,100	tr(5)	11 [4]	31/31	7/7
	2007	26	12	3,000	tr(6)	9 [3]	31/31	7/7
	2008	26	10	1,500	tr(6)	8 [3]	31/31	7/7
	2009	39	19	1,400	tr(5)	7 [3]	31/31	7/7
Fish (pg/g-wet)	2002	19	24	180	nd	18 [6]	54/70	13/14
	2003	14	10	180	nd	4.8 [1.6]	67/70	14/14
	2004	18	24	220	nd	12 [4.2]	57/70	13/14
	2005	tr(16)	tr(16)	2,100	nd	17 [5.5]	58/80	12/16
	2006	13	tr(10)	150	12	11 [4]	66/80	16/16
	2007	13	12	170	nd	9 [3]	69/80	15/16
	2008	11	10	200	nd	8 [3]	63/85	14/17
	2009	17	12	270	nd	7 [3]	86/90	18/18
Birds (pg/g-wet)	2002	22	52	99	nd	18 [6]	7/10	2/2
	2003	21	30	96	5.4	4.8 [1.6]	10/10	2/2
	2004	tr(11)	25	62	nd	12 [4.2]	5/10	1/2
	2005	tr(16)	28	64	nd	17 [5.5]	7/10	2/2
	2006	15	23	57	tr(4)	11 [4]	10/10	2/2
	2007	15	28	55	nd	9 [3]	9/10	2/2
	2008	10	26	83	nd	8 [3]	5/10	1/2
	2009	11	17	43	tr(3)	7 [3]	10/10	2/2

<Air>

The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 36 of the 37 valid sites adopting the detection limit of 0.04pg/m^3, and none of the detected concentrations exceeded 3.4pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 36 of the 37 valid sites adopting the detection limit of 0.04pg/m^3, and none of the detected concentrations exceeded 1.8pg/m^3.

Stocktaking of the detection of endrin in air during FY2002~2009

Endrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	0.22	0.28	2.5	nd	0.090 [0.030]	90/102	32/34
	2003 Warm season	0.74	0.95	6.2	0.081	0.042 [0.014]	35/35	35/35
	2003 Cold season	0.23	0.20	2.1	0.042		34/34	34/34
	2004 Warm season	0.64	0.68	6.5	tr(0.054)	0.14 [0.048]	37/37	37/37
	2004 Cold season	0.23	0.26	1.9	nd		36/37	36/37
	2005 Warm season	tr(0.4)	tr(0.3)	2.9	nd	0.5 [0.2]	27/37	27/37
	2005 Cold season	nd	nd	0.7	nd		8/37	8/37
	2006 Warm season	0.31	0.32	5.4	nd	0.30 [0.10]	32/37	32/37
	2006 Cold season	nd	nd	5.0	nd		7/37	7/37
	2007 Warm season	0.69	0.73	6.3	tr(0.06)	0.09 [0.04]	36/36	36/36
	2007 Cold season	0.16	0.13	1.5	nd		33/36	33/36
	2008 Warm season	0.53	0.68	4.6	tr(0.06)	0.10 [0.04]	37/37	37/37
	2008 Cold season	0.18	0.18	1.8	nd		35/37	35/37
	2009 Warm season	0.49	0.51	3.4	nd	0.09 [0.04]	36/37	36/37
	2009 Cold season	0.17	0.15	1.8	nd		36/37	36/37

[6] DDTs

・ History and state of monitoring

DDT, along with hexachlorocyclohexanes (HCHs) and drins, was used as insecticides in high volume. Its registration under the Agricultural Chemicals Regulation Law was expired in FY 1971. It was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in October 1981. Among several DDT isomers with chlorine at various positions on the aromatic ring, not only *p,p'*-DDT and *o,p'*-DDT as active substances but also *p,p'*-DDE, *o,p'*-DDE, *p,p'*-DDD and *o,p'*-DDD as the environmentally degraded products of DDTs have been the target chemicals in monitoring series since FY 1978.

In previous monitoring series, *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD had been monitored in wildlife (bivalves, fish and birds) during the period of FY 1978～2001 under the framework of "the Wildlife Monitoring." Under the framework of "the Surface Water/Sediment Monitoring," surface water and sediment had been the monitored media during the period of FY 1986～1998 and FY 1986～2001, respectively. Similarly, *o,p'*-DDT, *o,p'*-DDE and *o,p'*-DDD had been monitored in wildlife (bivalves, fish and birds) during the period of FY 1978～1996 and in FY 1998, FY 2000 and FY 2001 under the framework of "the Wildlife Monitoring."

Under the framework of the Environmental Monitoring, *p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD, *o,p'*-DDT, *o,p'*-DDE and *o,p'*-DDD have been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air since FY 2002.

・ Monitoring results

○ *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD

<Surface Water>

p,p'-DDT: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.06pg/L, and the detection range was 0.81～440 pg/L.

p,p'-DDE: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.4pg/L, and the detection range was 3.4～240 pg/L.

p,p'-DDD: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.2pg/L, and the detection range was 1.4～140 pg/L.

Stocktaking of the detection of *p,p′*-DDT, *p,p′*-DDE and *p,p′*-DDD in surface water during FY2002~2009

p,p′-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	12	11	440	tr(0.25)	0.6 [0.2]	114/114	38/38
	2003	14	12	740	tr(2.8)	3 [0.9]	36/36	36/36
	2004	15	14	310	nd	6 [2]	36/38	36/38
	2005	8	9	110	1	4 [1]	47/47	47/47
	2006	9.1	9.2	170	tr(1.6)	1.9 [0.6]	48/48	48/48
	2007	7.3	9.1	670	nd	1.7 [0.6]	46/48	46/48
	2008	11	11	1,200	nd	1.2 [0.5]	47/48	47/48
	2009	9.2	8.4	440	0.81	0.15 [0.06]	49/49	49/49

p,p′-DDE	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	24	26	760	1.3	0.6 [0.2]	114/114	38/38
	2003	26	22	380	5	4 [2]	36/36	36/36
	2004	36	34	680	tr(6)	8 [3]	38/38	38/38
	2005	26	24	410	4	6 [2]	47/47	47/47
	2006	24	24	170	tr(4)	7 [2]	48/48	48/48
	2007	22	23	440	tr(2)	4 [2]	48/48	48/48
	2008	27	28	350	2.5	1.1 [0.4]	48/48	48/48
	2009	23	23	240	3.4	1.1 [0.4]	49/49	49/49

p,p′-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	15	18	190	0.57	0.24 [0.08]	114/114	38/38
	2003	19	18	410	4	2 [0.5]	36/36	36/36
	2004	19	18	740	tr(2.4)	3 [0.8]	38/38	38/38
	2005	17	16	130	tr(1.8)	1.9 [0.64]	47/47	47/47
	2006	16	17	99	2.0	1.6 [0.5]	48/48	48/48
	2007	15	12	150	tr(1.5)	1.7 [0.6]	48/48	48/48
	2008	22	20	850	2.0	0.6 [0.2]	48/48	48/48
	2009	14	13	140	1.4	0.4 [0.2]	49/49	49/49

<Sediment>

p,p'-DDT: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.4pg/g-dry, and the detection range was 1.9～2,100,000 pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from a sea area was identified as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

p,p'-DDE: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.3pg/g-dry, and the detection range was 6.7～50,000 pg/g-dry.

p,p'-DDD: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.2pg/g-dry, and the detection range was 3.9～300,000 pg/g-dry.

Stocktaking of the detection of *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD in sediment during FY2002~2009

p,p'-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	270	240	97,000	tr(5)	6 [2]	189/189	63/63
	2003	240	220	55,000	3	2 [0.4]	186/186	62/62
	2004	330	230	98,000	7	2 [0.5]	189/189	63/63
	2005	280	230	1,700,000	5.1	1.0 [0.34]	189/189	63/63
	2006	260	240	130,000	4.5	1.4 [0.5]	192/192	64/64
	2007	170	150	130,000	3	1.3 [0.5]	192/192	64/64
	2008	210	180	1,400,000	4.8	1.2 [0.5]	192/192	64/64
	2009	180	170	2,100,000	1.9	1.0 [0.4]	192/192	64/64

p,p'-DDE	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	660	630	23,000	8.4	2.7 [0.9]	189/189	63/63
	2003	710	780	80,000	9.5	0.9 [0.3]	186/186	62/62
	2004	630	700	39,000	8	3 [0.8]	189/189	63/63
	2005	630	730	64,000	8.4	2.7 [0.94]	189/189	63/63
	2006	640	820	49,000	5.8	1.0 [0.3]	192/192	64/64
	2007	570	900	61,000	3.2	1.1 [0.4]	192/192	64/64
	2008	780	940	96,000	9.0	1.7 [0.7]	192/192	64/64
	2009	600	660	50,000	6.7	0.8 [0.3]	192/192	64/64

p,p'-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	540	690	51,000	tr(2.2)	2.4 [0.8]	189/189	63/63
	2003	590	580	32,000	3.7	0.9 [0.3]	186/186	62/62
	2004	550	550	75,000	4	2 [0.7]	189/189	63/63
	2005	520	570	210,000	5.2	1.7 [0.64]	189/189	63/63
	2006	490	540	53,000	2.2	0.7 [0.2]	192/192	64/64
	2007	430	550	80,000	3.5	1.0 [0.4]	192/192	64/64
	2008	610	660	300,000	2.8	1.0 [0.4]	192/192	64/64
	2009	450	560	300,000	3.9	0.4 [0.2]	192/192	64/64

<Wildlife>

p,p'-DDT: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 46～9,600 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 4～2,000 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 85～2,900 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from a black-tailed gull was identified as statistically significant.

p,p'-DDE: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 150～6,400 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 260～20,000 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 4,300～220,000 pg/g-wet.

p,p'-DDD: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 0.9pg/g-wet, and the detection range was 5.8～2,400 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 0.9pg/g-wet, and the detection range was 57～2,500 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 0.9pg/g-wet, and the detection range was 31～3,400 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from black-tailed gulls was identified as statistically significant.

Stocktaking of the detection of *p,p'*-DDT in wildlife (bivalves, fish and birds) during FY2002~2009

p,p'-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2002	200	200	1,200	38	4.2 [1.4]	38/38	8/8
	2003	290	290	1,800	49	11 [3.5]	30/30	6/6
	2004	280	340	2,600	48	3.2 [1.1]	31/31	7/7
	2005	180	170	1,300	66	5.1 [1.7]	31/31	7/7
	2006	210	220	1,100	56	6 [2]	31/31	7/7
	2007	200	150	1,200	49	5 [2]	31/31	7/7
	2008	130	100	1,400	12	5 [2]	31/31	7/7
	2009	180	170	9,600	46	3 [1]	31/31	7/7
Fish (pg/g-wet)	2002	330	450	24,000	6.8	4.2 [1.4]	70/70	14/14
	2003	210	400	1,900	tr(3.7)	11 [3.5]	70/70	14/14
	2004	310	330	53,000	5.5	3.2 [1.1]	70/70	14/14
	2005	250	330	8,400	tr(3.8)	5.1 [1.7]	80/80	16/16
	2006	280	340	3,000	tr(5)	6 [2]	80/80	16/16
	2007	250	320	1,800	9	5 [2]	80/80	16/16
	2008	270	310	2,900	7	5 [2]	85/85	17/17
	2009	230	300	2,000	4	3 [1]	90/90	18/18
Birds (pg/g-wet)	2002	380	510	1,300	76	4.2 [1.4]	10/10	2/2
	2003	540	620	1,400	180	11 [3.5]	10/10	2/2
	2004	330	320	700	160	3.2 [1.1]	10/10	2/2
	2005	410	550	900	180	5.1 [1.7]	10/10	2/2
	2006	420	490	1,800	110	6 [2]	10/10	2/2
	2007	450	350	1,900	160	5 [2]	10/10	2/2
	2008	150	170	270	56	5 [2]	10/10	2/2
	2009	240	190	2,900	85	3 [1]	10/10	2/2

Stocktaking of the detection of *p,p'*-DDE in wildlife (bivalves, fish and birds) during FY2002~2009

p,p'-DDE	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2002	1,100	1,700	6,000	140	2.4 [0.8]	38/38	8/8
	2003	1,100	1,000	6,500	190	5.7 [1.9]	30/30	6/6
	2004	1,000	1,400	8,400	220	8.2 [2.7]	31/31	7/7
	2005	1,100	1,600	6,600	230	8.5 [2.8]	31/31	7/7
	2006	910	1,200	6,000	160	1.9 [0.7]	31/31	7/7
	2007	980	1,200	5,600	180	3 [1]	31/31	7/7
	2008	820	1,100	5,800	120	3 [1]	31/31	7/7
	2009	820	1,100	6,400	150	4 [1]	31/31	7/7
Fish (pg/g-wet)	2002	2,500	2,200	98,000	510	2.4 [0.8]	70/70	14/14
	2003	2,000	2,200	12,000	180	5.7 [1.9]	70/70	14/14
	2004	2,500	2,100	52,000	390	8.2 [2.7]	70/70	14/14
	2005	2,200	2,400	73,000	230	8.5 [2.8]	80/80	16/16
	2006	2,100	2,600	28,000	280	1.9 [0.7]	80/80	16/16
	2007	2,100	2,000	22,000	160	3 [1]	80/80	16/16
	2008	2,300	2,000	53,000	320	3 [1]	85/85	17/17
	2009	2,100	2,100	20,000	260	4 [1]	90/90	18/18
Birds (pg/g-wet)	2002	36,000	60,000	170,000	8,100	2.4 [0.8]	10/10	2/2
	2003	63,000	76,000	240,000	18,000	5.7 [1.9]	10/10	2/2
	2004	34,000	65,000	200,000	6,800	8.2 [2.7]	10/10	2/2
	2005	44,000	86,000	300,000	7,100	8.5 [2.8]	10/10	2/2
	2006	35,000	57,000	160,000	5,900	1.9 [0.7]	10/10	2/2
	2007	38,000	56,000	320,000	6,700	3 [1]	10/10	2/2
	2008	45,000	79,000	160,000	7,500	3 [1]	10/10	2/2
	2009	29,000	64,000	220,000	4,300	4 [1]	10/10	2/2

Stocktaking of the detection of *p,p′*-DDD in wildlife (bivalves, fish and birds) during FY2002~2009

p,p′-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	340	710	3,200	11	5.4 [1.8]	38/38	8/8
	2003	380	640	2,600	tr(7.5)	9.9 [3.3]	30/30	6/6
	2004	300	240	8,900	7.8	2.2 [0.7]	31/31	7/7
	2005	300	800	1,700	13	2.9 [0.97]	31/31	7/7
	2006	240	480	1,400	7.3	2.4 [0.9]	31/31	7/7
	2007	250	360	1,500	7	3 [1]	31/31	7/7
	2008	230	280	1,300	6	3 [1]	31/31	7/7
	2009	170	170	2,400	5.8	2.4 [0.9]	31/31	7/7
Fish (pg/g-wet)	2002	610	680	14,000	80	5.4 [1.8]	70/70	14/14
	2003	500	520	3,700	43	9.9 [3.3]	70/70	14/14
	2004	640	510	9,700	56	2.2 [0.7]	70/70	14/14
	2005	470	650	6,700	29	2.9 [0.97]	80/80	16/16
	2006	500	580	4,300	60	2.4 [0.9]	80/80	16/16
	2007	440	490	4,100	36	3 [1]	80/80	16/16
	2008	440	440	4,100	33	3 [1]	85/85	17/17
	2009	410	460	2,500	57	2.4 [0.9]	90/90	18/18
Birds (pg/g-wet)	2002	560	740	3,900	140	5.4 [1.8]	10/10	2/2
	2003	590	860	3,900	110	9.9 [3.3]	10/10	2/2
	2004	310	520	1,400	52	2.2 [0.7]	10/10	2/2
	2005	300	540	1,400	45	2.9 [0.97]	10/10	2/2
	2006	370	740	1,800	55	2.4 [0.9]	10/10	2/2
	2007	430	780	2,300	70	3 [1]	10/10	2/2
	2008	240	490	1,100	35	3 [1]	10/10	2/2
	2009	260	430	3,400	31	2.4 [0.9]	10/10	2/2

<Air>

p,p'-DDT: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.03pg/m^3, and the detection range was 0.44～28 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.03pg/m^3, and the detection range was 0.20～8.0 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens at the cold season was identified as statistically significant.

p,p'-DDE: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.03pg/m^3, and the detection range was 0.87～130 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.03pg/m^3, and the detection range was 0.60～100 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens at the cold season as statistically significant.

p,p'-DDD: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was 0.03～0.82 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was tr(0.02)～0.35 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens at the cold season was identified as statistically significant.

Stocktaking of the detection of *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD in air during FY2002~2009

p,p'-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	1.9	1.8	22	0.25	0.24 [0.08]	102/102	34/34
	2003 Warm season	5.8	6.6	24	0.75	0.14 [0.046]	35/35	35/35
	2003 Cold season	1.7	1.6	11	0.31		34/34	34/34
	2004 Warm season	4.7	5.1	37	0.41	0.22 [0.074]	37/37	37/37
	2004 Cold season	1.8	1.7	13	0.29		37/37	37/37
	2005 Warm season	4.1	4.2	31	0.44	0.16 [0.054]	37/37	37/37
	2005 Cold season	1.1	0.99	4.8	0.25		37/37	37/37
	2006 Warm season	4.2	3.8	51	0.35	0.17 [0.06]	37/37	37/37
	2006 Cold season	1.4	1.2	7.3	0.29		37/37	37/37
	2007 Warm season	4.9	5.2	30	0.6	0.07 [0.03]	36/36	36/36
	2007 Cold season	1.2	1.2	8.8	0.23		36/36	36/36
	2008 Warm season	3.6	3.0	27	0.76	0.07 [0.03]	37/37	37/37
	2008 Cold season	1.2	1.0	15	0.22		37/37	37/37
	2009 Warm season	3.6	3.6	28	0.44	0.07 [0.03]	37/37	37/37
	2009 Cold season	1.1	1.0	8.0	0.20		37/37	37/37
p,p'-DDE	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	2.8	2.7	28	0.56	0.09 [0.03]	102/102	34/34
	2003 Warm season	7.2	7.0	51	1.2	0.40 [0.13]	35/35	35/35
	2003 Cold season	2.8	2.4	22	1.1		34/34	34/34
	2004 Warm season	6.1	6.3	95	0.62	0.12 [0.039]	37/37	37/37
	2004 Cold season	2.9	2.6	43	0.85		37/37	37/37
	2005 Warm season	5.0	5.7	42	1.2	0.14 [0.034]	37/37	37/37
	2005 Cold season	1.7	1.5	9.9	0.76		37/37	37/37
	2006 Warm season	5.0	4.7	49	1.7	0.10 [0.03]	37/37	37/37
	2006 Cold season	1.9	1.7	9.5	0.52		37/37	37/37
	2007 Warm season	6.4	6.1	120	0.54	0.04 [0.02]	36/36	36/36
	2007 Cold season	2.1	1.9	39	0.73		36/36	36/36
	2008 Warm season	4.8	4.4	96	0.98	0.04 [0.02]	37/37	37/37
	2008 Cold season	2.2	2.0	22	0.89		37/37	37/37
	2009 Warm season	4.9	4.8	130	0.87	0.08 [0.03]	37/37	37/37
	2009 Cold season	2.1	1.9	100	0.60		37/37	37/37
p,p'-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	0.12	0.13	0.76	nd	0.018 [0.006]	101/102	34/34
	2003 Warm season	0.30	0.35	1.4	0.063	0.054 [0.018]	35/35	35/35
	2003 Cold season	0.13	0.14	0.52	tr(0.037)		34/34	34/34
	2004 Warm season	0.24	0.27	1.4	tr(0.036)	0.053 [0.018]	37/37	37/37
	2004 Cold season	0.12	0.12	0.91	tr(0.025)		37/37	37/37
	2005 Warm season	0.24	0.26	1.3	tr(0.07)	0.16 [0.05]	37/37	37/37
	2005 Cold season	tr(0.06)	tr(0.07)	0.29	nd		28/37	28/37
	2006 Warm season	0.28	0.32	1.3	nd	0.13 [0.04]	36/37	36/37
	2006 Cold season	0.14	tr(0.12)	0.99	nd		36/37	36/37
	2007 Warm season	0.26	0.27	1.4	0.046	0.011 [0.004]	36/36	36/36
	2007 Cold season	0.093	0.087	0.5	0.026		36/36	36/36
	2008 Warm season	0.17	0.17	1.1	0.037	0.025 [0.009]	37/37	37/37
	2008 Cold season	0.091	0.081	0.31	0.036		37/37	37/37
	2009 Warm season	0.17	0.18	0.82	0.03	0.03 [0.01]	37/37	37/37
	2009 Cold season	0.08	0.08	0.35	tr(0.02)		37/37	37/37

・ Monitoring results

○*o,p'*-DDT、*o,p'*-DDE and *o,p'*-DDD

<Surface Water>

o,p'-DDT: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.06pg/L, and the detection range was 0.43～100 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from a lake area, river mouth area and sea area were identified as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

o,p'-DDE: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 47 of the 49 valid sites adopting the detection limit of 0.09pg/L, and none of the detected concentrations exceeded 140 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from a sea area was identified as statistically significant.

o,p'-DDD: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.09pg/L, and the detection range was 0.44～41 pg/L.

Stocktaking of the detection of *o,p'*-DDT, *o,p'*-DDE and *o,p'*-DDD in surface water during FY2002~2009

o,p'-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	5.1	4.6	77	0.19	1.2 [0.4]	114/114	38/38
	2003	6	5	100	tr(1.5)	3 [0.7]	36/36	36/36
	2004	tr(4.5)	5	85	nd	5 [2]	29/38	29/38
	2005	3	3	39	nd	3 [1]	42/47	42/47
	2006	2.8	2.4	52	0.51	2.3 [0.8]	48/48	48/48
	2007	tr(2.1)	tr(2.2)	86	nd	2.5 [0.8]	38/48	38/48
	2008	3.1	3.0	230	nd	1.4 [0.5]	44/48	44/48
	2009	2.4	2.4	100	0.43	0.16 [0.06]	49/49	49/49
***o,p'*-DDE**	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Surface water (pg/L)	2002	2.3	2.1	680	nd	0.9 [0.3]	113/114	38/38
	2003	2.2	2.0	170	tr(0.42)	0.8 [0.3]	36/36	36/36
	2004	3	2	170	tr(0.6)	2 [0.5]	38/38	38/38
	2005	2.5	2.1	410	0.4	1.2 [0.4]	47/47	47/47
	2006	tr(1.6)	tr(1.4)	210	nd	2.6 [0.9]	28/48	28/48
	2007	tr(1.5)	tr(1.1)	210	nd	2.3 [0.8]	29/48	29/48
	2008	1.5	1.8	260	nd	0.7 [0.3]	39/48	39/48
	2009	1.3	1.1	140	nd	0.22 [0.09]	47/49	47/49
***o,p'*-DDD**	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Surface water (pg/L)	2002	5.5	6.0	110	nd	0.60 [0.20]	113/114	38/38
	2003	7.1	5.0	160	1.1	0.8 [0.3]	36/36	36/36
	2004	6	5	81	tr(0.7)	2 [0.5]	38/38	38/38
	2005	5.2	5.4	51	tr(0.5)	1.2 [0.4]	47/47	47/47
	2006	2.5	3.3	39	nd	0.8 [0.3]	40/48	40/48
	2007	4.6	3.9	41	tr(0.3)	0.8 [0.3]	48/48	48/48
	2008	6.7	7.2	170	nd	0.8 [0.3]	47/48	47/48
	2009	4.4	3.8	41	0.44	0.22 [0.09]	49/49	49/49

<Sediment>

o,p'-DDT: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.5pg/g-dry, and none of the detected concentrations exceeded 100,000 pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from a sea area as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

o,p'-DDE: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.2pg/g-dry, and none of the detected concentrations exceeded 33,000 pg/g-dry.

o,p'-DDD: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.2pg/g-dry, and the detection range was 0.5～24,000 pg/g-dry.

Stocktaking of the detection of *o,p'*-DDT, *o,p'*-DDE and *o,p'*-DDD in sediment during FY2002~2009

o,p'-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	57	47	27,000	nd	6 [2]	183/189	62/63
	2003	43	43	3,200	nd	0.8 [0.3]	185/186	62/62
	2004	52	50	17,000	tr(1.1)	2 [0.6]	189/189	63/63
	2005	47	46	160,000	0.8	0.8 [0.3]	189/189	63/63
	2006	49	52	18,000	tr(0.8)	1.2 [0.4]	192/192	64/64
	2007	31	31	27,000	nd	1.8 [0.6]	186/192	63/64
	2008	39	40	140,000	tr(0.7)	1.5 [0.6]	192/192	64/64
	2009	32	30	100,000	nd	1.2 [0.5]	190/192	64/64
o,p'-DDE	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	46	37	16,000	nd	3 [1]	188/189	63/63
	2003	43	39	24,000	tr(0.5)	0.6 [0.2]	186/186	62/62
	2004	35	34	28,000	nd	3 [0.8]	184/189	63/63
	2005	35	32	31,000	nd	2.6 [0.9]	181/189	62/63
	2006	37	40	27,000	tr(0.4)	1.1 [0.4]	192/192	64/64
	2007	31	41	25,000	nd	1.2 [0.4]	186/192	63/64
	2008	42	48	37,000	nd	1.4 [0.6]	186/192	63/64
	2009	31	31	33,000	nd	0.6 [0.2]	191/192	64/64
o,p'-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	140	150	14,000	nd	6 [2]	184/189	62/63
	2003	140	130	8,800	tr(1.0)	2 [0.5]	186/186	62/62
	2004	120	120	16,000	tr(0.7)	2 [0.5]	189/189	63/63
	2005	110	110	32,000	tr(0.8)	1.0 [0.3]	189/189	63/63
	2006	110	110	13,000	tr(0.3)	0.5 [0.2]	192/192	64/64
	2007	97	130	21,000	tr(0.5)	1.0 [0.4]	192/192	64/64
	2008	140	150	50,000	0.5	0.3 [0.1]	192/192	64/64
	2009	100	120	24,000	0.5	0.5 [0.2]	192/192	64/64

<Wildlife>

o,p'-DDT: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 0.8pg/g-wet, and the detection range was 17～2,500 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 0.8pg/g-wet, and the detection range was 2.4～470 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 0.8pg/g-wet, and the detection range was tr(1.4)～12 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from bivalves and black-tailed gulls were identified as statistically significant.

o,p'-DDE: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 8～310 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was tr(1)～4,300 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and none of the detected concentrations exceeded tr(2) pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from black-tailed gulls was identified as statistically significant and the second-half period indicated lower concentration than the first-half period in specimens from bivalves and fish as statistically significant.

o,p'-DDD: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 5～1,000 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and none of the detected concentrations exceeded 760 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 3～13 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from black-tailed gulls and gray starlings were identified as statistically significant and the second-half period indicated lower concentration than the first-half period in specimens from fish as statistically significant.

Stocktaking of the detection of *o,p'*-DDT in wildlife (bivalves, fish and birds) during FY2002~2009

o,p'-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	100	83	480	22	12 [4]	38/38	8/8
	2003	130	120	480	35	2.9 [0.97]	30/30	6/6
	2004	130	140	910	20	1.8 [0.61]	31/31	7/7
	2005	75	57	440	29	2.6 [0.86]	31/31	7/7
	2006	76	79	380	24	3 [1]	31/31	7/7
	2007	64	52	350	20	3 [1]	31/31	7/7
	2008	46	37	330	5	3 [1]	31/31	7/7
	2009	54	48	2,500	17	2.2 [0.8]	31/31	7/7
Fish (pg/g-wet)	2002	110	130	2,300	tr(6)	12 [4]	70/70	14/14
	2003	80	120	520	2.9	2.9 [0.97]	70/70	14/14
	2004	130	140	1,800	3.7	1.8 [0.61]	70/70	14/14
	2005	94	110	1,500	5.8	2.6 [0.86]	80/80	16/16
	2006	91	110	700	6	3 [1]	80/80	16/16
	2007	66	90	430	3	3 [1]	80/80	16/16
	2008	68	92	720	3	3 [1]	85/85	17/17
	2009	58	73	470	2.4	2.2 [0.8]	90/90	18/18
Birds (pg/g-wet)	2002	tr(10)	tr(10)	58	nd	12 [4]	8/10	2/2
	2003	18	16	66	8.3	2.9 [0.97]	10/10	2/2
	2004	7.7	13	43	tr(0.9)	1.8 [0.61]	10/10	2/2
	2005	11	14	24	3.4	2.6 [0.86]	10/10	2/2
	2006	10	10	120	3	3 [1]	10/10	2/2
	2007	8	9	26	tr(2)	3 [1]	10/10	2/2
	2008	3	6	16	nd	3 [1]	8/10	2/2
	2009	5.4	7.6	12	tr(1.4)	2.2 [0.8]	10/10	2/2

Stocktaking of the detection of *o,p'*-DDE in wildlife (bivalves, fish and birds) during FY2002~2009

o,p'-DDE	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	88	66	1,100	13	3.6 [1.2]	38/38	8/8
	2003	84	100	460	17	3.6 [1.2]	30/30	6/6
	2004	70	69	360	19	2.1 [0.69]	31/31	7/7
	2005	66	89	470	12	3.4 [1.1]	31/31	7/7
	2006	56	81	340	12	3 [1]	31/31	7/7
	2007	51	69	410	8.9	2.3 [0.9]	31/31	7/7
	2008	45	52	390	8	3 [1]	31/31	7/7
	2009	40	58	310	8	3 [1]	31/31	7/7
Fish (pg/g-wet)	2002	77	50	13,000	3.6	3.6 [1.2]	70/70	14/14
	2003	48	54	2,500	nd	3.6 [1.2]	67/70	14/14
	2004	68	48	5,800	tr(0.9)	2.1 [0.69]	70/70	14/14
	2005	50	45	12,000	tr(1.4)	3.4 [1.1]	80/80	16/16
	2006	50	43	4,800	tr(1)	3 [1]	80/80	16/16
	2007	43	29	4,400	nd	2.3 [0.9]	79/80	16/16
	2008	46	37	13,000	tr(1)	3 [1]	85/85	17/17
	2009	43	33	4,300	tr(1)	3 [1]	90/90	18/18
Birds (pg/g-wet)	2002	28	26	49	20	3.6 [1.2]	10/10	2/2
	2003	tr(2.0)	tr(2.0)	4.2	nd	3.6 [1.2]	9/10	2/2
	2004	tr(1.0)	tr(1.1)	3.7	nd	2.1 [0.69]	5/10	1/2
	2005	tr(1.4)	tr(1.9)	tr(2.9)	nd	3.4 [1.1]	7/10	2/2
	2006	tr(2)	tr(2)	3	tr(1)	3 [1]	10/10	2/2
	2007	tr(1.1)	tr(1.4)	2.8	nd	2.3 [0.9]	6/10	2/2
	2008	nd	nd	3	nd	3 [1]	5/10	1/2
	2009	nd	tr(1)	tr(2)	nd	3 [1]	6/10	2/2

Stocktaking of the detection of *o,p′*-DDD in wildlife (bivalves, fish and birds) during FY2002~2009

o,p′-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	130	190	2,900	tr(9)	12 [4]	38/38	8/8
	2003	200	220	1,900	6.5	6.0 [2.0]	30/30	6/6
	2004	160	130	2,800	6.0	5.7 [1.9]	31/31	7/7
	2005	140	280	1,800	10	3.3 [1.1]	31/31	7/7
	2006	120	200	1,000	7	4 [1]	31/31	7/7
	2007	130	200	1,200	6	3 [1]	31/31	7/7
	2008	110	140	1,100	5	4 [2]	31/31	7/7
	2009	80	51	1,000	5	3 [1]	31/31	7/7
Fish (pg/g-wet)	2002	83	90	1,100	nd	12 [4]	66/70	14/14
	2003	73	96	920	nd	6.0 [2.0]	66/70	14/14
	2004	100	96	1,700	nd	5.7 [1.9]	68/70	14/14
	2005	77	81	1,400	nd	3.3 [1.1]	79/80	16/16
	2006	76	86	1,100	tr(1)	4 [1]	80/80	16/16
	2007	63	62	1,300	nd	3 [1]	78/80	16/16
	2008	62	74	1,000	nd	4 [2]	80/85	16/17
	2009	60	64	760	nd	3 [1]	87/90	18/18
Birds (pg/g-wet)	2002	15	15	23	tr(8)	12 [4]	10/10	2/2
	2003	14	14	36	tr(5.0)	6.0 [2.0]	10/10	2/2
	2004	tr(5.6)	5.7	25	nd	5.7 [1.9]	9/10	2/2
	2005	7.1	7.5	9.7	4.7	3.3 [1.1]	10/10	2/2
	2006	8	8	19	5	4 [1]	10/10	2/2
	2007	7	7	10	5	3 [1]	10/10	2/2
	2008	4	tr(3)	14	tr(2)	4 [2]	10/10	2/2
	2009	6	5	13	3	3 [1]	10/10	2/2

<Air>

o,p'-DDT: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.008pg/m^3, and the detection range was 0.33～14 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.008pg/m^3, and the detection range was 0.20～3.7 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendencies in specimens at the both season were identified as statistically significant.

o,p'-DDE: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.006pg/m^3, and the detection range was 0.098～6.7 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.006pg/m^3, and the detection range was 0.072～23 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendencies in specimens at the both season were identified as statistically significant.

o,p'-DDD: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was 0.04～0.90 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was tr(0.02)～0.28 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens at the cold season was identified as statistically significant.

Stocktaking of the detection of *o,p′*-DDT, *o,p′*-DDE and *o,p′*-DDD in air during FY2002~2009

o,p′-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	2.2	2.0	40	0.41	0.15 [0.05]	102/102	34/34
	2003 Warm season	6.9	7.7	38	0.61	0.12 [0.040]	35/35	35/35
	2003 Cold season	1.6	1.4	6.4	0.43		34/34	34/34
	2004 Warm season	5.1	5.4	22	0.54	0.093 [0.031]	37/37	37/37
	2004 Cold season	1.5	1.4	9.4	0.35		37/37	37/37
	2005 Warm season	3.0	3.1	14	0.67	0.10 [0.034]	37/37	37/37
	2005 Cold season	0.76	0.67	3.0	0.32		37/37	37/37
	2006 Warm season	2.5	2.4	20	0.55	0.09 [0.03]	37/37	37/37
	2006 Cold season	0.90	0.79	3.9	0.37		37/37	37/37
	2007 Warm season	2.9	2.6	19	0.24	0.03 [0.01]	36/36	36/36
	2007 Cold season	0.77	0.63	3.4	0.31		36/36	36/36
	2008 Warm season	2.3	2.1	18	0.33	0.03 [0.01]	37/37	37/37
	2008 Cold season	0.80	0.62	6.5	0.32		37/37	37/37
	2009 Warm season	2.3	2.2	14	0.33	0.019 [0.008]	37/37	37/37
	2009 Cold season	0.80	0.71	3.7	0.20		37/37	37/37

o,p′-DDE	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	0.60	0.56	8.5	0.11	0.03 [0.01]	102/102	34/34
	2003 Warm season	1.4	1.5	7.5	0.17	0.020 [0.0068]	35/35	35/35
	2003 Cold season	0.50	0.47	1.7	0.18		34/34	34/34
	2004 Warm season	1.1	1.2	8.9	0.14	0.037 [0.012]	37/37	37/37
	2004 Cold season	0.53	0.49	3.9	0.14		37/37	37/37
	2005 Warm season	1.6	1.5	7.9	0.33	0.074 [0.024]	37/37	37/37
	2005 Cold season	0.62	0.59	2.0	0.24		37/37	37/37
	2006 Warm season	1.1	1.1	7.4	nd	0.09 [0.03]	36/37	36/37
	2006 Cold season	0.65	0.56	2.6	0.19		37/37	37/37
	2007 Warm season	0.66	0.67	7	0.096	0.017 [0.007]	36/36	36/36
	2007 Cold season	0.3	0.29	3.7	0.12		36/36	36/36
	2008 Warm season	0.48	0.52	5.0	0.11	0.025 [0.009]	37/37	37/37
	2008 Cold season	0.30	0.24	1.1	0.15		37/37	37/37
	2009 Warm season	0.51	0.46	6.7	0.098	0.016 [0.006]	37/37	37/37
	2009 Cold season	0.27	0.24	23	0.072		37/37	37/37

o,p′-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	0.14	0.18	0.85	nd	0.021 [0.007]	97/102	33/34
	2003 Warm season	0.37	0.42	1.3	0.059	0.042 [0.014]	35/35	35/35
	2003 Cold season	0.15	0.14	0.42	0.062		34/34	34/34
	2004 Warm season	0.31	0.33	2.6	tr(0.052)	0.14 [0.048]	37/37	37/37
	2004 Cold season	0.14	tr(0.13)	0.86	nd		35/37	35/37
	2005 Warm season	0.22	0.19	0.90	tr(0.07)	0.10 [0.03]	37/37	37/37
	2005 Cold season	tr(0.07)	tr(0.07)	0.21	nd		35/37	35/37
	2006 Warm season	0.28	0.28	1.4	tr(0.05)	0.10 [0.03]	37/37	37/37
	2006 Cold season	0.12	0.11	0.79	nd		34/37	34/37
	2007 Warm season	0.28	0.29	1.9	0.05	0.05 [0.02]	36/36	36/36
	2007 Cold season	0.095	0.09	0.33	tr(0.03)		36/36	36/36
	2008 Warm season	0.19	0.16	1.6	0.05	0.04 [0.01]	37/37	37/37
	2008 Cold season	0.10	0.09	0.26	0.04		37/37	37/37
	2009 Warm season	0.20	0.19	0.90	0.04	0.03 [0.01]	37/37	37/37
	2009 Cold season	0.08	0.08	0.28	tr(0.02)		37/37	37/37

[7] Chlordanes

・ History and state of monitoring

Chlordanes were used as insecticides, but the registration of Chlordanes under the Agricultural Chemicals Regulation Law was expired in FY 1968. The substances were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in September 1986 because of its properties such as persistency, since it had been used as termitecides for wood products such as primary processed timber, plywood and house.

Although manufactured Chlordanes have complicated compositions, heptachlor, γ-chlordane, heptachlor epoxide, *cis*-chlordane, *trans*-chlordane, oxychlordane (as a chlordane metabolite), *cis*-nonachlor (not registrated as an Agricultural Chemical) and *trans*-nonachlor (not registrated as an Agricultural Chemical) were the original target chemicals in monitoring series. Since FY 1983, 5 of those 8 chemicals (*cis*-chlordane, *trans*-chlordane, oxychlordane, *cis*-nonachlor and *trans*-nonachlor) have been the target chemicals owning to their high detection frequency in the FY 1982 High-Precision Environmental Survey.

In previous monitoring series, Chlordanes had been monitored in wildlife (bivalves, fish and birds) during the period of FY 1978～2001 under the framework of “the Wildlife Monitoring.” Under the framework of “the Surface Water/Sediment Monitoring”, *cis*-chlordane, *trans*-chlordane, *cis*-nonachlor and *trans*-nonachlor in surface water and sediment have been the monitored during the period of FY 1986～1998 and FY 1986～2001, respectively.

Under the framework of the Environmental Monitoring, *cis*-chlordane, *trans*-chlordane, oxychlordane (as a chlordane metabolite), *cis*-nonachlor (not registrated as an Agricultural Chemical) and *trans*-nonachlor have been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air since FY 2002.

・ Monitoring results

○ *cis*-Chlordane and *trans*-Chlordane

<Surface Water>

cis-Chlordane: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.4pg/L, and the detection range was 4.4～710 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from the overall areas was identified as statistically significant.

trans-Chlordane: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.3pg/L, and the detection range was 3.0～690 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from a river mouth area and sea area as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

Stocktaking of the detection of *cis*-chlordane and *trans*-chlordane in surface water FY2002~2009

cis-chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	41	32	880	2.5	0.9 [0.3]	114/114	38/38
	2003	69	51	920	12	3 [0.9]	36/36	36/36
	2004	92	87	1,900	10	6 [2]	38/38	38/38
	2005	53	54	510	6	4 [1]	47/47	47/47
	2006	31	26	440	5	5 [2]	48/48	48/48
	2007	23	22	680	nd	4 [2]	47/48	47/48
	2008	29	29	480	2.9	1.6 [0.6]	48/48	48/48
	2009	29	26	710	4.4	1.1 [0.4]	49/49	49/49

trans-chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	32	24	780	3.1	1.5 [0.5]	114/114	38/38
	2003	34	30	410	6	5 [2]	36/36	36/36
	2004	32	26	1,200	5	5 [2]	38/38	38/38
	2005	25	21	200	3	4 [1]	47/47	47/47
	2006	24	16	330	tr(4)	7 [2]	48/48	48/48
	2007	16	20	580	nd	2.4 [0.8]	47/48	47/48
	2008	23	22	420	3	3 [1]	48/48	48/48
	2009	23	18	690	3.0	0.8 [0.3]	49/49	49/49

<Sediment>

cis-Chlordane: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.3pg/g-dry, and the detection range was 2.0～8,600 pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from a river area, lake area and sea area as statistically significant. In addition, the second-half period also indicated lower concentration than the first-half period in specimens from overall areas as statistically significant.

trans-Chlordane: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.7pg/g-dry, and the detection range was 2.1～8,300 pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from a sea area as statistically significant. In addition, the second-half period also indicated lower concentration than the first-half period in specimens from overall areas as statistically significant.

Stocktaking of the detection of *cis*-chlordane and *trans*-chlordane in sediment FY2002~2009

cis-chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2002	120	98	18,000	1.8	0.9 [0.3]	189/189	63/63
	2003	170	140	19,000	tr(3.6)	4 [2]	186/186	62/62
	2004	140	97	36,000	4	4 [2]	189/189	63/63
	2005	140	100	44,000	3.3	1.9 [0.64]	189/189	63/63
	2006	90	70	13,000	tr(0.9)	2.4 [0.8]	192/192	64/64
	2007	73	55	7,500	nd	5 [2]	191/192	64/64
	2008	89	63	11,000	tr(2.3)	2.4 [0.9]	192/192	64/64
	2009	74	61	8,600	2.0	0.7 [0.3]	192/192	64/64
trans-chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2002	130	110	16,000	2.1	1.8 [0.6]	189/189	63/63
	2003	120	100	13,000	tr(2.4)	4 [2]	186/186	62/62
	2004	95	80	26,000	3	3 [0.9]	189/189	63/63
	2005	98	81	32,000	3.4	2.3 [0.84]	189/189	63/63
	2006	98	76	12,000	2.2	1.1 [0.4]	192/192	64/64
	2007	72	58	7,500	nd	2.2 [0.8]	191/192	64/64
	2008	93	66	10,000	2.4	2.0 [0.8]	192/192	64/64
	2009	79	68	8,300	2.1	1.7 [0.7]	192/192	64/64

<Wildlife>

cis-Chlordane: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 83～16,000 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 41～3,200 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 4～130 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from black-tailed gulls and gray starlings were identified as statistically significant and the second-half period indicated lower concentration than the first-half period in specimens from a fish as statistically significant.

trans-Chlordane: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 48～16,000 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 10～1,300 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was tr(3)～13 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from black-tailed gulls was identified as statistically significant and the second-half period indicated lower concentration than the first-half period in specimens from a fish as statistically significant.

Stocktaking of the detection of *cis*-chlordane in wildlife (bivalves, fish and birds) FY2002~2009

cis-chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	810	1,200	26,000	24	2.4 [0.8]	38/38	8/8
	2003	1,100	1,400	14,000	110	3.9 [1.3]	30/30	6/6
	2004	1,200	1,600	14,000	91	18 [5.8]	31/31	7/7
	2005	820	960	13,000	78	12 [3.9]	31/31	7/7
	2006	810	1,100	18,000	67	4 [1]	31/31	7/7
	2007	760	590	19,000	59	5 [2]	31/31	7/7
	2008	660	560	11,000	85	5 [2]	31/31	7/7
	2009	1,100	1,100	16,000	83	4 [2]	31/31	7/7
Fish (pg/g-wet)	2002	580	550	6,900	57	2.4 [0.8]	70/70	14/14
	2003	490	400	4,400	43	3.9 [1.3]	70/70	14/14
	2004	580	490	9,800	68	18 [5.8]	70/70	14/14
	2005	490	600	8,000	42	12 [3.9]	80/80	16/16
	2006	490	420	4,900	56	4 [1]	80/80	16/16
	2007	410	360	5,200	30	5 [2]	80/80	16/16
	2008	410	340	3,500	36	5 [2]	85/85	17/17
	2009	400	450	3,200	41	4 [2]	90/90	18/18
Birds (pg/g-wet)	2002	67	180	450	10	2.4 [0.8]	10/10	2/2
	2003	47	120	370	6.8	3.9 [1.3]	10/10	2/2
	2004	39	110	240	tr(5.8)	18 [5.8]	10/10	2/2
	2005	49	120	340	tr(5.8)	12 [3.9]	10/10	2/2
	2006	32	83	250	5	4 [1]	10/10	2/2
	2007	30	83	230	tr(4)	5 [2]	10/10	2/2
	2008	26	87	280	tr(3)	5 [2]	10/10	2/2
	2009	22	48	130	4	4 [2]	10/10	2/2

Stocktaking of the detection of *trans*-chlordane in wildlife (bivalves, fish and birds) FY2002~2009

trans-chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	420	840	2,300	33	2.4 [0.8]	38/38	8/8
	2003	550	840	2,800	69	7.2 [2.4]	30/30	6/6
	2004	510	770	2,800	53	48 [16]	31/31	7/7
	2005	370	660	2,400	40	10 [3.5]	31/31	7/7
	2006	370	580	2,800	41	4 [2]	31/31	7/7
	2007	360	460	1,500	34	6 [2]	31/31	7/7
	2008	300	410	1,300	52	7 [3]	31/31	7/7
	2009	490	560	16,000	48	4 [1]	31/31	7/7
Fish (pg/g-wet)	2002	180	160	2,700	20	2.4 [0.8]	70/70	14/14
	2003	150	120	1,800	9.6	7.2 [2.4]	70/70	14/14
	2004	190	130	5,200	tr(17)	48 [16]	70/70	14/14
	2005	150	180	3,100	tr(9.8)	10 [3.5]	76/80	16/16
	2006	150	120	2,000	14	4 [2]	80/80	16/16
	2007	120	100	2,100	8	6 [2]	80/80	16/16
	2008	120	71	1,300	14	7 [3]	85/85	17/17
	2009	120	140	1,300	10	4 [1]	90/90	18/18
Birds (pg/g-wet)	2002	14	14	26	8.9	2.4 [0.8]	10/10	2/2
	2003	11	12	27	tr(5.9)	7.2 [2.4]	10/10	2/2
	2004	tr(14)	tr(11)	tr(26)	nd	48 [16]	5/10	1/2
	2005	10	12	30	tr(4.5)	10 [3.5]	10/10	2/2
	2006	7	8	17	tr(3)	4 [2]	10/10	2/2
	2007	7	8	19	tr(3)	6 [2]	10/10	2/2
	2008	tr(6)	9	27	nd	7 [3]	7/10	2/2
	2009	6	7	13	tr(3)	4 [1]	10/10	2/2

<Air>

cis-Chlordane: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.06pg/m^3, and the detection range was 2.7～790 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.06pg/m^3, and the detection range was 0.65～180 pg/m^3.

trans-Chlordane: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.05pg/m^3, and the detection range was 2.6～960 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.05pg/m^3, and the detection range was 0.68～210 pg/m^3.

Stocktaking of the detection of *cis*-chlordane and *trans*-chlordane in air during FY2002~2009

cis-chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	31	40	670	0.86	0.60 [0.20]	102/102	34/34
	2003 Warm season	110	120	1,600	6.4	0.51 [0.17]	35/35	35/35
	2003 Cold season	30	38	220	2.5		34/34	34/34
	2004 Warm season	92	160	1,000	2.3	0.57 [0.19]	37/37	37/37
	2004 Cold season	29	49	290	1.2		37/37	37/37
	2005 Warm season	92	120	1,000	3.4	0.16 [0.054]	37/37	37/37
	2005 Cold season	16	19	260	1.4		37/37	37/37
	2006 Warm season	82	110	760	2.9	0.13 [0.04]	37/37	37/37
	2006 Cold season	19	19	280	2.0		37/37	37/37
	2007 Warm season	90	120	1,100	3.3	0.10 [0.04]	36/36	36/36
	2007 Cold season	17	20	230	1.4		36/36	36/36
	2008 Warm season	75	120	790	1.9	0.14 [0.05]	37/37	37/37
	2008 Cold season	21	34	200	1.5		37/37	37/37
	2009 Warm season	67	110	790	2.7	0.16 [0.06]	37/37	37/37
	2009 Cold season	19	22	180	0.65		37/37	37/37

trans-chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	36	48	820	0.62	0.60 [0.20]	102/102	34/34
	2003 Warm season	130	150	2,000	6.5	0.86 [0.29]	35/35	35/35
	2003 Cold season	37	44	290	2.5		34/34	34/34
	2004 Warm season	110	190	1,300	2.2	0.69 [0.23]	37/37	37/37
	2004 Cold season	35	60	360	1.5		37/37	37/37
	2005 Warm season	100	130	1,300	3.2	0.34 [0.14]	37/37	37/37
	2005 Cold season	19	23	310	1.9		37/37	37/37
	2006 Warm season	96	140	1,200	3.4	0.17 [0.06]	37/37	37/37
	2006 Cold season	22	21	350	2.0		37/37	37/37
	2007 Warm season	100	140	1,300	3.8	0.12 [0.05]	36/36	36/36
	2007 Cold season	20	24	300	1.5		36/36	36/36
	2008 Warm season	87	130	990	2.5	0.17 [0.06]	37/37	37/37
	2008 Cold season	25	41	250	1.8		37/37	37/37
	2009 Warm season	79	120	960	2.6	0.12 [0.05]	37/37	37/37
	2009 Cold season	23	30	210	0.68		37/37	37/37

○Oxychlordane, *cis*-Nonachlor and *trans*-Nonachlor

<Surface Water>

Oxychlordane: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 45 of the 49 valid sites adopting the detection limit of 0.4pg/L, and none of the detected concentrations exceeded 19pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from a river mouth area was identified as statistically significant. In addition, the second-half period also indicated lower concentration than the first-half period in specimens from overall areas as statistically significant.

cis-Nonachlor: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.1pg/L, and the detection range was 1.4～210 pg/L.

trans-Nonachlor: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.4pg/L, and the detection range was 2.7～530 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009 and reduction tendency in specimens from the overall areas was also identified as statistically significant.

Stocktaking of the detection of Oxychlordane, *cis*-Nonachlor and *trans*-Nonachlor in surface water during FY2002~2009

Oxychlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	2.4	3.5	41	nd	1.2 [0.4]	96/114	35/38
	2003	3	2	39	tr(0.6)	2 [0.5]	36/36	36/36
	2004	3.2	2.9	47	tr(0.7)	2 [0.5]	38/38	38/38
	2005	2.6	2.1	19	nd	1.1 [0.4]	46/47	46/47
	2006	tr(2.5)	tr(2.4)	18	nd	2.8 [0.9]	43/48	43/48
	2007	tr(2)	nd	41	nd	6 [2]	25/48	25/48
	2008	1.9	1.9	14	nd	1.9 [0.7]	40/48	40/48
	2009	2.0	1.9	19	nd	1.1 [0.4]	45/49	45/49
cis-Nonachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	7.6	6.7	250	0.23	1.8 [0.6]	114/114	38/38
	2003	8.0	7.0	130	1.3	0.3 [0.1]	36/36	36/36
	2004	7.5	6.3	340	0.8	0.6 [0.2]	38/38	38/38
	2005	6.0	5.9	43	0.9	0.5 [0.2]	47/47	47/47
	2006	6.6	5.6	83	1.0	0.8 [0.3]	48/48	48/48
	2007	5.9	6.1	210	nd	2.4 [0.8]	43/48	43/48
	2008	6.5	5.9	130	0.9	0.9 [0.3]	48/48	48/48
	2009	7.1	5.5	210	1.4	0.3 [0.1]	49/49	49/49
trans-Nonachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	29	24	780	1.8	1.2 [0.4]	114/114	38/38
	2003	26	20	450	4	2 [0.5]	36/36	36/36
	2004	25	19	1,100	tr(3)	4 [2]	38/38	38/38
	2005	20	17	150	2.6	2.5 [0.84]	47/47	47/47
	2006	21	16	310	3.2	3.0 [1.0]	48/48	48/48
	2007	17	17	540	tr(2)	5 [2]	48/48	48/48
	2008	18	17	340	1.9	1.6 [0.6]	48/48	48/48
	2009	20	17	530	2.7	1.0 [0.4]	49/49	49/49

<Sediment>

Oxychlordane: The presence of the substance in sediment was monitored at 64 sites, and it was detected at 45 of the 64 valid sites adopting the detection limit of 1pg/g-dry, and none of the detected concentrations exceeded 150pg/g-dry.

cis-Nonachlor: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.4pg/g-dry, and the detection range was 1.4～4,700 pg/g-dry.

trans-Nonachlor: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.3pg/g-dry, and the detection range was 2.0～7,800 pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from a sea area as statistically significant. In addition, the second-half period also indicated lower concentration than the first-half period in specimens from overall areas as statistically significant.

Stocktaking of the detection of Oxychlordane, *cis*-Nonachlor and *trans*-Nonachlor in sediment during FY2002~2009

Oxychlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	2.2	1.7	120	nd	1.5 [0.5]	153/189	59/63
	2003	2	2	85	nd	1 [0.4]	158/186	57/62
	2004	tr(2.0)	tr(1.3)	140	nd	3 [0.8]	129/189	54/63
	2005	2.1	tr(1.9)	160	nd	2.0 [0.7]	133/189	51/63
	2006	tr(2.4)	tr(1.7)	280	nd	2.9 [1.0]	141/192	54/64
	2007	tr(1.8)	tr(1.5)	76	nd	2.5 [0.9]	117/192	46/64
	2008	tr(2)	tr(1)	340	nd	3 [1]	110/192	48/64
	2009	2	tr(1)	150	nd	2 [1]	97/192	45/64
cis-Nonachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	65	66	7,800	nd	2.1 [0.7]	188/189	63/63
	2003	59	50	6,500	nd	3 [0.9]	184/186	62/62
	2004	46	34	9,400	tr(0.8)	2 [0.6]	189/189	63/63
	2005	50	42	9,900	tr(1.1)	1.9 [0.64]	189/189	63/63
	2006	52	48	5,800	tr(0.6)	1.2 [0.4]	192/192	64/64
	2007	43	35	4,200	nd	1.6 [0.6]	191/192	64/64
	2008	49	42	5,100	1.1	0.6 [0.2]	192/192	64/64
	2009	46	38	4,700	1.4	1.0 [0.4]	192/192	64/64
trans-Nonachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	120	83	13,000	3.1	1.5 [0.5]	189/189	63/63
	2003	100	78	11,000	2	2 [0.6]	186/186	62/62
	2004	83	63	23,000	3	2 [0.6]	189/189	63/63
	2005	89	72	24,000	2.4	1.5 [0.54]	189/189	63/63
	2006	91	65	10,000	3.4	1.2 [0.4]	192/192	64/64
	2007	70	55	8,400	tr(1.6)	1.7 [0.6]	192/192	64/64
	2008	79	53	8,400	tr(1.6)	2.2 [0.8]	192/192	64/64
	2009	75	58	7,800	2.0	0.9 [0.3]	192/192	64/64

<Wildlife>

Oxychlordane: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 10～820 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 23～2,400 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 190～540 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from fish, black-tailed gulls and gray starlings were identified as statistically significant and the second-half period indicated lower concentration than the first-half period in specimens from a bivalves as statistically significant.

cis-Nonachlor: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 31～10,000 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 27～2,600 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 44～160 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from fish, black-tailed gulls and gray starlings were identified as statistically significant.

trans-Nonachlor: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 79～33,000 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 68～7,400 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 220～730 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from fish, black-tailed gulls and gray starlings were identified as statistically significant.

Stocktaking of the detection of Oxychlordane in wildlife (bivalves, fish and birds) during FY2002~2009

Oxychlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	76	83	5,600	nd	3.6 [1.2]	37/38	8/8
	2003	90	62	1,900	11	8.4 [2.8]	30/30	6/6
	2004	110	100	1,700	14	9.2 [3.1]	31/31	7/7
	2005	81	79	1,400	12	9.3 [3.1]	31/31	7/7
	2006	77	90	2,400	7	7 [3]	31/31	7/7
	2007	62	43	2,200	8	6 [2]	31/31	7/7
	2008	54	55	1,100	7	7 [2]	31/31	7/7
	2009	100	89	820	10	4 [1]	31/31	7/7
Fish (pg/g-wet)	2002	160	140	3,900	16	3.6 [1.2]	70/70	14/14
	2003	140	160	820	30	8.4 [2.8]	70/70	14/14
	2004	150	140	1,500	25	9.2 [3.1]	70/70	14/14
	2005	140	150	1,900	20	9.3 [3.1]	80/80	16/16
	2006	140	120	3,000	28	7 [3]	80/80	16/16
	2007	120	100	1,900	17	6 [2]	80/80	16/16
	2008	120	130	2,200	15	7 [2]	85/85	17/17
	2009	110	99	2,400	23	4 [1]	90/90	18/18
Birds (pg/g-wet)	2002	640	630	890	470	3.6 [1.2]	10/10	2/2
	2003	750	700	1,300	610	8.4 [2.8]	10/10	2/2
	2004	460	450	730	320	9.2 [3.1]	10/10	2/2
	2005	600	660	860	390	9.3 [3.1]	10/10	2/2
	2006	500	560	720	270	7 [3]	10/10	2/2
	2007	440	400	740	290	6 [2]	10/10	2/2
	2008	530	530	960	290	7 [2]	10/10	2/2
	2009	300	290	540	190	4 [1]	10/10	2/2

Stocktaking of the detection of *cis*-Nonachlor in wildlife (bivalves, fish and birds) during FY2002~2009

cis-Nonachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	190	300	870	8.6	1.2 [0.4]	38/38	8/8
	2003	290	260	1,800	48	4.8 [1.6]	30/30	6/6
	2004	280	380	1,800	43	3.4 [1.1]	31/31	7/7
	2005	220	220	1,300	27	4.5 [1.5]	31/31	7/7
	2006	210	180	1,500	31	3 [1]	31/31	7/7
	2007	210	250	1,000	26	3 [1]	31/31	7/7
	2008	180	210	780	33	4 [1]	31/31	7/7
	2009	270	310	10,000	31	3 [1]	31/31	7/7
Fish (pg/g-wet)	2002	420	420	5,100	46	1.2 [0.4]	70/70	14/14
	2003	350	360	2,600	19	4.8 [1.6]	70/70	14/14
	2004	410	310	10,000	48	3.4 [1.1]	70/70	14/14
	2005	360	360	6,200	27	4.5 [1.5]	80/80	16/16
	2006	360	330	3,300	33	3 [1]	80/80	16/16
	2007	310	280	3,700	16	3 [1]	80/80	16/16
	2008	330	300	3,200	46	4 [1]	85/85	17/17
	2009	310	340	2,600	27	3 [1]	90/90	18/18
Birds (pg/g-wet)	2002	200	240	450	68	1.2 [0.4]	10/10	2/2
	2003	200	260	660	68	4.8 [1.6]	10/10	2/2
	2004	130	150	240	73	3.4 [1.1]	10/10	2/2
	2005	160	180	370	86	4.5 [1.5]	10/10	2/2
	2006	120	130	270	60	3 [1]	10/10	2/2
	2007	120	140	300	42	3 [1]	10/10	2/2
	2008	130	150	410	37	4 [1]	10/10	2/2
	2009	81	85	160	44	3 [1]	10/10	2/2

Stocktaking of the detection of *trans*-Nonachlor in wildlife (bivalves, fish and birds) during FY2002~2009

trans-Nonachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2002	510	1,100	1,800	21	2.4 [0.8]	38/38	8/8
	2003	780	700	3,800	140	3.6 [1.2]	30/30	6/6
	2004	710	870	3,400	110	13 [4.2]	31/31	7/7
	2005	570	650	3,400	72	6.2 [2.1]	31/31	7/7
	2006	530	610	3,200	85	3 [1]	31/31	7/7
	2007	540	610	2,400	71	7 [3]	31/31	7/7
	2008	440	510	2,000	94	6 [2]	31/31	7/7
	2009	720	680	33,000	79	3 [1]	31/31	7/7
Fish (pg/g-wet)	2002	970	900	8,300	98	2.4 [0.8]	70/70	14/14
	2003	880	840	5,800	85	3.6 [1.2]	70/70	14/14
	2004	1,000	760	21,000	140	13 [4.2]	70/70	14/14
	2005	910	750	13,000	80	6.2 [2.1]	80/80	16/16
	2006	910	680	6,900	120	3 [1]	80/80	16/16
	2007	780	680	7,900	71	7 [3]	80/80	16/16
	2008	820	750	6,900	87	6 [2]	85/85	17/17
	2009	750	720	7,400	68	3 [1]	90/90	18/18
Birds (pg/g-wet)	2002	880	980	1,900	350	2.4 [0.8]	10/10	2/2
	2003	1,100	1,400	3,700	350	3.6 [1.2]	10/10	2/2
	2004	680	780	1,200	390	13 [4.2]	10/10	2/2
	2005	850	880	2,000	440	6.2 [2.1]	10/10	2/2
	2006	630	620	1,500	310	3 [1]	10/10	2/2
	2007	590	680	1,400	200	7 [3]	10/10	2/2
	2008	680	850	2,600	180	6 [2]	10/10	2/2
	2009	390	430	730	220	3 [1]	10/10	2/2

<Air>

Oxychlordane: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.38～6.5 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.24～2.7 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens at the cold season was identified as statistically significant.

cis-Nonachlor: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.33～110 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.07～18 pg/m^3.

trans-Nonachlor: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.03pg/m^3, and the detection range was 2.2～630 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.03pg/m^3, and the detection range was 0.75～140 pg/m^3.

Stocktaking of the detection of Oxychlordane, cis-Nonachlor and trans-Nonachlor in air during FY2002~2009

Oxychlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	0.96	0.98	8.3	nd	0.024 [0.008]	101/102	34/34
	2003 Warm season	2.5	2.7	12	0.41	0.045 [0.015]	35/35	35/35
	2003 Cold season	0.87	0.88	3.2	0.41		34/34	34/34
	2004 Warm season	1.9	2.0	7.8	0.41	0.13 [0.042]	37/37	37/37
	2004 Cold season	0.80	0.76	3.9	0.27		37/37	37/37
	2005 Warm season	1.9	2.0	8.8	0.65	0.16 [0.054]	37/37	37/37
	2005 Cold season	0.55	0.50	2.2	0.27		37/37	37/37
	2006 Warm season	1.8	1.9	5.7	0.47	0.23 [0.08]	37/37	37/37
	2006 Cold season	0.54	0.56	5.1	tr(0.13)		37/37	37/37
	2007 Warm season	1.9	1.8	8.6	0.56	0.05 [0.02]	36/36	36/36
	2007 Cold season	0.61	0.63	2.4	0.26		36/36	36/36
	2008 Warm season	1.7	1.7	7.1	0.50	0.04 [0.01]	37/37	37/37
	2008 Cold season	0.61	0.63	1.8	0.27		37/37	37/37
	2009 Warm season	1.7	1.8	6.5	0.38	0.04 [0.02]	37/37	37/37
	2009 Cold season	0.65	0.61	2.7	0.24		37/37	37/37

cis-Nonachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	3.1	4.0	62	0.071	0.030 [0.010]	102/102	34/34
	2003 Warm season	12	15	220	0.81	0.026 [0.0088]	35/35	35/35
	2003 Cold season	2.7	3.5	23	0.18		34/34	34/34
	2004 Warm season	10	15	130	0.36	0.072 [0.024]	37/37	37/37
	2004 Cold season	2.7	4.4	28	0.087		37/37	37/37
	2005 Warm season	10	14	160	0.30	0.08 [0.03]	37/37	37/37
	2005 Cold season	1.6	1.6	34	0.08		37/37	37/37
	2006 Warm season	11	12	170	0.28	0.15 [0.05]	37/37	37/37
	2006 Cold season	2.4	2.0	41	tr(0.14)		37/37	37/37
	2007 Warm season	10	14	150	0.31	0.03 [0.01]	36/36	36/36
	2007 Cold season	1.6	1.7	22	0.09		36/36	36/36
	2008 Warm season	7.9	12	87	0.18	0.03 [0.01]	37/37	37/37
	2008 Cold season	2.0	2.7	19	0.16		37/37	37/37
	2009 Warm season	7.5	10	110	0.33	0.04 [0.02]	37/37	37/37
	2009 Cold season	1.9	2.1	18	0.07		37/37	37/37

trans-Nonachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	24	30	550	0.64	0.30 [0.10]	102/102	34/34
	2003 Warm season	87	100	1,200	5.1	0.35 [0.12]	35/35	35/35
	2003 Cold season	24	28	180	2.1		34/34	34/34
	2004 Warm season	72	120	870	1.9	0.48 [0.16]	37/37	37/37
	2004 Cold season	23	39	240	0.95		37/37	37/37
	2005 Warm season	75	95	870	3.1	0.13 [0.044]	37/37	37/37
	2005 Cold season	13	16	210	1.2		37/37	37/37
	2006 Warm season	68	91	800	3.0	0.10 [0.03]	37/37	37/37
	2006 Cold season	16	15	240	1.4		37/37	37/37
	2007 Warm season	72	96	940	2.5	0.09 [0.03]	36/36	36/36
	2007 Cold season	13	15	190	1.1		36/36	36/36
	2008 Warm season	59	91	650	1.5	0.09 [0.03]	37/37	37/37
	2008 Cold season	17	25	170	1.3		37/37	37/37
	2009 Warm season	54	81	630	2.2	0.07 [0.03]	37/37	37/37
	2009 Cold season	16	19	140	0.75		37/37	37/37

[8] Heptachlors

・ History and state of monitoring

Heptachlor and its metabolite, heptachlor epoxide, are a group of organochlorine insecticides applied for agricultural crops such as rice, wheat, barley, potato, sweet potato, tobacco, beans, cruciferous vegetables, alliaceous vegetables, cucurbitaceous vegetables, sugar beet and spinach. The substances were not registrated under the Agricultural Chemicals Regulation Law in FY 1975. The substances were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in September 1986, since it includes the technical chlordane used as a termitecide.

In previous monitoring series before FY 2001, heptachlor and heptachlor epoxide were measured in FY 1982 (in surface water, sediment and fish) and in FY 1986 (in air) under the framework of “the Environmental Survey and Monitoring of Chemicals.”

Under the framework of the Environmental Monitoring, Heptachlor in water, sediment, and fish has been monitored since FY 2002, and *cis*-Heptachlor epoxide and *trans*-Heptachlor epoxide have also been monitored since FY 2003.

・ Monitoring results

<Surface Water>

Heptachlor: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 20 of the 49 valid sites adopting the detection limit of 0.3pg/L, and none of the detected concentrations exceeded 17pg/L.

cis-Heptachlor epoxide: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.2pg/L, and the detection range was 0.8～72 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from the overall areas was also identified as statistically significant.

trans-Heptachlor epoxide: The presence of the substance in surface water was monitored at 49 sites, and it was not detected at all 49 valid sites adopting the detection limit of 0.3pg/L.

Stocktaking of the detection of heptachlor, *cis*-heptachlor epocide and *trans*-heptachlor epocide in surface water during FY2002~2009

Heptachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	tr(1.1)	1.0	25	nd	1.5 [0.5]	97/114	38/38
	2003	tr(1.8)	tr(1.6)	7	tr(1.0)	2 [0.5]	36/36	36/36
	2004	nd	nd	29	nd	5 [2]	9/38	9/38
	2005	nd	tr(1)	54	nd	3 [1]	25/47	25/47
	2006	nd	nd	6	nd	5 [2]	5/48	5/48
	2007	nd	nd	5.2	nd	2.4 [0.8]	12/48	12/48
	2008	nd	nd	4.6	nd	2.1 [0.8]	19/48	19/48
	2009	tr(0.5)	nd	17	nd	0.8 [0.3]	20/49	20/49
cis-Heptachlor epoxide	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2003	9.8	11	170	1.2	0.7 [0.2]	36/36	36/36
	2004	10	10	77	2	2 [0.4]	38/38	38/38
	2005	7.1	6.6	59	1.0	0.7 [0.2]	47/47	47/47
	2006	7.6	6.6	47	1.1	2.0 [0.7]	48/48	48/48
	2007	6.1	5.8	120	tr(0.9)	1.3 [0.4]	48/48	48/48
	2008	4.7	5.0	37	nd	0.6 [0.2]	46/48	46/48
	2009	5.5	4.2	72	0.8	0.5 [0.2]	49/49	49/49
trans-Heptachlor epoxide	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2003	nd	nd	2	nd	2 [0.4]	4/36	4/36
	2004	nd	nd	nd	nd	0.9 [0.3]	0/38	0/38
	2005	nd	nd	nd	nd	0.7 [0.2]	0/47	0/47
	2006	nd	nd	nd	nd	1.8 [0.6]	0/48	0/48
	2007	nd	nd	tr(0.9)	nd	2.0 [0.7]	2/48	2/48
	2008	nd	nd	nd	nd	1.9 [0.7]	0/48	0/48
	2009	nd	nd	nd	nd	0.7 [0.3]	0/49	0/49

<Sediment>

Heptachlor: The presence of the substance in sediment was monitored at 64 sites, and it was detected at 59 of the 64 valid sites adopting the detection limit of 0.4pg/g-dry, and none of the detected concentrations exceeded 65pg/g-dry.

cis-Heptachlor epoxide: The presence of the substance in sediment was monitored at 64 sites, and it was detected at 63 of the 64 valid sites adopting the detection limit of 0.3pg/g-dry, and none of the detected concentrations exceeded 290 pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from a river mouth area and sea area as statistically significant.

trans-Heptachlor epoxide: The presence of the substance in sediment was monitored at 64 sites, and it was not detected at all 64 valid sites adopting the detection limit of 0.6pg/g-dry.

Stocktaking of the detection of heptachlor, *cis*-heptachlor epocide and *trans*-heptachlor epocide in sediment during FY2002~2009

Heptachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	3.5	3.2	120	nd	1.8 [0.6]	167/189	60/63
	2003	tr(2.4)	tr(2.2)	160	nd	3 [1]	138/186	53/62
	2004	tr(2.5)	tr(2.3)	170	nd	3 [0.9]	134/189	53/63
	2005	2.5	2.8	200	nd	2.5 [0.8]	120/189	48/63
	2006	4.6	3.9	230	nd	1.9 [0.6]	190/192	64/64
	2007	tr(1.7)	tr(1.5)	110	nd	3 [0.7]	143/192	57/64
	2008	tr(1)	nd	85	nd	4 [1]	59/192	27/64
	2009	1.4	1.3	65	nd	1.1 [0.4]	144/192	59/64
cis-Heptachlor epoxide	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2003	4	3	160	nd	3 [1]	153/186	55/62
	2004	tr(4.4)	tr(3.0)	230	nd	6 [2]	136/189	52/63
	2005	tr(4)	tr(3)	140	nd	7 [2]	119/189	49/63
	2006	3.7	3.2	210	nd	3.0 [1.0]	157/192	58/64
	2007	3	tr(2)	270	nd	3 [1]	141/192	53/64
	2008	2	2	180	nd	2 [1]	130/192	51/64
	2009	2.3	1.9	290	nd	0.7 [0.3]	176/192	63/64
trans-Heptachlor epoxide	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2003	nd	nd	nd	nd	9 [3]	0/186	0/62
	2004	nd	nd	tr(2.5)	nd	4 [2]	1/189	1/63
	2005	nd	nd	nd	nd	5 [2]	0/189	0/63
	2006	nd	nd	19	nd	7 [2]	2/192	2/64
	2007	nd	nd	31	nd	10 [4]	2/192	2/64
	2008	nd	nd	nd	nd	1.7 [0.7]	0/192	0/64
	2009	nd	nd	nd	nd	1.4 [0.6]	0/192	0/64

<Wildlife>

Heptachlor: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at 4 of the 7 valid areas adopting the detection limit of 2pg/g-wet, and none of the detected concentrations exceeded 120 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at 11 of the 18 valid areas adopting the detection limit of 2pg/g-wet, and none of the detected concentrations exceeded 8 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was not detected at all 18 valid areas adopting the detection limit of 2pg/g-wet.

cis-Heptachlor epoxide: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 10～380 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 4～310 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 160～390 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from black-tailed gulls was identified as statistically significant.

trans-Heptachlor epoxide: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at 3 of the 7 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 24 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was not detected at all 18 valid areas adopting the detection limit of 3pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was not detected at all 18 valid areas adopting the detection limit of 3pg/g-wet.

Stocktaking of the detection of heptachlor in wildlife (bivalves, fish and birds) during FY2002~2009

Heptachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	3.6	4.6	15	nd	4.2 [1.4]	28/38	6/8
	2003	tr(2.8)	tr(2.4)	14	nd	6.6 [2.2]	16/30	4/6
	2004	tr (3.5)	5.2	16	nd	4.1 [1.4]	23/31	6/7
	2005	tr(2.3)	tr(2.9)	24	nd	6.1 [2.0]	18/31	6/7
	2006	tr(3)	tr(4)	20	nd	6 [2]	23/31	6/7
	2007	tr(3)	tr(3)	12	nd	6 [2]	20/31	6/7
	2008	tr(2)	nd	9	nd	6 [2]	13/31	5/7
	2009	tr(3)	nd	120	nd	5 [2]	14/31	4/7
Fish (pg/g-wet)	2002	4.0	4.8	20	nd	4.2 [1.4]	57/70	12/14
	2003	nd	nd	11	nd	6.6 [2.2]	29/70	8/14
	2004	tr(1.9)	tr(2.1)	460	nd	4.1 [1.4]	50/70	11/14
	2005	nd	nd	7.6	nd	6.1 [2.0]	32/80	8/16
	2006	tr(2)	nd	8	nd	6 [2]	36/80	8/16
	2007	nd	nd	7	nd	6 [2]	28/80	6/16
	2008	nd	nd	9	nd	6 [2]	25/85	7/17
	2009	nd	nd	8	nd	5 [2]	30/90	11/18
Birds (pg/g-wet)	2002	tr(2.1)	tr(2.8)	5.2	nd	4.2 [1.4]	7/10	2/2
	2003	nd	nd	nd	nd	6.6 [2.2]	0/10	0/2
	2004	nd	nd	tr(1.5)	nd	4.1 [1.4]	1/10	1/2
	2005	nd	nd	nd	nd	6.1 [2.0]	0/10	0/2
	2006	nd	nd	nd	nd	6 [2]	0/10	0/2
	2007	nd	nd	nd	nd	6 [2]	0/10	0/2
	2008	nd	nd	nd	nd	6 [2]	0/10	0/2
	2009	nd	nd	nd	nd	5 [2]	0/10	0/2

Stocktaking of the detection of *cis*-heptachlor epocide in wildlife (bivalves, fish and birds) during FY2002~2009

cis-Heptachlor epoxide	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2003	42	29	880	9.7	6.9 [2.3]	30/30	6/6
	2004	57	34	840	tr(9.8)	9.9 [3.3]	31/31	7/7
	2005	36	20	590	7.4	3.5 [1.2]	31/31	7/7
	2006	44	23	1,100	8	4 [1]	31/31	7/7
	2007	30	20	1,100	8	4 [1]	31/31	7/7
	2008	31	19	510	8	5 [2]	31/31	7/7
	2009	58	33	380	10	3 [1]	31/31	7/7
Fish (pg/g-wet)	2003	42	43	320	7.0	6.9 [2.3]	70/70	14/14
	2004	46	49	620	tr(3.3)	9.9 [3.3]	70/70	14/14
	2005	39	45	390	4.9	3.5 [1.2]	80/80	16/16
	2006	40	48	270	4	4 [1]	80/80	16/16
	2007	41	49	390	4	4 [1]	80/80	16/16
	2008	38	46	350	tr(3)	5 [2]	85/85	17/17
	2009	40	50	310	4	3 [1]	90/90	18/18
Birds (pg/g-wet)	2003	520	510	770	370	6.9 [2.3]	10/10	2/2
	2004	270	270	350	190	9.9 [3.3]	10/10	2/2
	2005	360	340	690	250	3.5 [1.2]	10/10	2/2
	2006	320	310	650	240	4 [1]	10/10	2/2
	2007	280	270	350	250	4 [1]	10/10	2/2
	2008	350	370	560	180	5 [2]	10/10	2/2
	2009	220	210	390	160	3 [1]	10/10	2/2

Stocktaking of the detection of *trans*-heptachlor epoxide in wildlife (bivalves, fish and birds) during FY2002~2009

trans-Heptachlor epoxide	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2003	nd	nd	48	nd	13 [4.4]	5/30	1/6
	2004	tr(4.0)	nd	55	nd	12 [4]	9/31	2/7
	2005	nd	nd	37	nd	23 [7.5]	5/31	1/7
	2006	nd	nd	45	nd	13 [5]	5/31	1/7
	2007	nd	nd	61	nd	13 [5]	5/31	1/7
	2008	nd	nd	33	nd	10 [4]	5/31	1/7
	2009	nd	nd	24	nd	8 [3]	13/31	3/7
Fish (pg/g-wet)	2003	nd	nd	nd	nd	13 [4.4]	0/70	0/14
	2004	nd	nd	tr(10)	nd	12 [4]	2/70	2/14
	2005	nd	nd	nd	nd	23 [7.5]	0/80	0/16
	2006	nd	nd	nd	nd	13 [5]	0/80	0/16
	2007	nd	nd	nd	nd	13 [5]	0/80	0/16
	2008	nd	nd	nd	nd	10 [4]	0/85	0/17
	2009	nd	nd	nd	nd	8 [3]	0/90	0/18
Birds (pg/g-wet)	2003	nd	nd	nd	nd	13 [4.4]	0/10	0/2
	2004	nd	nd	nd	nd	12 [4]	0/10	0/2
	2005	nd	nd	nd	nd	23 [7.5]	0/10	0/2
	2006	nd	nd	nd	nd	13 [5]	0/10	0/2
	2007	nd	nd	nd	nd	13 [5]	0/10	0/2
	2008	nd	nd	nd	nd	10 [4]	0/10	0/2
	2009	nd	nd	nd	nd	8 [3]	0/10	0/2

<Air>

Heptachlor: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was 0.48～110 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was 0.15～48 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens at the both season as statistically significant.

cis-Heptachlor epoxide: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was 0.37～16 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was 0.42～3.8 pg/m^3.

trans-Heptachlor epoxide: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 10 of the 37 valid sites adopting the detection limit of 0.05pg/m^3, and none of the detected concentrations exceeded 0.18 pg/gm^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 1 of the 37 valid sites adopting the detection limit of 0.05pg/m^3, and none of the detected concentrations exceeded tr(0.06) pg/gm^3.

Stocktaking of the detection of heptachlor, *cis*-heptachlor epocide and *trans*-heptachlor epocide in air during FY2002~2009

Heptachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2002	11	14	220	0.20	0.12 [0.04]	102/102	34/34
	2003 Warm season	27	41	240	1.1	0.25 [0.085]	35/35	35/35
	2003 Cold season	10	16	65	0.39		34/34	34/34
	2004 Warm season	23	36	200	0.46	0.23 [0.078]	37/37	37/37
	2004 Cold season	11	18	100	0.53		37/37	37/37
	2005 Warm season	25	29	190	1.1	0.16 [0.054]	37/37	37/37
	2005 Cold season	6.5	7.9	61	0.52		37/37	37/37
	2006 Warm season	20	27	160	0.88	0.11 [0.04]	37/37	37/37
	2006 Cold season	6.8	7.2	56	0.32		37/37	37/37
	2007 Warm season	22	27	320	1.1	0.07 [0.03]	36/36	36/36
	2007 Cold season	6.3	8.0	74	0.42		36/36	36/36
	2008 Warm season	20	31	190	0.92	0.06 [0.02]	37/37	37/37
	2008 Cold season	7.5	12	60	0.51		37/37	37/37
	2009 Warm season	18	30	110	0.48	0.04 [0.01]	37/37	37/37
	2009 Cold season	6.3	7.8	48	0.15		37/37	37/37
***cis*-Heptachlor epoxide**	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Air (pg/m^3)	2003 Warm season	3.5	3.5	28	0.45	0.015 [0.0048]	35/35	35/35
	2003 Cold season	1.3	1.3	6.6	0.49		34/34	34/34
	2004 Warm season	2.8	2.9	9.7	0.65	0.052 [0.017]	37/37	37/37
	2004 Cold season	1.1	1.1	7.0	0.44		37/37	37/37
	2005 Warm season	1.5	1.7	11	tr(0.10)	0.12 [0.044]	37/37	37/37
	2005 Cold season	0.91	0.81	2.9	0.43		37/37	37/37
	2006 Warm season	1.7	2.0	6.7	0.13	0.11 [0.04]	37/37	37/37
	2006 Cold season	0.74	0.88	3.2	nd		36/37	36/37
	2007 Warm season	2.9	2.8	13	0.54	0.03 [0.01]	36/36	36/36
	2007 Cold season	0.93	0.82	3.0	0.41		36/36	36/36
	2008 Warm season	2.4	2.2	9.9	0.53	0.022 [0.008]	37/37	37/37
	2008 Cold season	0.91	0.84	3.0	0.37		37/37	37/37
	2009 Warm season	2.5	2.6	16	0.37	0.03 [0.01]	37/37	37/37
	2009 Cold season	1.0	0.91	3.8	0.42		37/37	37/37
***trans*-Heptachlor epoxide**	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Air (pg/m^3)	2003 Warm season	tr(0.036)	tr(0.038)	0.30	nd	0.099 [0.033]	18/35	18/35
	2003 Cold season	nd	nd	tr(0.094)	nd		3/34	3/34
	2004 Warm season	nd	nd	tr(0.38)	nd	0.6 [0.2]	4/37	4/37
	2004 Cold season	nd	nd	nd	nd		0/37	0/37
	2005 Warm season	tr(0.10)	tr(0.12)	1.2	nd	0.16 [0.05]	27/37	27/37
	2005 Cold season	nd	nd	0.32	nd		3/37	3/37
	2006 Warm season	nd	nd	0.7	nd	0.3 [0.1]	2/37	2/37
	2006 Cold season	nd	nd	tr(0.1)	nd		1/37	1/37
	2007 Warm season	nd	nd	0.16	nd	0.14 [0.06]	8/36	8/36
	2007 Cold season	nd	nd	tr(0.06)	nd		1/36	1/36
	2008 Warm season	nd	nd	0.17	nd	0.16 [0.06]	6/37	6/37
	2008 Cold season	nd	nd	nd	nd		0/37	0/37
	2009 Warm season	nd	nd	0.18	nd	0.14 [0.05]	10/37	10/37
	2009 Cold season	nd	nd	tr(0.06)	nd		1/37	1/37

[9] Toxaphenes

- History and state of monitoring

Toxaphenes are a group of organochlorine insecticides. No domestic record of manufacture/import of the substances was reported since those were historically never registrated under the Agricultural Chemicals Regulation Law. The substances were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in September 2002.

In previous monitoring series before FY 2001, the substance was measured in FY 1983 (in surface water and sediment) under the framework of "the Environmental Survey and Monitoring of Chemicals."

Under the framework of the Environmental Monitoring, Parlar-26, Parlar-50 and Parlar-62 have been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air since FY 2003.

- Monitoring results

○ Parlar-26, Parlar-50 and Parlar-62

<Surface Water>

Parlar-26: The presence of the substance in surface water was monitored at 49 sites, and it was not detected at all 49 valid sites adopting the detection limit of 2pg/L.

Parlar-50: The presence of the substance in surface water was monitored at 49 sites, and it was not detected at all 49 valid sites adopting the detection limit of 3pg/L.

Parlar-62: The presence of the substance in surface water was monitored at 49 sites, and it was not detected at all 49 valid sites adopting the detection limit of 20pg/L.

Stocktaking of the detection of Parlar-26, Parlar-50 and Parlar-62 in surface water during FY2002~2009

Parlar-26	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2003	nd	nd	nd	nd	40 [20]	0/36	0/36
	2004	nd	nd	nd	nd	9 [3]	0/38	0/38
	2005	nd	nd	nd	nd	10 [4]	0/47	0/47
	2006	nd	nd	nd	nd	16 [5]	0/48	0/48
	2007	nd	nd	nd	nd	20 [5]	0/48	0/48
	2008	nd	nd	nd	nd	8 [3]	0/48	0/48
	2009	nd	nd	nd	nd	5 [2]	0/49	0/49
Parlar-50	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2003	nd	nd	nd	nd	70 [30]	0/36	0/36
	2004	nd	nd	nd	nd	20 [7]	0/38	0/38
	2005	nd	nd	nd	nd	20 [5]	0/47	0/47
	2006	nd	nd	nd	nd	16 [5]	0/48	0/48
	2007	nd	nd	nd	nd	9 [3]	0/48	0/48
	2008	nd	nd	nd	nd	7 [3]	0/48	0/48
	2009	nd	nd	nd	nd	7 [3]	0/49	0/49
Parlar-62	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2003	nd	nd	nd	nd	300 [90]	0/36	0/36
	2004	nd	nd	nd	nd	90 [30]	0/38	0/38
	2005	nd	nd	nd	nd	70[30]	0/47	0/47
	2006	nd	nd	nd	nd	60 [20]	0/48	0/48
	2007	nd	nd	nd	nd	70 [30]	0/48	0/48
	2008	nd	nd	nd	nd	40 [20]	0/48	0/48
	2009	nd	nd	nd	nd	40 [20]	0/49	0/49

<Sediment>

Parlar-26: The presence of the substance in sediment was monitored at 64 sites, and it was not detected at all 64 valid sites adopting the detection limit of 4pg/g-dry.

Parlar-50: The presence of the substance in sediment was monitored at 64 sites, and it was not detected at all 64 valid sites adopting the detection limit of 5pg/g-dry.

Parlar-62: The presence of the substance in sediment was monitored at 64 sites, and it was not detected at all 64 valid sites adopting the detection limit of 30pg/g-dry.

Stocktaking of the detection of Parlar-26, Parlar-50 and Parlar-62 in sediment during FY2002~2009

Parlar-26	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2003	nd	nd	nd	nd	90 [30]	0/186	0/62
	2004	nd	nd	nd	nd	60 [20]	0/189	0/63
	2005	nd	nd	nd	nd	60 [30]	0/189	0/63
	2006	nd	nd	nd	nd	12 [4]	0/192	0/64
	2007	nd	nd	nd	nd	7 [3]	0/192	0/64
	2008	nd	nd	nd	nd	12 [5]	0/192	0/64
	2009	nd	nd	nd	nd	10 [4]	0/192	0/64
Parlar-50	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency**	
							Sample	**Site**
Sediment (pg/g-dry)	2003	nd	nd	nd	nd	200 [50]	0/186	0/62
	2004	nd	nd	nd	nd	60 [20]	0/189	0/63
	2005	nd	nd	nd	nd	90 [40]	0/189	0/63
	2006	nd	nd	nd	nd	24 [7]	0/192	0/64
	2007	nd	nd	nd	nd	30 [10]	0/192	0/64
	2008	nd	nd	nd	nd	17 [6]	0/192	0/64
	2009	nd	nd	nd	nd	12 [5]	0/192	0/64
Parlar-62	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency**	
							Sample	**Site**
Sediment (pg/g-dry)	2003	nd	nd	nd	nd	4,000 [2,000]	0/186	0/62
	2004	nd	nd	nd	nd	2,000 [400]	0/189	0/63
	2005	nd	nd	nd	nd	2,000 [700]	0/189	0/63
	2006	nd	nd	nd	nd	210 [60]	0/192	0/64
	2007	nd	nd	nd	nd	300 [70]	0/192	0/64
	2008	nd	nd	nd	nd	90 [40]	0/192	0/64
	2009	nd	nd	nd	nd	80 [30]	0/192	0/64

<Wildlife>

Parlar-26: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 23 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 690 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 500 pg/g-wet. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens from black-tailed gulls was identified as statistically significant.

Parlar-50: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 31 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 910 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at 1 of the 2 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 620 pg/g-wet. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens from black-tailed gulls was identified as statistically significant.

Parlar-62: The presence of the substance in bivalves was monitored in 7 areas, and it was not detected at all 7 valid areas adopting the detection limit of 20pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at 8 of the 18 valid areas adopting the detection limit of 20pg/g-wet, and none of the detected concentrations exceeded 660 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at 1 of the 2 valid areas adopting the detection limit of 20pg/g-wet, and none of the detected concentrations exceeded 210 pg/g-wet. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens from black-tailed gulls was identified as statistically significant.

Stocktaking of the detection of Parlar-26 in wildlife (bivalves, fish and birds) during FY2002~2009

Parlar-26	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2003	nd	nd	tr(39)	nd	45 [15]	11/30	3/6
	2004	nd	nd	tr(32)	nd	42 [14]	15/31	3/7
	2005	nd	nd	tr(28)	nd	47 [16]	7/31	4/7
	2006	tr(9)	tr(12)	25	nd	18 [7]	21/31	5/7
	2007	tr(8)	tr(8)	20	nd	10[4]	26/31	6/7
	2008	tr(8)	tr(8)	22	nd	9 [3]	27/31	7/7
	2009	9	9	23	nd	7 [3]	27/31	7/7
Fish (pg/g-wet)	2003	tr(29)	tr(24)	810	nd	45 [15]	44/70	11/14
	2004	tr(40)	tr(41)	1,000	nd	42 [14]	54/70	13/14
	2005	tr(39)	53	900	nd	47 [16]	50/75	13/16
	2006	37	44	880	nd	18 [7]	70/80	15/16
	2007	24	32	690	nd	10[4]	64/80	14/16
	2008	30	33	730	nd	9 [3]	79/85	17/17
	2009	23	20	690	nd	7 [3]	82/90	18/18
Birds (pg/g-wet)	2003	110	650	2,500	nd	45 [15]	5/10	1/2
	2004	71	340	810	nd	42 [14]	5/10	1/2
	2005	85	380	1,200	nd	47 [16]	5/10	1/2
	2006	48	290	750	nd	18 [7]	5/10	1/2
	2007	34	280	650	nd	10[4]	5/10	1/2
	2008	40	320	1,200	nd	9 [3]	6/10	2/2
	2009	28	200	500	nd	7 [3]	6/10	2/2

Stocktaking of the detection of Parlar-50 in wildlife (bivalves, fish and birds) during FY2002~2009

Parlar-50	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2003	tr(13)	tr(12)	58	nd	33 [11]	17/30	4/6
	2004	tr(16)	nd	tr(45)	nd	46 [15]	15/31	3/7
	2005	nd	nd	tr(38)	nd	54 [18]	9/31	4/7
	2006	tr(11)	14	32	nd	14 [5]	24/31	6/7
	2007	10	10	37	nd	9 [3]	27/31	7/7
	2008	tr(7)	tr(6)	23	nd	10 [4]	23/31	6/7
	2009	9	9	31	nd	8 [3]	27/31	7/7
Fish (pg/g-wet)	2003	34	34	1,100	nd	33 [11]	55/70	14/14
	2004	54	61	1,300	nd	46 [15]	59/70	14/14
	2005	tr(50)	66	1,400	nd	54 [18]	55/80	13/16
	2006	49	52	1,300	nd	14 [5]	79/80	16/16
	2007	32	41	1,100	nd	9 [3]	77/80	16/16
	2008	38	45	1,000	nd	10 [4]	77/85	17/17
	2009	28	23	910	nd	8 [3]	85/90	18/18
Birds (pg/g-wet)	2003	110	850	3,000	nd	33 [11]	5/10	1/2
	2004	83	440	1,000	nd	46 [15]	5/10	1/2
	2005	100	480	1,500	nd	54 [18]	5/10	1/2
	2006	46	380	1,000	nd	14 [5]	5/10	1/2
	2007	34	360	930	nd	9 [3]	5/10	1/2
	2008	49	410	1,600	nd	10 [4]	5/10	1/2
	2009	29	250	620	nd	8 [3]	5/10	1/2

Stocktaking of the detection of Parlar-62 in wildlife (bivalves, fish and birds) during FY2002~2009

Parlar-62	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2003	nd	nd	nd	nd	120 [40]	0/30	0/6
	2004	nd	nd	nd	nd	98 [33]	0/31	0/7
	2005	nd	nd	nd	nd	100 [34]	0/31	0/7
	2006	nd	nd	nd	nd	70 [30]	0/31	0/7
	2007	nd	nd	nd	nd	70 [30]	0/31	0/7
	2008	nd	nd	nd	nd	80 [30]	0/31	0/7
	2009	nd	nd	nd	nd	70 [20]	0/31	0/7
Fish (pg/g-wet)	2003	nd	nd	580	nd	120 [40]	9/70	3/14
	2004	nd	nd	870	nd	98 [33]	24/70	7/14
	2005	nd	nd	830	nd	100 [34]	23/80	8/16
	2006	tr(30)	nd	870	nd	70 [30]	28/80	10/16
	2007	nd	nd	530	nd	70 [30]	22/80	7/16
	2008	tr(30)	nd	590	nd	80 [30]	31/85	8/17
	2009	nd	nd	660	nd	70 [20]	24/90	8/18
Birds (pg/g-wet)	2003	tr(96)	200	530	nd	120 [40]	5/10	1/2
	2004	tr(64)	110	280	nd	98 [33]	5/10	1/2
	2005	tr(77)	130	460	nd	100 [34]	5/10	1/2
	2006	70	120	430	nd	70 [30]	5/10	1/2
	2007	tr(60)	100	300	nd	70 [30]	5/10	1/2
	2008	tr(70)	130	360	nd	80 [30]	5/10	1/2
	2009	tr(43)	80	210	nd	70 [20]	5/10	1/2

<Air>

Parlar-26: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.09pg/m^3, and the detection range was tr(0.11)～0.26 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 33 of the 37 valid sites adopting the detection limit of 0.09pg/m^3, and none of the detected concentrations exceeded 0.27 pg/m^3.

Parlar-50: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 11 of the 37 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded tr(0.1) pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 1 of the 37 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded tr(0.1) pg/m^3.

Parlar-62: The presence of the substance in air in the warm season was monitored at 37 sites, and it was not detected at all 37 valid sites adopting the detection limit of 0.6pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was not detected at all 37 valid sites adopting the detection limit of 0.6pg/m^3.

Stocktaking of the detection of Parlar-26, Parlar-50 and Parlar-62 in air during FY2002~2009

Parlar-26	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2003 Warm season	0.31	0.31	0.77	tr(0.17)	0.20 [0.066]	35/35	35/35
	2003 Cold season	tr(0.17)	tr(0.17)	0.27	tr(0.091)		34/34	34/34
	2004 Warm season	0.27	0.26	0.46	tr(0.17)	0.20 [0.066]	37/37	37/37
	2004 Cold season	tr(0.15)	tr(0.15)	0.50	tr(0.094)		37/37	37/37
	2005 Warm season	nd	nd	nd	nd	0.3 [0.1]	0/37	0/37
	2005 Cold season	nd	nd	nd	nd		0/37	0/37
	2006 Warm season	nd	nd	nd	nd	1.8 [0.6]	0/37	0/37
	2006 Cold season	nd	nd	nd	nd		0/37	0/37
	2007 Warm season	nd	nd	tr(0.3)	nd	0.6 [0.2]	18/36	18/36
	2007 Cold season	nd	nd	nd	nd		0/36	0/36
	2008 Warm season	tr(0.21)	0.22	0.58	tr(0.12)	0.22 [0.08]	37/37	37/37
	2008 Cold season	tr(0.11)	tr(0.12)	tr(0.20)	nd		36/37	36/37
	2009 Warm season	tr(0.18)	tr(0.19)	0.26	tr(0.11)	0.23 [0.09]	37/37	37/37
	2009 Cold season	tr(0.12)	tr(0.13)	0.27	nd		33/37	33/37

Parlar-50	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2003 Warm season	nd	nd	tr(0.37)	nd	0.81 [0.27]	2/35	2/35
	2003 Cold season	nd	nd	nd	nd		0/34	0/34
	2004 Warm season	nd	nd	nd	nd	1.2 [0.4]	0/37	0/37
	2004 Cold season	nd	nd	nd	nd		0/37	0/37
	2005 Warm season	nd	nd	nd	nd	0.6 [0.2]	0/37	0/37
	2005 Cold season	nd	nd	nd	nd		0/37	0/37
	2006 Warm season	nd	nd	nd	nd	1.6 [0.5]	0/37	0/37
	2006 Cold season	nd	nd	nd	nd		0/37	0/37
	2007 Warm season	nd	tr(0.1)	tr(0.2)	nd	0.3 [0.1]	29/36	29/36
	2007 Cold season	nd	nd	nd	nd		0/36	0/36
	2008 Warm season	nd	nd	tr(0.19)	nd	0.25 [0.09]	15/37	15/37
	2008 Cold season	nd	nd	nd	nd		0/37	0/37
	2009 Warm season	nd	nd	tr(0.1)	nd	0.3 [0.1]	11/37	11/37
	2009 Cold season	nd	nd	tr(0.1)	nd		1/37	1/37

Parlar-62	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2003 Warm season	nd	nd	nd	nd	1.6 [0.52]	0/35	0/35
	2003 Cold season	nd	nd	nd	nd		0/34	0/34
	2004 Warm season	nd	nd	nd	nd	2.4 [0.81]	0/37	0/37
	2004 Cold season	nd	nd	nd	nd		0/37	0/37
	2005 Warm season	nd	nd	nd	nd	1.2 [0.4]	0/37	0/37
	2005 Cold season	nd	nd	nd	nd		0/37	0/37
	2006 Warm season	nd	nd	nd	nd	8 [3]	0/37	0/37
	2006 Cold season	nd	nd	nd	nd		0/37	0/37
	2007 Warm season	nd	nd	nd	nd	1.5 [0.6]	0/36	0/36
	2007 Cold season	nd	nd	nd	nd		0/36	0/36
	2008 Warm season	nd	nd	nd	nd	1.6 [0.6]	0/37	0/37
	2008 Cold season	nd	nd	nd	nd		0/37	0/37
	2009 Warm season	nd	nd	nd	nd	1.6 [0.6]	0/37	0/37
	2009 Cold season	nd	nd	nd	nd		0/37	0/37

[10] Mirex

・ History and state of monitoring

Mirex was developed as an organochlorine insecticide chemical in the United States, and it was also used as a flame retardant. No domestic record of manufacture/import of the substance was reported since it was historically never registrated under the Agricultural Chemicals Regulation Law. The substance was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in September 2002.

Before FY 2001, the substance was measured in FY 1983 (in surface water and sediment) under the framework of "the Environmental Survey and Monitoring of Chemicals."

Under the framework of the Environmental Monitoring, Mirex has been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air since FY 2003.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 49 sites, and it was detected at 8 of the 49 valid sites adopting the detection limit of 0.2pg/L, and none of the detected concentrations exceeded 0.5pg/L.

Stocktaking of the detection of mirex in surface water during FY2002~2009

Mirex	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2003	tr(0.13)	tr(0.12)	0.8	nd	0.3 [0.09]	25/36	25/36
	2004	nd	nd	1.1	nd	0.4 [0.2]	18/38	18/38
	2005	nd	nd	1.0	nd	0.4 [0.1]	14/47	14/47
	2006	nd	nd	0.07	nd	1.6 [0.5]	1/48	1/48
	2007	nd	nd	tr(0.5)	nd	1.1[0.4]	2/48	2/48
	2008	nd	nd	0.7	nd	0.6 [0.2]	4/48	4/48
	2009	nd	nd	0.5	nd	0.4 [0.2]	8/49	8/49

<Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at 49 of the 64 valid sites adopting the detection limit of 0.4pg/g-dry, and none of the detected concentrations exceeded 620pg/g-dry. As results of the inter-annual trend analysis from FY 2003 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from a sea area as statistically significant. In addition, the second-half period also indicated lower concentration than the first-half period in specimens from overall areas as statistically significant.

Stocktaking of the detection of mirex in sediment during FY2002~2009

Mirex	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2003	tr(1.8)	tr(1.6)	1,500	nd	2 [0.4]	137/186	51/62
	2004	2.1	tr(1.6)	220	nd	2 [0.5]	153/189	55/63
	2005	1.5	1.2	5,300	nd	0.9 [0.3]	134/189	48/63
	2006	1.5	1.2	640	nd	0.6 [0.2]	156/192	57/64
	2007	1.3	0.9	200	nd	0.9[0.3]	147/192	55/64
	2008	1.1	1.1	820	nd	0.7 [0.3]	117/192	48/64
	2009	1.3	1.3	620	nd	1.0 [0.4]	126/192	49/64

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 0.8pg/g-wet, and the detection range was tr(1.7)～21 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 0.8pg/g-wet, and the detection range was tr(0.9)～37 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 0.8pg/g-wet, and the detection range was 32～79 pg/g-wet. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendencies in specimens from black-tailed gulls and gray starlings were identified as statistically significant.

Stocktaking of the detection of mirex in wildlife (bivalves, fish and birds) during FY2002~2009

Mirex	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2003	4.8	4.2	19	tr(1.6)	2.4 [0.81]	30/30	6/6
	2004	4.5	4.3	12	tr(1.1)	2.5 [0.82]	31/31	7/7
	2005	5.7	5.2	20	tr(1.9)	3.0 [0.99]	31/31	7/7
	2006	5	4	19	tr(2)	3 [1]	31/31	7/7
	2007	5	4	18	tr(2)	3 [1]	31/31	7/7
	2008	4	tr(3)	18	tr(2)	4 [1]	31/31	7/7
	2009	6.0	5.2	21	tr(1.7)	2.1 [0.8]	31/31	7/7
Fish (pg/g-wet)	2003	7.9	9.0	25	tr(1.7)	2.4 [0.81]	70/70	14/14
	2004	11	11	180	3.8	2.5 [0.82]	70/70	14/14
	2005	12	13	78	tr(1.0)	3.0 [0.99]	80/80	16/16
	2006	10	10	53	tr(2)	3 [1]	80/80	16/16
	2007	9	11	36	tr(1)	3 [1]	80/80	16/16
	2008	11	13	48	tr(1)	4 [1]	85/85	17/17
	2009	8.2	9.6	37	tr(0.9)	2.1 [0.8]	90/90	18/18
Birds (pg/g-wet)	2003	110	150	450	31	2.4 [0.81]	10/10	2/2
	2004	61	64	110	33	2.5 [0.82]	10/10	2/2
	2005	76	66	180	41	3.0 [0.99]	10/10	2/2
	2006	72	70	280	39	3 [1]	10/10	2/2
	2007	56	59	100	32	3 [1]	10/10	2/2
	2008	72	68	260	27	4 [1]	10/10	2/2
	2009	49	50	79	32	2.1 [0.8]	10/10	2/2

<Air>

The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.006pg/m^3, and the detection range was 0.049～0.48 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.006pg/m^3, and the detection range was 0.030～0.18 pg/m^3.

Stocktaking of the detection of mirex in air during FY2002~2009

Mirex	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2003 Warm season	0.11	0.12	0.19	0.047	0.0084 [0.0028]	35/35	35/35
	2003 Cold season	0.044	0.043	0.099	0.024		34/34	34/34
	2004 Warm season	0.099	0.11	0.16	tr(0.042)	0.05 [0.017]	37/37	37/37
	2004 Cold season	tr(0.046)	tr(0.047)	0.23	tr(0.019)		37/37	37/37
	2005 Warm season	tr(0.09)	tr(0.09)	0.24	tr(0.05)	0.10 [0.03]	37/37	37/37
	2005 Cold season	tr(0.04)	tr(0.04)	tr(0.08)	nd		29/37	29/37
	2006 Warm season	tr(0.07)	tr(0.10)	0.22	nd	0.13 [0.04]	29/37	29/37
	2006 Cold season	tr(0.07)	tr(0.07)	2.1	nd		27/37	27/37
	2007 Warm season	0.11	0.11	0.28	0.04	0.03 [0.01]	36/36	36/36
	2007 Cold season	0.04	0.04	0.09	tr(0.02)		36/36	36/36
	2008 Warm season	0.09	0.09	0.25	0.03	0.03 [0.01]	37/37	37/37
	2008 Cold season	0.05	0.04	0.08	0.03		37/37	37/37
	2009 Warm season	0.12	0.13	0.48	0.049	0.015 [0.006]	37/37	37/37
	2009 Cold season	0.058	0.054	0.18	0.030		37/37	37/37

[11] HCHs

・ History and state of monitoring

HCHs were used as plant protection products, pesticides, household insecticides, and termitecides, etc. Even after their registration under the Agricultural Chemicals Regulation Law was expired in FY 1971, they continue to be used as termitecides and wood preservatives. *α*-HCH, *β*-HCH, and *γ*-HCH (synonym:Lindane) were adopted as target chemicals at the COP4 of the Stockholm convention on Persistent Organic Pollutants in May 2009.

Among many HCH isomers, *α*-HCH, *β*-HCH, *γ*-HCH (synonym: Lindane) and *δ*-HCH have been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air.

Before FY 2001, the substances were measured in FY 1974 (in surface water, sediment and fish) under the framework of "the Environmental Survey and Monitoring of Chemicals." *α*-HCH and *β*-HCH had been the target chemicals, and surface water and sediment had been the monitored media during the period of FY 1986～1998 and FY 1986～2001, respectively. Under the framework of the Wildlife Monitoring, the substances were monitored in wildlife (bivalves, fish and birds) during the period of FY 1978～1996 and in FY 1998, FY 2000 and FY 2001 (*γ*-HCH (synonym:Lindane) and *δ*-HCH had not been monitored since FY 1997 and FY 1993, respectively.)

Under the framework of the Environmental Monitoring, *α*-HCH and *β*-HCH have been monitored in surface water, sediment, and wildlife (bivalves, fish and birds) since FY 2002. *α*-HCH and *β*-HCH have also been monitored in air, and *γ*-HCH (synonym:Lindane) and *δ*-HCH have been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air since FY 2003.

・ Monitoring results

○ *α*-HCH, *β*-HCH, *γ*-HCH (synonym:Lindane) and *δ*-HCH

<Surface Water>

α-HCH: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.4pg/L, and the detection range was 14～560 pg/L.

β-HCH: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.2pg/L, and the detection range was 18～1,100 pg/L. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from a lake area was identified as statistically significant. In addition, the second-half period also indicated lower concentration than the first-half period in specimens from overall areas as statistically significant.

γ-HCH (synonym:Lindane): The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.2pg/L, and the detection range was 5.1～280 pg/L. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens from a lake areas, river mouth areas and sea areas were identified as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

δ-HCH: The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 0.4pg/L, and the detection range was tr(0.7)～450 pg/L.

Stocktaking of the detection of α-HCH, β-HCH, γ-HCH (synonym: Lindane) and δ-HCH in surface water during FY2002~2009

α-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface water (pg/L)	2002	84	76	6,500	1.9	0.9 [0.3]	114/114	38/38
	2003	120	120	970	13	3 [0.9]	36/36	36/36
	2004	150	145	5,700	13	6 [2]	38/38	38/38
	2005	90	81	660	16	4 [1]	47/47	47/47
	2006	110	90	2,100	25	3 [1]	48/48	48/48
	2007	76	73	720	13	1.9 [0.6]	48/48	48/48
	2008	78	75	1,100	9	4 [2]	48/48	48/48
	2009	74	73	560	14	1.2 [0.4]	49/49	49/49
β-HCH	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Surface water (pg/L)	2002	210	180	1,600	24	0.9 [0.3]	114/114	38/38
	2003	250	240	1,700	14	3 [0.7]	36/36	36/36
	2004	260	250	3,400	31	4 [2]	38/38	38/38
	2005	200	170	2,300	25	2.6 [0.9]	47/47	47/47
	2006	200	160	2,000	42	1.7 [0.6]	48/48	48/48
	2007	170	150	1,300	18	2.7[0.9]	48/48	48/48
	2008	150	150	1,800	15	1.0 [0.4]	48/48	48/48
	2009	150	150	1,100	18	0.6 [0.2]	49/49	49/49
γ-HCH （synonym: Lindane）	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**DetectionFrequency Sample**	**DetectionFrequency Site**
Surface water (pg/L)	2003	92	90	370	32	7 [2]	36/36	36/36
	2004	91	76	8,200	21	20 [7]	38/38	38/38
	2005	48	40	250	tr(8)	14 [5]	47/47	47/47
	2006	44	43	460	tr(9)	18 [6]	48/48	48/48
	2007	34	32	290	5.2	2.1 [0.7]	48/48	48/48
	2008	34	32	340	4	3 [1]	48/48	48/48
	2009	32	26	280	5.1	0.6 [0.2]	49/49	49/49
δ-HCH	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**DetectionFrequency Sample**	**DetectionFrequency Site**
Surface water (pg/L)	2003	14	14	200	tr(1.1)	2 [0.5]	36/36	36/36
	2004	24	29	670	tr(1.4)	2 [0.7]	38/38	38/38
	2005	1.8	nd	62	nd	1.5 [0.5]	23/47	23/47
	2006	24	18	1,000	2.2	2.0 [0.8]	48/48	48/48
	2007	11	9.7	720	tr(0.7)	1.2 [0.4]	48/48	48/48
	2008	11	10	1,900	tr(1.1)	2.3 [0.9]	48/48	48/48
	2009	10	11	450	tr(0.7)	0.9 [0.4]	49/49	49/49

<Sediment>

α-HCH: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.4pg/g-dry, and none of the detected concentrations exceeded 6,300 pg/g-dry.

β-HCH: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.5pg/g-dry, and the detection range was 2.4～10,000 pg/g-dry. As results of the inter-annual trend analysis from FY 2002 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from overall areas as statistically significant.

γ-HCH (synonym:Lindane): The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.2pg/g-dry, and none of the detected concentrations exceeded 3,800 pg/g-dry. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens from a river area was identified as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

δ-HCH: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 0.5pg/g-dry, and none of the detected concentrations exceeded 5,000 pg/g-dry. As results of the inter-annual trend analysis from FY 2003 to FY 2009, the second-half period indicated lower concentration than the first-half period in specimens from a river area and river month area as statistically significant and reduction tendency in specimens from the overall areas was also identified as statistically significant.

Stocktaking of the detection of α-HCH, β-HCH, γ-HCH (synonym: Lindane) and δ-HCH in sediment during FY2002~2009

α-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2002	130	170	8,200	2.0	1.2 [0.4]	189/189	63/63
	2003	140	170	9,500	2	2 [0.5]	186/186	62/62
	2004	140	180	5,700	tr(1.5)	2 [0.6]	189/189	63/63
	2005	120	160	7,000	3.4	1.7 [0.6]	189/189	63/63
	2006	130	160	4,300	tr(2)	5 [2]	192/192	64/64
	2007	120	150	12,000	tr(1.3)	1.8 [0.6]	192/192	64/64
	2008	120	190	5,200	nd	1.6 [0.6]	191/192	64/64
	2009	100	120	6,300	nd	1.1 [0.4]	191/192	64/64

β-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2002	200	230	11,000	3.9	0.9 [0.3]	189/189	63/63
	2003	220	220	39,000	5	2 [0.7]	186/186	62/62
	2004	220	230	53,000	4	3 [0.8]	189/189	63/63
	2005	180	220	13,000	3.9	2.6 [0.9]	189/189	63/63
	2006	180	210	21,000	2.3	1.3 [0.4]	192/192	64/64
	2007	170	190	59,000	1.6	0.9 [0.3]	192/192	64/64
	2008	170	200	8,900	2.8	0.8 [0.3]	192/192	64/64
	2009	160	170	10,000	2.4	1.3 [0.5]	192/192	64/64

γ-HCH （synonym: Lindane）	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2003	45	47	4,000	tr(1.4)	2 [0.4]	186/186	62/62
	2004	46	48	4,100	tr(0.8)	2 [0.5]	189/189	63/63
	2005	44	46	6,400	tr(1.8)	2.0 [0.7]	189/189	63/63
	2006	45	49	3,500	tr(1.4)	2.1 [0.7]	192/192	64/64
	2007	35	41	5,200	tr(0.6)	1.2 [0.4]	192/192	64/64
	2008	35	43	2,200	tr(0.7)	0.9 [0.4]	192/192	64/64
	2009	32	43	3,800	nd	0.6 [0.2]	191/192	64/64

δ-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2003	37	46	5,400	nd	2 [0.7]	180/186	61/62
	2004	48	55	5,500	tr(0.5)	2 [0.5]	189/189	63/63
	2005	46	63	6,200	nd	1.0 [0.3]	188/189	63/63
	2006	41	47	6,000	nd	1.7 [0.6]	189/192	64/64
	2007	22	28	5,400	nd	5 [2]	165/192	60/64
	2008	36	53	3,300	nd	2 [1]	186/192	64/64
	2009	31	37	5,000	nd	1.2 [0.5]	190/192	64/64

<Wildlife>

α-HCH: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 9～2,200 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was tr(2)～830 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 34～56 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from bivalves, black-tailed gulls and gray starlings were identified as statistically significant.

β-HCH: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 27～1,600 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at all 18 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was tr(5)～970 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 870～4,200 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendency in specimens from gray starlings were identified as statistically significant.

γ-HCH (synonym:Lindane): The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 3pg/g-wet, and the detection range was tr(3)～89 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at 17 of the 18 valid areas adopting the detection limit of 3pg/g-wet, and none of the detected concentrations exceeded 180 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 3pg/g-wet, and the detection range was tr(6)～21 pg/g-wet. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendencies in specimens from bivalves and gray starlings were identified as statistically significant.

δ-HCH: The presence of the substance in bivalves was monitored in 7 areas, and it was detected at 4 of the 7 valid areas adopting the detection limit of 2pg/g-wet, and none of the detected concentrations exceeded 700 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at 13 of the 18 valid areas adopting the detection limit of 2pg/g-wet, and none of the detected concentrations exceeded 18 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was tr(3)～9 pg/g-wet. As results of the inter-annual trend analysis from FY 2002 to FY 2009, reduction tendencies in specimens from black-tailed gulls and gray starlings were identified as statistically significant.

Stocktaking of the detection of α-HCH in wildlife (bivalves, fish and birds) during FY2002~2009

α-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	65	64	1,100	12	4.2 [1.4]	38/38	8/8
	2003	45	30	610	9.9	1.8 [0.61]	30/30	6/6
	2004	35	25	1,800	tr(12)	13 [4.3]	31/31	7/7
	2005	24	25	1,100	tr(7.1)	11 [3.6]	31/31	7/7
	2006	21	21	390	6	3 [1]	31/31	7/7
	2007	19	17	1,400	8	7 [2]	31/31	7/7
	2008	18	16	380	7	6 [2]	31/31	7/7
	2009	27	21	2,200	9	5 [2]	31/31	7/7
Fish (pg/g-wet)	2002	51	56	590	tr(1.9)	4.2 [1.4]	70/70	14/14
	2003	41	58	590	2.6	1.8 [0.61]	70/70	14/14
	2004	57	55	2,900	nd	13 [4.3]	63/70	14/14
	2005	41	43	1,000	nd	11 [3.6]	75/80	16/16
	2006	42	53	360	tr(2)	3 [1]	80/80	16/16
	2007	37	40	730	tr(2)	7 [2]	80/80	16/16
	2008	35	47	410	nd	6 [2]	84/85	17/17
	2009	37	32	830	tr(2)	5 [2]	90/90	18/18
Birds (pg/g-wet)	2002	160	130	360	93	4.2 [1.4]	10/10	2/2
	2003	70	74	230	30	1.8 [0.61]	10/10	2/2
	2004	120	80	1,600	58	13 [4.3]	10/10	2/2
	2005	76	77	85	67	11 [3.6]	10/10	2/2
	2006	75	75	100	55	3 [1]	10/10	2/2
	2007	68	59	210	43	7 [2]	10/10	2/2
	2008	48	48	61	32	6 [2]	10/10	2/2
	2009	43	42	56	34	5 [2]	10/10	2/2

Stocktaking of the detection of β-HCH in wildlife (bivalves, fish and birds) during FY2002~2009

β-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	89	62	1,700	32	12 [4]	38/38	8/8
	2003	77	50	1,100	23	9.9 [3.3]	30/30	6/6
	2004	69	74	1,800	22	6.1 [2.0]	31/31	7/7
	2005	56	56	2,000	20	2.2 [0.75]	31/31	7/7
	2006	59	70	880	11	3 [1]	31/31	7/7
	2007	53	56	1,800	21	7 [3]	31/31	7/7
	2008	51	51	1,100	23	6 [2]	31/31	7/7
	2009	56	55	1,600	27	6 [2]	31/31	7/7
Fish (pg/g-wet)	2002	99	120	1,800	tr(5)	12 [4]	70/70	14/14
	2003	78	96	1,100	tr(3.5)	9.9 [3.3]	70/70	14/14
	2004	100	140	1,100	tr(3.9)	6.1 [2.0]	70/70	14/14
	2005	88	110	1,300	6.7	2.2 [0.75]	80/80	16/16
	2006	85	110	1,100	4	3 [1]	80/80	16/16
	2007	100	120	810	7	7 [3]	80/80	16/16
	2008	90	150	750	tr(4)	6 [2]	85/85	17/17
	2009	94	130	970	tr(5)	6 [2]	90/90	18/18
Birds (pg/g-wet)	2002	3,000	3,000	7,300	1,600	12 [4]	10/10	2/2
	2003	3,400	3,900	5,900	1,800	9.9 [3.3]	10/10	2/2
	2004	2,200	2,100	4,800	1,100	6.1 [2.0]	10/10	2/2
	2005	2,500	2,800	6,000	930	2.2 [0.75]	10/10	2/2
	2006	2,100	2,400	4,200	1,100	3 [1]	10/10	2/2
	2007	2,000	1,900	3,200	1,400	7 [3]	10/10	2/2
	2008	2,200	2,000	5,600	1,300	6 [2]	10/10	2/2
	2009	1,600	1,400	4,200	870	6 [2]	10/10	2/2

Stocktaking of the detection of γ-HCH (synonym: Lindane) in wildlife (bivalves, fish and birds) during FY2002~2009

γ-HCH (synonym:Lindane)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2003	19	18	130	5.2	3.3 [1.1]	30/30	6/6
	2004	tr(19)	tr(16)	230	nd	31 [10]	28/31	7/7
	2005	15	13	370	tr(5.7)	8.4 [2.8]	31/31	7/7
	2006	14	12	140	7	4 [2]	31/31	7/7
	2007	11	10	450	tr(4)	9 [3]	31/31	7/7
	2008	9	10	98	tr(3)	9 [3]	31/31	7/7
	2009	11	12	89	tr(3)	7 [3]	31/31	7/7
Fish (pg/g-wet)	2003	16	22	130	tr(1.7)	3.3 [1.1]	70/70	14/14
	2004	tr(27)	tr(24)	660	nd	31 [10]	55/70	11/14
	2005	17	17	230	nd	8.4 [2.8]	78/80	16/16
	2006	18	22	97	tr(2)	4 [2]	80/80	16/16
	2007	15	15	190	nd	9 [3]	71/80	15/16
	2008	13	16	96	nd	9 [3]	70/85	15/17
	2009	14	12	180	nd	7 [3]	81/90	17/18
Birds (pg/g-wet)	2003	14	19	40	3.7	3.3 [1.1]	10/10	2/2
	2004	34	tr(21)	1,200	tr(11)	31 [10]	10/10	2/2
	2005	18	20	32	9.6	8.4 [2.8]	10/10	2/2
	2006	16	17	29	8	4 [2]	10/10	2/2
	2007	18	14	140	tr(8)	9 [3]	10/10	2/2
	2008	12	14	19	tr(5)	9 [3]	10/10	2/2
	2009	11	11	21	tr(6)	7 [3]	10/10	2/2

Stocktaking of the detection of δ-HCH in wildlife (bivalves, fish and birds) during FY2002~2009

δ-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2003	7.2	tr(2.6)	1,300	nd	3.9 [1.3]	29/30	6/6
	2004	tr(3.0)	tr(2.1)	1,500	nd	4.6 [1.5]	25/31	6/7
	2005	tr(2.5)	tr(2.1)	1,600	nd	5.1 [1.7]	23/31	6/7
	2006	3	tr(2)	890	tr(1)	3 [1]	31/31	7/7
	2007	nd	nd	750	nd	4 [2]	12/31	4/7
	2008	nd	nd	610	nd	6 [2]	7/31	3/7
	2009	tr(2)	nd	700	nd	5 [2]	14/31	4/7
Fish (pg/g-wet)	2003	tr(3.5)	4.0	16	nd	3.9 [1.3]	59/70	13/14
	2004	tr(4.1)	tr(3.5)	270	nd	4.6 [1.5]	54/70	11/14
	2005	tr(3.2)	tr(3.1)	32	nd	5.1 [1.7]	55/80	12/16
	2006	4	3	35	nd	3 [1]	72/80	16/16
	2007	tr(3)	tr(2)	31	nd	4 [2]	42/80	10/16
	2008	tr(4)	tr(3)	77	nd	6 [2]	54/85	12/17
	2009	tr(3)	tr(3)	18	nd	5 [2]	57/90	13/18
Birds (pg/g-wet)	2003	18	18	31	12	3.9 [1.3]	10/10	2/2
	2004	16	14	260	6.4	4.6 [1.5]	10/10	2/2
	2005	16	15	30	10	5.1 [1.7]	10/10	2/2
	2006	13	12	21	9	3 [1]	10/10	2/2
	2007	10	10	22	4	4 [2]	10/10	2/2
	2008	8	8	31	tr(3)	6 [2]	10/10	2/2
	2009	6	6	9	tr(3)	5 [2]	10/10	2/2

<Air>

α-HCH: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.05pg/m^3, and the detection range was 19～340 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.05pg/m^3, and the detection range was 7.8～400 pg/m^3.

β-HCH: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.03pg/m^3, and the detection range was 0.96～28 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.03pg/m^3, and the detection range was 0.31～24 pg/m^3.

γ-HCH (synonym:Lindane): The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 2.9～65 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 1.5～55 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendency in specimens at the warm season was identified as statistically significant.

δ-HCH: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.09～21 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.04～20 pg/m^3. As results of the inter-annual trend analysis from FY 2003 to FY 2009, reduction tendencies in specimens at the both season were identified as statistically significant.

In addition, it was found that there were some problems in collection of HCHs because of some parts of the air sampler that was used between FY2003 and FY2008 were contaminated by HCHs and affected monitored concentration. Therefore all samples in the air were recognized as undetectable in calculation of data for that period.

Stocktaking of the detection of *α*-HCH, *β*-HCH, *γ*-HCH (synonym: Lindane) and *δ*-HCH in air during FY2002~2009

α-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009 Warm season	58	58	340	19	0.12 [0.05]	37/37	37/37
	2009 Cold season	21	18	400	7.8		37/37	37/37
β-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Sample	Site
Air (pg/m^3)	2009 Warm season	5.6	5.6	28	0.96	0.09 [0.03]	37/37	37/37
	2009 Cold season	1.8	1.8	24	0.31		37/37	37/37
γ-HCH (synonym: Lindane)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Sample	Site
Air (pg/m^3)	2009 Warm season	17	19	65	2.9	0.06 [0.02]	37/37	37/37
	2009 Cold season	5.6	4.6	55	1.5		37/37	37/37
δ-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Sample	Site
Air (pg/m^3)	2009 Warm season	1.3	1.3	21	0.09	0.04 [0.02]	37/37	37/37
	2009 Cold season	0.36	0.33	20	0.04		37/37	37/37

[12] Hexabromobiphenyls

・ History and state of monitoring

Hexabromobiphenyls have been used as flame retardants for plastics products. Hexabromobiphenyls were adopted as target chemicals at the COP4 of the Stockholm convention on Persistent Organic Pollutants in May 2009 and designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in April 2010.

FY 2009 was the first year for this Environmental Monitoring series, and the substances were measured in FY 1989, 2003, 2005 under the framework of "the Environmental Survey".

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 49 sites, and it was not detected at all 49 valid sites adopting the detection limit of 2.2pg/L.

Stocktaking of the detection of Hexabromobiphenyls in surface water in 2009

Hexabromobiphenyls	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2009	nd	nd	nd	nd	∗5.7 [2.2]	0/49	0/49

(Note 1) " * " indicates the sum value of the Quantification [Detection] limits of each congener.

<Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at 21 of the 64 valid sites adopting the detection limit of 0.40pg/g-dry, and none of the detected concentrations exceeded 12pg/g-dry.

Stocktaking of the detection of Hexabromobiphenyls in sediment in 2009

Hexabromobiphenyls	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	nd	nd	12	nd	∗1.1 [0.40]	45/190	21/64

(Note 1) " * " indicates the sum value of the Quantification [Detection] limits of each congener.

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at 1 of the 7 valid areas adopting the detection limit of *0.43pg/g-wet, and none of the detected concentrations exceeded tr (0.53) pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at 12 of the 18 valid areas adopting the detection limit of *0.43pg/g-wet, and none of the detected concentrations exceeded 6.0 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of *0.43pg/g-wet, and the detection range was tr(1.2)～2.1 pg/g-wet.

Stocktaking of the detection of Hexabromobiphenyls in wildlife (bivalves, fish and birds) in FY2009

Hexabromobiphenyls	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2009	nd	nd	tr(0.53)	nd	∗1.3 [0.43]	1/31	1/7
Fish (pg/g-wet)	2009	tr(0.49)	tr(0.43)	6.0	nd	∗1.3 [0.43]	46/90	12/18
Birds (pg/g-wet)	2009	1.6	1.6	2.1	tr(1.2)	∗1.3 [0.43]	10/10	2/2

(Note 1) " * " indicates the sum value of the Quantification [Detection] limits of each congener.

[13] Polybromodiphenyl ethers（Br4～Br10）

・ History and state of monitoring

Polybrominated diphenyl ethers have been used as flame retardants for plastics products. Tetrabromodiphenyl ethers, Pentabromodiphenyl ethers, Hexabromodiphenyl ethers, and Heptabromodiphenyl ethers were adopted as target chemicals at the COP4 of the Stockholm convention on Persistent Organic Pollutants in May 2009.

Under the framework of the Environmental Monitoring, the substance was monitored in wildlife (bivalves, fish and birds) in FY 2008.

・ Monitoring results

〇Tetrabromodiphenyl ethers, Pentabromodiphenyl ethers, Hexabromodiphenyl ethers, Heptabromodiphenyl ethers, Octabromodiphenyl ethers, Nonabromodiphenyl ethers and Decabromodiphenyl ether

<Surface Water>

Tetrabromodiphenyl ethers: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 44 of the 49 valid sites adopting the detection limit of 3pg/L, and none of the detected concentrations exceeded 160pg/L.

Pentabromodiphenyl ethers: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 43 of the 49 valid sites adopting the detection limit of 4pg/L, and none of the detected concentrations exceeded 87pg/L.

Hexabromodiphenyl ethers: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 26 of the 49 valid sites adopting the detection limit of 0.6pg/L, and none of the detected concentrations exceeded 18pg/L.

Heptabromodiphenyl ethers: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 9 of the 49 valid sites adopting the detection limit of 2pg/L, and none of the detected concentrations exceeded 40pg/L.

Octabromodiphenyl ethers: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 37 of the 49 valid sites adopting the detection limit of 0.6pg/L, and none of the detected concentrations exceeded 56pg/L.

Nonabromodiphenyl ethers: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 32 of the 49 valid sites adopting the detection limit of 30pg/L, and none of the detected concentrations exceeded 500pg/L.

Decabromodiphenyl ether: The presence of the substance in surface water was monitored at 49 sites, and it was detected at 26 of the 49 valid sites adopting the detection limit of 200pg/L, and none of the detected concentrations exceeded 3,400pg/L.

Stocktaking of the detection of Polybromodiphenyl ethers (Br4～Br10) in surface water in FY2009

Tetrabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2009	17	16	160	nd	8 [3]	44/49	44/49

Pentabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2009	11	12	87	nd	11 [4]	43/49	43/49

Hexabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2009	tr(0.9)	tr(0.7)	18	nd	1.4 [0.6]	26/49	26/49

Heptabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2009	nd	nd	40	nd	4 [2]	9/49	9/49

Octabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2009	3.0	3.9	56	nd	1.4 [0.6]	37/49	37/49

Nonabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2009	tr(46)	tr(38)	500	nd	91 [30]	32/49	32/49

Decabromodiphenyl ether	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface water (pg/L)	2009	tr(310)	tr(220)	3,400	nd	600 [200]	26/49	26/49

<Sediment>

Tetrabromodiphenyl ethers: The presence of the substance in sediment was monitored at 64 sites, and it was detected at 51 of the 64 valid sites adopting the detection limit of 23pg/g-dry, and none of the detected concentrations exceeded 1,400pg/g-dry.

Pentabromodiphenyl ethers: The presence of the substance in sediment was monitored at 64 sites, and it was detected at 57 of the 64 valid sites adopting the detection limit of 8pg/g-dry, and none of the detected concentrations exceeded 1,700pg/g-dry.

Hexabromodiphenyl ethers: The presence of the substance in sediment was monitored at 64 sites, and it was detected at 53 of the 64 valid sites adopting the detection limit of 2pg/g-dry, and none of the detected concentrations exceeded 2,600pg/g-dry.

Heptabromodiphenyl ethers: The presence of the substance in sediment was monitored at 64 sites, and it was detected at 51 of the 64 valid sites adopting the detection limit of 4pg/g-dry, and none of the detected concentrations exceeded 16,000pg/g-dry.

Octabromodiphenyl ethers: The presence of the substance in sediment was monitored at 64 sites, and it was detected at 63 of the 64 valid sites adopting the detection limit of 0.5pg/g-dry, and none of the detected concentrations exceeded 110,000pg/g-dry.

Nonabromodiphenyl ethers: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 4pg/g-dry, and none of the detected concentrations exceeded 230,000pg/g-dry.

Decabromodiphenyl ether: The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 20pg/g-dry, and the detection range was tr(30)～880,000 pg/g-dry.

Stocktaking of the detection of Polybromodiphenyl ethers (Br4～Br10) in sediment in FY2009

Tetrabromodiphenyl ethers:	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2009	tr(54)	tr(44)	1,400	nd	69 [23]	131/192	51/64
Pentabromodiphenyl ethers	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2009	30	24	1,700	nd	24 [8]	146/192	57/64
Hexabromodiphenyl ethers	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2009	17	21	2,600	nd	5 [2]	139/192	53/64
Heptabromodiphenyl ethers	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2009	23	25	16,000	nd	9 [4]	125/192	51/64
Octabromodiphenyl ethers	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2009	140	96	110,000	nd	1.2 [0.5]	182/192	63/64
Nonabromodiphenyl ethers	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2009	780	710	230,000	nd	9 [4]	181/192	64/64
Decabromodiphenyl ether	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2009	4,800	4,800	880,000	tr(30)	60 [20]	192/192	64/64

<Air>

Tetrabromodiphenyl ethers: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.04pg/m^3, and the detection range was 0.11～18 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 0.04pg/m^3, and the detection range was tr(0.04)～7.1 pg/m^3.

Pentabromodiphenyl ethers: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 33 of the 37 valid sites adopting the detection limit of 0.06pg/m^3, and none of the detected concentrations exceeded 18pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 29 of the 37 valid sites adopting the detection limit of 0.06pg/m^3, and none of the detected concentrations exceeded 10pg/m^3.

Hexabromodiphenyl ethers: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 19 of the 37 valid sites adopting the detection limit of 0.09pg/m^3, and none of the detected concentrations exceeded 2.0pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 24 of the 37 valid sites adopting the detection limit of 0.09pg/m^3, and none of the detected concentrations exceeded 27pg/m^3.

Heptabromodiphenyl ethers: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 17 of the 37 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded 1.7pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 25 of the 37 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded 20pg/m^3.

Octabromodiphenyl ethers: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 23 of the 37 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded 1.6pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 26 of the 37 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded 7.1pg/m^3.

Nonabromodiphenyl ethers: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 22 of the 37 valid sites adopting the detection limit of 0.6pg/m^3, and none of the detected concentrations exceeded 3.0pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 27 of the 37 valid sites adopting the detection limit of 0.6pg/m^3, and none of the detected concentrations exceeded 3.9pg/m^3.

Decabromodiphenyl ether: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at 28 of the 37 valid sites adopting the detection limit of 5pg/m^3, and none of the detected concentrations exceeded 31pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at 29 of the 37 valid sites adopting the detection limit of 5pg/m^3, and none of the detected concentrations exceeded 45pg/m^3.

Stocktaking of the detection of Polybromodiphenyl ethers (Br4～Br10) in air in FY2009

Tetrabromodi phenyl ethers:	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009 Warm season	0.89	0.80	18	0.11	0.11 [0.04]	37/37	37/37
	2009 Cold season	0.40	0.37	7.1	tr(0.04)	0.11 [0.04]	37/37	37/37

Pentabromodi phenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009 Warm season	0.20	0.19	18	nd	0.16 [0.06]	33/37	33/37
	2009 Cold season	0.19	0.16	10	nd	0.16 [0.06]	29/37	29/37

Hexabromodi phenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009 Warm season	tr(0.11)	tr(0.11)	2.0	nd	0.22 [0.09]	19/37	19/37
	2009 Cold season	tr(0.20)	0.22	27	nd	0.22 [0.09]	24/37	24/37

Heptabromodi phenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009 Warm season	tr(0.1)	nd	1.7	nd	0.3 [0.1]	17/37	17/37
	2009 Cold season	tr(0.2)	0.3	20	nd	0.3 [0.1]	25/37	25/37

Octabromodip henyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009 Warm season	tr(0.2)	0.3	1.6	nd	0.3 [0.1]	23/37	23/37
	2009 Cold season	0.3	0.4	7.1	nd	0.3 [0.1]	26/37	26/37

Nonabromodi phenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009 Warm season	tr(0.7)	tr(0.7)	3.0	nd	1.8 [0.6]	22/37	22/37
	2009 Cold season	tr(1.0)	tr(0.8)	3.9	nd	1.8 [0.6]	27/37	27/37

Decabromodi phenyl ether	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009 Warm season	tr(7)	tr(9)	31	nd	16 [5]	28/37	28/37
	2009 Cold season	tr(10)	tr(11)	45	nd	16 [5]	29/37	29/37

[14] Perfluorooctane sulfonic acid (PFOS)

・ History and state of monitoring

Perfluorooctane sulfonic acids (PFOS) have been used as water repellent agent, oil repellent agent and surface acting agent. Perfluorooctane sulfonic acids (PFOS) were adopted as target chemicals at the COP4 of the Stockholm convention on Persistent Organic Pollutants in May 2009.

FY 2009 was the first year for this Environmental Monitoring series, and the substances were measured in FY 2002, 2003, 2004, 2005 under the framework of “the Environmental Survey and Monitoring of Chemicals”.

The survey of the Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) only monitored linear octyl Perfluorooctane sulfonic acid (PFOS) and linear octyl Perfluorooctanoic acid (PFOA).

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 14pg/L, and the detection range was tr(26)～14,000 pg/L.

Stocktaking of the detection of Perfluorooctane sulfonic acid (PFOS) in surface water in FY2009

Perfluorooctane sulfonic acid (PFOS)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2009	730	580	14,000	tr(26)	37 [14]	49/49	49/49

<Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 3.7pg/g-dry, and none of the detected concentrations exceeded 1,900pg/g-dry.

Stocktaking of the detection of Perfluorooctane sulfonic acid (PFOS) in sediment in FY2009

Perfluorooctane sulfonic acid (PFOS)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	69	97	1,900	nd	9.6 [3.7]	180/190	64/64

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at 5 of the 7 valid areas adopting the detection limit of 7.4pg/g-wet, and none of the detected concentrations exceeded 640 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at 17 of the 18 valid areas adopting the detection limit of 7.4pg/g-wet, and none of the detected concentrations exceeded 15,000 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 7.4pg/g-wet, and the detection range was 37～890 pg/g-wet.

Stocktaking of the detection of Perfluorooctane sulfonic acid (PFOS) in wildlife (bivalves, fish and birds) in FY2009

Perfluorooctane sulfonic acid (PFOS)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2009	24	28	640	nd	19 [7.4]	17/31	5/7
Fish (pg/g-wet)	2009	210	230	15,000	nd	19 [7.4]	83/90	17/18
Birds (pg/g-wet)	2009	270	360	890	37	19 [7.4]	10/10	2/2

[15] Perfluorooctanoic acid (PFOA)

・ History and state of monitoring

Perfluorooctanoic acids (PFOA) have been used as water repellent agent, oil repellent agent and surface acting agent. Perfluorooctanoic acids (PFOA) were adopted as target chemicals at the COP4 of the Stockholm convention on Persistent Organic Pollutants in May 2009.

FY 2009 was the first year for this Environmental Monitoring series, and the substances were measured in surface water, sediment and wildlife in FY 2002, 2003, 2004, 2005 under the framework of “the Environmental Survey and Monitoring of Chemicals”.

The survey of the Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) only monitored linear octyl Perfluorooctane sulfonic acid (PFOS) and linear octyl Perfluorooctanoic acid (PFOA). However, it remains possible that the survey in wildlife monitored branched-chain Perfluorooctane sulfonic acid (PFOS) and branched-chain Perfluorooctanoic acid (PFOA).

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 49 sites, and it was detected at all 49 valid sites adopting the detection limit of 23pg/L, and the detection range was 250～31,000 pg/L.

Stocktaking of the detection of Perfluorooctanoic acid (PFOA) in surface water in FY2009

Perfluorooctanoic acid(PFOA)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2009	1,600	1,300	31,000	250	59 [23]	49/49	49/49

<Sediment>

The presence of the substance in sediment was monitored at 64 sites, and it was detected at all 64 valid sites adopting the detection limit of 3.3pg/g-dry, and none of the detected concentrations exceeded 500pg/g-dry.

Stocktaking of the detection of Perfluorooctanoic acid (PFOA) in sediment in FY2009

Perfluorooctanoic acid(PFOA)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	24	24	500	nd	8.3 [3.3]	182/190	64/64

<Wildlife>

The presence of the substance in bivalves was monitored in 7 areas, and it was detected at all 7 valid areas adopting the detection limit of 9.9pg/g-wet, and none of the detected concentrations exceeded 94 pg/g-wet. For fish, the presence of the substance was monitored in 18 areas, and it was detected at 17 of the 18 valid areas adopting the detection limit of 9.9pg/g-wet, and none of the detected concentrations exceeded 490 pg/g-wet. For birds, the presence of the substance was monitored in 2 areas, and it was detected at all 2 valid areas adopting the detection limit of 9.9pg/g-wet, and the detection range was tr(16)～58 pg/g-wet.

Stocktaking of the detection of Perfluorooctanoic acid (PFOA) in wildlife (bivalves, fish and birds) in FY2009

Perfluorooctanoic acid(PFOA)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2009	tr(20)	tr(21)	94	nd	25 [9.9]	27/31	7/7
Fish (pg/g-wet)	2009	tr(21)	tr(19)	490	nd	25 [9.9]	74/90	17/18
Birds (pg/g-wet)	2009	29	29	58	tr(16)	25 [9.9]	10/10	2/2

[16] Pentachlorobenzene

・ History and state of monitoring

Pentachlorobenzene have been used as flame retardants and pesticide. It was historically never registered under the Agricultural Chemicals Regulation Law. The pentachlorobenzene is produced as a by-product when agricultural chemicals are produced. In addition, it is generated unintentionally at the time of combustion. Pentachlorobenzene was adopted as target chemicals at the COP4 of the Stockholm convention on Persistent Organic Pollutants in May 2009 and designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in April 2010.

Under the framework of the Environmental Monitoring, the substance was monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY 2007.

・ Monitoring results

<Air>

The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 2.5pg/m^3, and the detection range was 20～210 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 2.5pg/m^3, and the detection range was tr(5.0)～120 pg/m^3.

Stocktaking of the detection of Pentachlorobenzene in air in FY2007 and FY2009

Penta chloro benzene	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2007 Warm season	85	83	310	18	12 [4.8]	78/78	26/26
	2007 Cold season	60	55	220	27		75/75	25/25
	2009 Warm season	63	64	210	20	6.4 [2.5]	111/111	37/37
	2009 Cold season	25	22	120	tr(5.0)		111/111	37/37

[17] Tetrachlorobenzenes

・ History and state of monitoring

Tetrachlorobenzenes were detected in the air in FY2007 and their concentration level was comparable to that of Pentachlorobenzene.

Under the framework of the Environmental Monitoring, the substance was monitored in air in FY 2007.

・ Monitoring results

○1,2,3,4-Tetrachlorobenzene、1,2,3,5-Tetrachlorobenzene and 1,2,4,5-Tetrachlorobenzene

<Air>

1,2,3,4-Tetrachlorobenzene: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 3.2pg/m^3, and the detection range was 21～480 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 3.2pg/m^3, and the detection range was 26～380 pg/m^3.

1,2,3,5-Tetrachlorobenzene: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 3.4pg/m^3, and the detection range was tr(4.1)～110 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 3.4pg/m^3, and the detection range was 9.3～120 pg/m^3.

1,2,4,5-Tetrachlorobenzene: The presence of the substance in air in the warm season was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 3.7pg/m^3, and the detection range was 21～150 pg/m^3. For air in the cold season, the presence of the substance was monitored at 37 sites, and it was detected at all 37 valid sites adopting the detection limit of 3.7pg/m^3, and the detection range was tr(4.6)～120 pg/m^3.

Stocktaking of the detection of Tetrachlorobenzenes in air in FY2007 and FY2009

1,2,3,4-Tetrachlorobenzene	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2007 Warm season	85	75	950	31	11 [4.1]	78/78	26/26
	2007 Cold season	76	71	400	33		75/75	25/25
	2009 Warm season	58	58	480	21	8.3 [3.2]	111/111	37/37
	2009 Cold season	55	49	380	26		111/111	37/37
1,2,3,5-Tetrachlorobenzene	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Air (pg/m^3)	2007 Warm season	40	37	290	tr(7.0)	15 [5.8]	78/78	26/26
	2007 Cold season	37	34	150	tr(13)		75/75	25/25
	2009 Warm season	20	21	110	tr(4.1)	8.8 [3.4]	111/111	37/37
	2009 Cold season	24	23	120	9.3		111/111	37/37
1,2,4,5-Tetrachlorobenzene	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Air (pg/m^3)	2007 Warm season	52	47	390	20	14 [5.6]	78/78	26/26
	2007 Cold season	42	41	150	17		75/75	25/25
	2009 Warm season	39	37	150	21	9.4 [3.7]	111/111	37/37
	2009 Cold season	21	20	120	tr(4.6)		111/111	37/37