Chapter 3 Results of the Environmental Monitoring in FY2019

1. Purpose of the monitoring

Environmental Monitoring provides annual surveys of the environmental persistence of target chemicals as listed in the Stockholm Convention, chemicals that while undesignated are still subject to review for potential risk, and/or highly persistent chemicals annotated as Specified Chemical Substances and Monitored Chemical Substances under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances (aka, the Chemical Substances Control Law), all target chemicals whose year to year changes in persistence in the environment must be understood.

*POPs: persistent organic pollutants

2. Target chemicals

In the FY2019 Environmental Monitoring, 14 chemicals (groups) were designated as target chemical.

2 of the target chemicals (groups) were Polychlorinated biphenyls (Total PCBs) and Hexachlorobenzene, which were listed as Persistent Organic Pollutants (POPs) initially in the Stockholm Convention in 2004[1]. 4 of them were HCHs (Hexachlorohexanes)[2], Polybromodiphenyl ethers (Br_4~Br_{10})[3], Perfluorooctane sulfonic acid (PFOS)[4] and Pentachlorobenzene, which were adopted to be the POPs at fourth meeting of the Conference of the Parties (COP) held 2009. 1 of them was 1,2,5,6,9,10-Hexabromocyclododecanes[5], which was adopted to be the POPs at six meeting of COP held 2013. 3 of them were Polychlorinated Naphthalenes[6], Hexachlorobuta-1,3-diene and Pentachlorophenol and its salts and esters[7], which were adopted to be the POPs at seventh meeting of COP held 2015. 1 of them was Short-chain chlorinated paraffins[8], which was adopted to be the POPs at eighth meeting of COP held 2017. 2 were Dicofol and Perfluorooctanoic acid (PFOA)[9], which were adopted to be the POPs at ninth meeting of COP held 2019. Another was Perfluorohexane sulfonic acid (PFHxS), which was decided to recommend to the COP that it consider listing as POPs at the persistent organic pollutants review committee held 2019.

The combinations of target chemicals and the monitoring media are given below.

(Note 1) Up to FY2009, the 11 target chemicals (groups) were monitored each fiscal year. 10 out of the 11 target chemicals (groups) were exceptions of Polychlorinated dibenzo-p-dioxin (PCDDs) and Polychlorinated dibenzofurans (PCDFs) from 12 chemicals (groups) listed as the POPs initially in the Stockholm Convention. Another was HCHs. As of FY2010, chemicals (groups) adopted or considerd to be the POPs in the convention have been monitored too, and adjustments made to implementation frequency. In FY2019, 11 chemicals (groups) that have been designated as target chemicals (groups) in this Environmental Monitoring were not moniterd. They were Aldrin, Dieldrin, Endrin, DDTs[10,] Chlordanes[11], Heptachlors[12], Toxaphenes[13], Mirex, Chlordecone, Hexabromobiphenyls, Chlordecone, Hexabromobiphenyls and Endosulfans. Up to the latest results of the 11 chemicals (groups) have been included in this report for purpose of reference.

(Note 2) 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.

(Note 3) 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. Decabromodiphenyl ether was adopted as target chemicals at the COP8 of the Stockholm convention on Persistent Organic Pollutants.In the survey, Polybromodiphenyl ethers including those from 4 to 10 bromines are target chemicals.

(Note 4) Perfluorooctane sulfonic acid (PFOS) and its salts and Perfluorooctanesulfonyl fluoride were adopted as target chemicals at the COP4 of the Stockholm convention on Persistent Organic Pollutants. The survey of the Perfluorooctane sulfonic acid (PFOS) only monitored linear octyl Perfluorooctane sulfonic acid (PFOS).

(Note 5) *α*-1,2,5,6,9,10-Hexabromocyclododecane, *β*-1,2,5,6,9,10-Hexabromocyclododecane and *γ*-1,2,5,6,9,10-Hexabromocyclododecane were adopted as target chemicals at the COP6 of the Stockholm convention on Persistent Organic Pollutants. In the survey, 1,2,5,6,9,10-Hexabromocyclododecanes including *δ*-1,2,5,6,9,10-Hexabromocyclododecane and *ε*-1,2,5,6,9,10- Hexabromocyclododecane are target chemicals.

(Note 6) PCNs (Cl_2~Cl_8) was adopted as target chemicals at the COP7 of the Stockholm convention on Persistent Organic Pollutants. In the survey, PCNs including those with one (1) chlorine are target chemicals.

(Note 7) Pentachlorophenol and its salts and esters were adopted as target chemicals at the COP7 of the Stockholm convention on Persistent Organic Pollutants, the survey monitored Pentachlorophenol and Pentachloroanisole.

(Note 8) Chlorinated paraffins (C_{10}~C_{13}) was adopted as target chemicals at the COP8 of the Stockholm convention on Persistent Organic Pollutants. In the survey, Chlorinated paraffins with 5~9 chlorines are target chemicals in surface water, sediment and wildlife, and Chlorinated paraffins with 4~7 chlorines are target chemicals in air.

(Note 9) The survey of the Perfluorooctanoic acid (PFOA) only monitored linear octyl Perfluorooctanoic acid (PFOA).

(Note 10) *p,p'*-DDT and *o,p'*-DDT were adopted as target chemicals of the Stockholm convention on Persistent Organic Pollutants. In the survey, DDTs including environmental degraded products *p,p'*-DDT, *o,p'*-DDT, *p,p'*-DDD and *o,p'*-DDD were target chemicals.

(Note 11) *cis*-Chlordane and *trans*-Chlordane were adopted as target chemical of the Stockholm convention on Persistent Organic Pollutants. In the survey, Chlordanes including *cis*-Chlordane, *trans*-Chlordane Oxychlordane, *cis*-Nonachlor and *trans*-Nonachlor are target chemicals.

(Note 12) Heptachlor was adopted as target chemical of the Stockholm convention on Persistent Organic Pollutants. In the survey, Heptachlors including *cis*-Heptachlor epoxide and *trans*-Heptachlor epoxide are target chemicals.

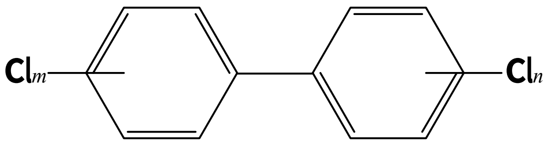
(Note 13) Chlorobornane and Chlorocamphene of industrial blended material (about 16,000 congeners or isomer） were adopted as target chemicals of the Stockholm convention on Persistent Organic Pollutants. In the survey, 2-endo,3-exo,5-endo,6-exo,8,8,10,10-octachlorobornane (Parlar-26), 2-endo,3-exo,5-endo,6-exo,8,8,9,10,10-nonachlorobornane (Parlar-50) and 2,2,5,5,8,9,9,10,10-Nonachlorobornane (Parlar-62) are target chemicals.

No	Name	Monitored media			
		Surface water	Sediment	Wildlife	Air
[1]	Total Polychlorinated biphenyls (Total PCBs) Total PCBs represents the sum of the PCB congeners listed in the table below. "Total PCBs" only indicates the total amount in the following pages, and the measured values of the individual congeners and coplanar PCBs are listed on the website. [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 (reference)				
[4]	Dieldrin (reference)				
[5]	Endrin (reference)				
[6]	DDTs (reference) [6-1] *p,p'*-DDT (reference) [6-2] *p,p'*-DDE (reference) [6-3] *p,p'*-DDD (reference) [6-4] *o,p'*-DDT (reference) [6-5] *o,p'*-DDE (reference) [6-6] *o,p'*-DDD (reference)				
[7]	Chlordanes (reference) [7-1] *cis*-Chlordane(reference) [7-2] *trans*-Chlordane(reference) [7-3] Oxychlordane(reference) [7-4] *cis*-Nonachlor(reference) [7-5] *trans*-Nonachlor(reference)				
[8]	Heptachlors (reference) [8-1] Heptachlor(reference) [8-2] *cis*-Heptachlor epoxide(reference) [8-3] *trans*-Heptachlor epoxide(reference)				
[9]	Toxaphenes (reference) [9-1] 2-endo,3-exo,5-endo,6-exo,8,8,10,10-octachlorobornane (Parlar-26) (reference) [9-2] 2-endo,3-exo,5-endo,6-exo,8,8,9,10,10-nonachlorobornane (Parlar-50) (reference) [9-3] 2,2,5,5,8,9,9,10,10-Nonachlorobornane (Parlar-62) (reference)				
[10]	Mirex (reference)				
[11]	HCHs (Hexachlorohexanes) [11-1] α-HCH [11-2] β-HCH [11-3] γ-HCH (synonym:Lindane) [11-4] δ-HCH	○	○	○	○
[12]	Chlordecone (reference)				
[13]	Hexabromobiphenyls (reference)				

No	Name	Monitored media			
		Surface water	Sediment	Wildlife	Air
[14]	Polybromodiphenyl ethers(Br_4~Br_{10}) [14-1] Tetrabromodiphenyl ethers [14-1-1] 2,2',4,4'-Tetrabromodiphenyl ether (#47) [14-2] Pentabromodiphenyl ethers [14-2-1] 2,2',4,4',5-Pentabromodiphenyl ether (#99) [14-3] Hexabromodiphenyl ethers [14-3-1] 2,2',4,4',5,5'-Pentabromodiphenyl ether (#153) [14-3-2] 2,2',4,4',5,6'-Pentabromodiphenyl ether (#154) [14-4] Heptabromodiphenyl ethers [14-4-1] 2,2',3,3',4,5',6'-Pentabromodiphenyl ether (#175) [14-4-2] 2,2',3,4,4',5',6'-Pentabromodiphenyl ether (#183) [14-5] Octabromodiphenyl ethers [14-6] Nonabromodiphenyl ethers [14-7] Decabromodiphenyl ether	○	○	○	○
[15]	Perfluorooctane sulfonic acid (PFOS)	○	○	○	○
[16]	Perfluorooctanoic acid (PFOA)	○	○	○	○
[17]	Pentachlorobenzene	○	○	○	○
[18]	Endosulfans (reference) [18-1] *α*-Endosulfan (reference) [18-2] *β*- Endosulfan (reference)				
[19]	1,2,5,6,9,10-Hexabromocyclododecanes [19-1] *α*-1,2,5,6,9,10-Hexabromocyclododecane [19-2] *β*-1,2,5,6,9,10-Hexabromocyclododecane [19-3] *γ*-1,2,5,6,9,10-Hexabromocyclododecane [19-4] *δ*-1,2,5,6,9,10-Hexabromocyclododecane (reference) [19-5] *ε*-1,2,5,6,9,10-Hexabromocyclododecane (reference)			○	○
[20]	Total Polychlorinated naphthalenes Total Polychlorinated naphthalenes represents the sum of the Polychlorinated naphthalenes congeners. The measured values of the individual congeners are listed on the website.	○	○	○	○
[21]	Hexachlorobuta-1,3-diene				○
[22]	Pentachlorophenol and its salts and esters [22-1] Pentachlorophenol [22-2] Pentachloroanisole	○	○	○	○
[23]	Short-chain chlorinated paraffins [23-1] Chlorinated decanes [23-2] Chlorinated undecanes [23-3] Chlorinated dodecanes [23-4] Chlorinated tridecanes	○	○	○	○
[24]	Dicofol	○	○	○	○
[25]	Perfluorohexane sulfonic acid (PFHxS)	○	○		

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

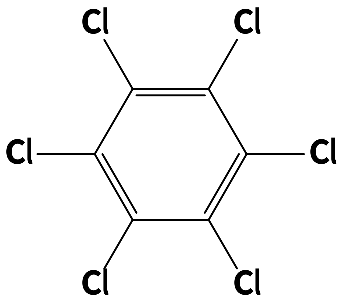
[1] Total Polychlorinated biphenyls (Total PCBs)



i = m+n =1~10

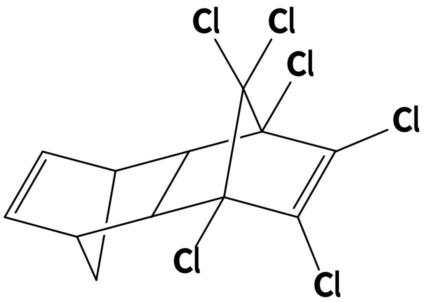
Molecular formula:	$C_{12}H_{(10-i)}Cl_i$ (i = m+n =1~10)
CAS:	27323-18-8 (Cl_1), 22512-42-9 (Cl_2), 25323-68-6 (Cl_3), 26914-33-0 (Cl_4), 25429-29-2 (Cl_5), 26601-64-9 (Cl_6), 28655-71-2 (Cl_7), 31472-83-0 (Cl_8), 53742-07-7 (Cl_9), 5051-24-3 (Cl_{10})
ENCS:	No pertinence
MW:	188.65~498.66
mp:	Not specified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

[2] HCB (Hexachlorobenzene)



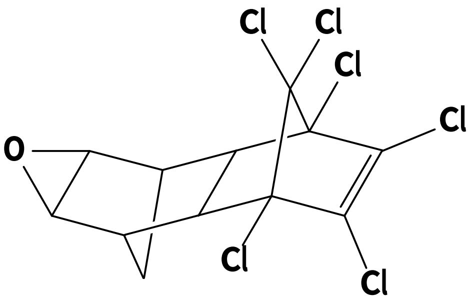
Molecular formula:	C_6Cl_6
CAS:	118-74-1
ENCS:	3-0076
MW:	284.78
mp:	231.8°C [1)]
bp:	323~326°C [1)]
SW:	0.0000096g/kg (25°C) [2)]
Specific gravity:	2.044 (23°C) [1)]
logPow:	5.73 [3)]

[3] Aldrin (reference)



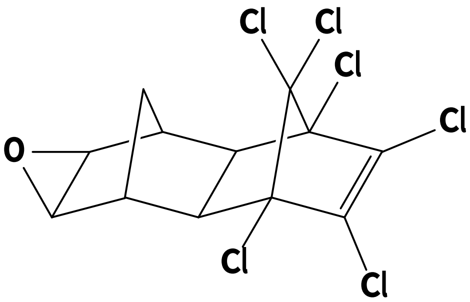
Molecular formula:	$C_{12}H_8Cl_6$
CAS:	309-00-2
ENCS:	4-0303
MW:	364.91
mp:	104°C[1)]
bp:	145°C (0.27kPa) [4)]
SW:	0.0002g/kg (25°C) [2)]
Specific gravity:	1.6g/cm^3 [5)]
logPow:	6.50 [3)]

[4] Dieldrin (reference)



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)]

[5] Endrin (reference)

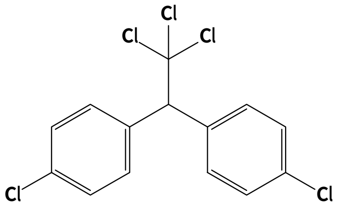


Molecular formula:	$C_{12}H_8Cl_6O$
CAS:	72-20-8
ENCS:	4-0299
MW:	380.91
mp:	200°C[6)]
bp:	245°C (Decomposition) [6)]
SW:	0.00025g/kg [2)]
Specific gravity:	1.7g/cm^3 [6)]
logPow:	5.20 [3)]

(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 approximately equal to 101.3kPa).

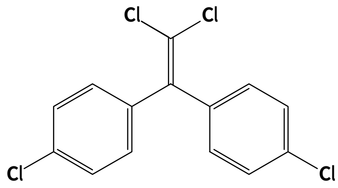
[6] DDTs (reference)

[6-1] *p,p′*-DDT (reference)



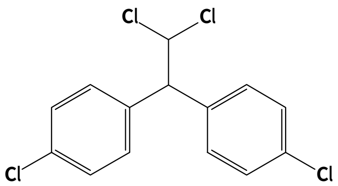
Molecular formula: $C_{14}H_9Cl_5$
CAS: 50-29-3
ENCS: 4-0910
MW: 354.49
mp: 108.5°C [2]
bp: 260°C [2]
SW: Insoluble [1]
Specific gravity: 1.6g/cm^3 [7]
logPow: 6.91 [3]

[6-2] *p,p′*-DDE (reference)



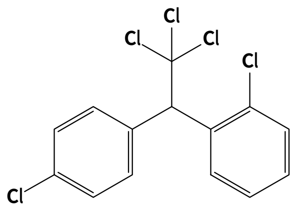
Molecular formula: $C_{14}H_8Cl_4$
CAS: 72-55-9
ENCS: No pertinence
MW: 318.03
mp: 89°C [2]
bp: 336°C [5]
SW: 0.12mg/L (25°C) [5]
Specific gravity: Uncertain
logPow: 6.51 [3]

[6-3] *p,p′*-DDD (reference)



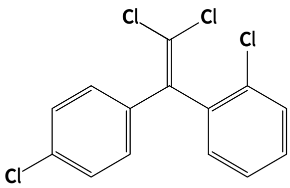
Molecular formula: $C_{14}H_{10}Cl_4$
CAS: 72-54-8
ENCS: No pertinence
MW: 320.04
mp: 109~110°C[1]
bp: 193°C (1mmHg) [2]
SW: 0.09mg/L (25°C) [5]
Specific gravity: Uncertain
logPow: 6.02 [3]

[6-4] *o,p′*-DDT (reference)



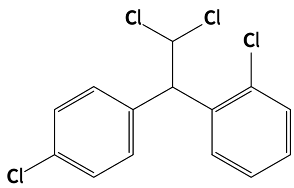
Molecular formula: $C_{14}H_9Cl_5$
CAS: 789-02-6
ENCS: No pertinence
MW: 354.49
mp: Uncertain
bp: Uncertain
SW: Uncertain
Specific gravity: Uncertain
logPow: Uncertain

[6-5] *o,p′*-DDE (reference)



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

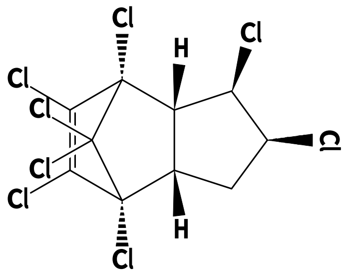
[6-6] *o,p′*-DDD (reference)



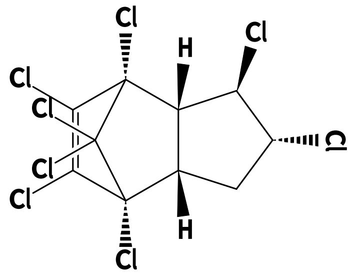
Molecular formula: $C_{14}H_{10}Cl_4$
CAS: 53-19-0
ENCS: No pertinence
MW: 320.04
mp: 76~78°C [1]
bp: Uncertain
SW: Uncertain
Specific gravity: Uncertain
logPow: Uncertain

[7] Chlordanes (reference)

[7-1] *cis*-Chlordane(reference)



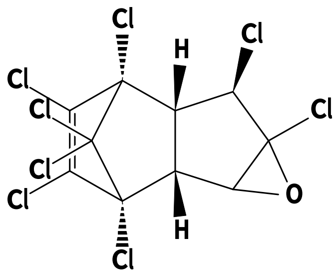
[7-2] *trans*-Chlordane (reference)



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

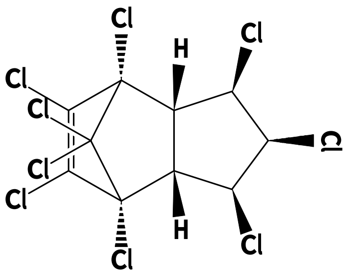
Molecular formula:	$C_{10}H_6Cl_8$
CAS:	5103-71-9 (*cis*), 5103-74-2 (*trans*)
ENCS:	4-637
MW:	409.78
mp:	106°C [1)]
bp:	175°C (1mmHg) [1)]
SW:	0.0006g/kg (25°C) [1)]
Specific gravity:	1.59~1.63 (25°C) [2)]
logPow:	6.16 [3)]

[7-3] Oxychlordane (reference)



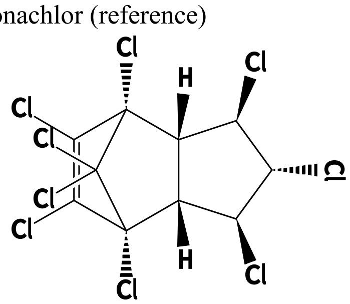
Molecular formula:	$C_{10}H_4Cl_8O$
CAS:	26880-48-8
ENCS:	No pertinence
MW:	423.76
mp:	100°C [1)]
bp:	Uncertain
SW:	Uncertain
Specific gravity:	Uncertain
logPow:	4.76 [3)]

[7-4] *cis*-Nonachlor (reference)



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)]

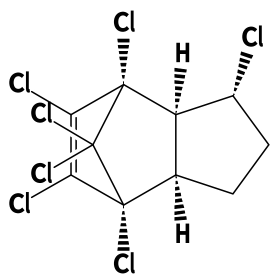
[7-5] *trans*-Nonachlor (reference)



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)]

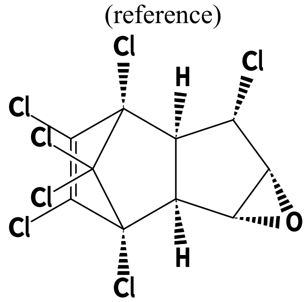
[8] Heptachlors (reference)

[8-1] Heptachlor (reference)

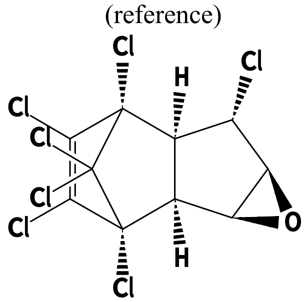


Molecular formula:	$C_{10}H_5Cl_7$
CAS:	76-44-8
ENCS:	4-637, 9-1646
MW:	373.32
mp:	95~96°C [2)]
bp:	Uncertain
SW:	0.00018g/kg (25°C) [1)]
Specific gravity:	1.57 (9°C) [1)]
logPow:	6.10 [3)]

[8-2] *cis*-Heptachlor epoxide (reference)



[8-3] *trans*-Heptachlor epoxide (reference)

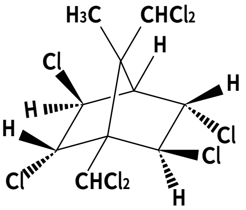


The following data are for both [8-2] and [8-3].

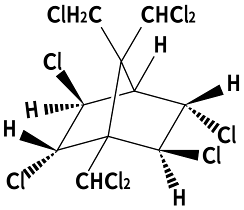
Molecular formula:	$C_{10}H_5Cl_7O$
CAS:	1024-57-3
ENCS:	No pertinence
MW:	389.32
mp:	160°C [1)]
bp:	Uncertain
SW:	Uncertain
Specific gravity:	Uncertain
logPow:	5.40 [3)]

[9] Toxaphenes (reference)

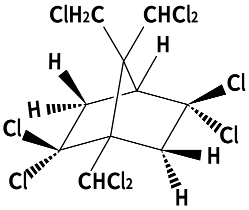
[9-1]
2-Endo,3-exo,5-endo,6-exo,8,8,10,10-octachlorobornane (Parlar-26) (reference)



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

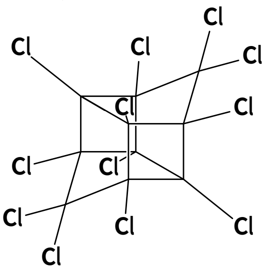


[9-3]
2,2,5,5,8,9,9,10,10-nonachlorobornane (Parlar-62) (reference)



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)]

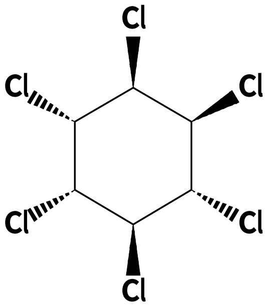
[10] Mirex (reference)



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
logPow:	5.28 [3)]

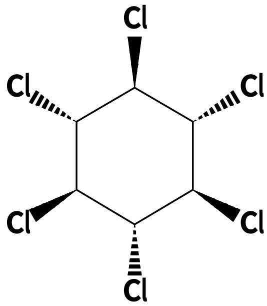
[11] HCHs(Hexachlorohexanes)

[11-1] *α*-HCH



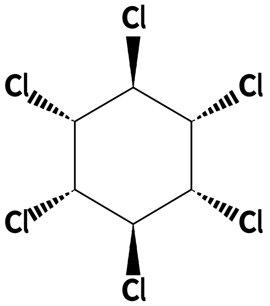
Molecular formula:	$C_6H_6Cl_6$
CAS:	319-84-6
ENCS:	3-2250, 9-1652
MW:	290.83
mp:	158°C [1)]
bp:	288°C [9)]
SW:	0.00018g/kg (25°C) [2)]
Specific gravity:	1.87 (20°C) [10)]
logPow:	3.80 [3)]

[11-2] *β*-HCH



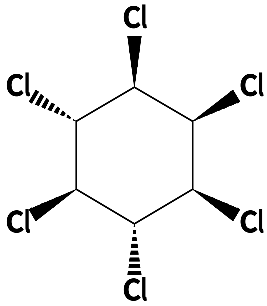
Molecular formula:	$C_6H_6Cl_6$
CAS:	319-85-7
ENCS:	3-2250, 9-1652
MW:	290.83
mp:	309°C[11)]
bp:	60°C (0.50mmHg) [1)]
SW:	0.0002g/kg (25°C) [2)]
Specific gravity:	1.87 (20°C) [10)]
logPow:	3.78 [1)]

[11-3] *γ*-HCH (synonym:Lindane)



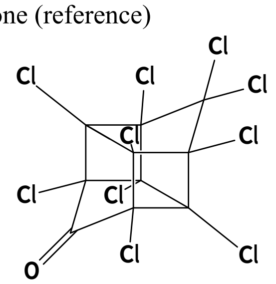
Molecular formula:	$C_6H_6Cl_6$
CAS:	58-89-9
ENCS:	3-2250, 9-1652
MW:	290.83
mp:	112.5°C [1)]
bp:	323.4°C [1)]
SW:	0.0078g/kg (25°C) [1)]
Specific gravity:	1.85 (20°C) [10)]
logPow:	3.72 [3)]

[11-4] *δ*-HCH



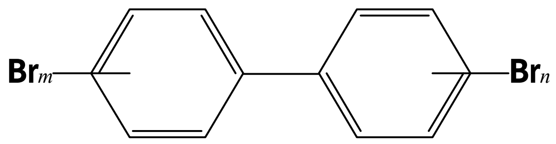
Molecular formula:	$C_6H_6Cl_6$
CAS:	319-86-8
ENCS:	3-2250, 9-1652
MW:	290.83
mp:	141.5°C [1)]
bp:	60°C (0.36mmHg) [1)]
SW:	Uncertain
Specific gravity:	1.87 (20°C) [10)]
logPow:	4.14 [3)]

[12] Chlordecone (reference)



Molecular formula:	$C_{10}Cl_{10}O$
CAS:	143-50-0
ENCS:	No pertinence
MW:	490.64
mp:	350°C[2)]
bp:	Not specified
sw:	7.6mg/L (24°C) [5)]
Specific gravity:	1.61 (25°C) [1)]
logPow:	3.45 [12)]

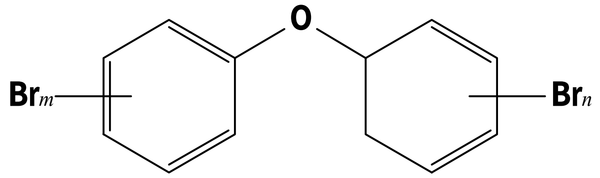
[13] Hexabromobiphenyls (reference)



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

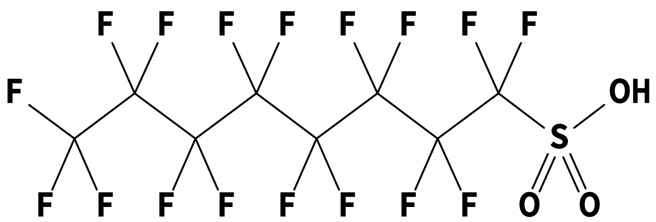
[14] Polybromodiphenyl ethers (Br_4~Br_{10})



i = m+n =4~10

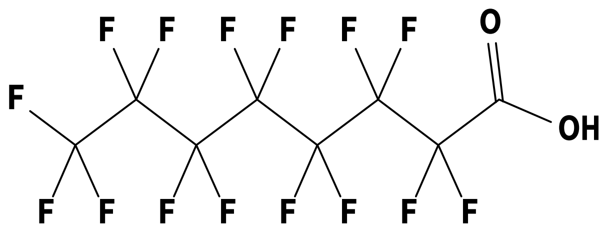
Molecular formula: $C_{12}H_{(10-i)}Br_iO$ (i = m+n =4~10)
CAS: 40088-47-9 (Br_4), 32534-81-9 (Br_5), 36483-60-0 (Br_6), 68928-80-3 (Br_7), 32536-52-0 (Br_8), 63936-56-1 (Br_9), 1163-19-5 (Br_{10})
ENCS: 3-61 (Br_4), 3-2845 (Br_6)
MW: 485.79~959.17
mp: Not specified
bp: Not specified
sw: Not specified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

[15] Perfluorooctane sulfonic acid (PFOS)



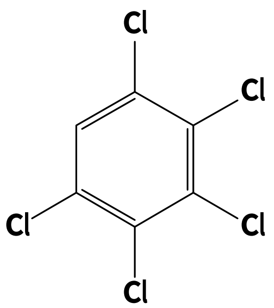
Molecular formula: $C_8HF_{17}O_3S$
CAS: 1763-23-1
ENCS: 2-1595
MW: 500.13
mp: >400°C (Potassium salt) [13)]
bp: Uncertain
sw: 519mg/L (20°C, Potassium salt) [13)]
Specific gravity: Uncertain
logPow: Uncertain

[16] 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) [14)]
Specific gravity: 1.79g/cm^3 [15)]
logPow: 6.3 [15)]

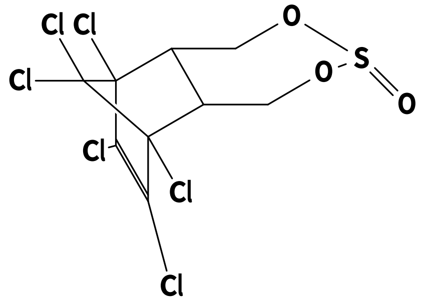
[17] Pentachlorobenzene



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

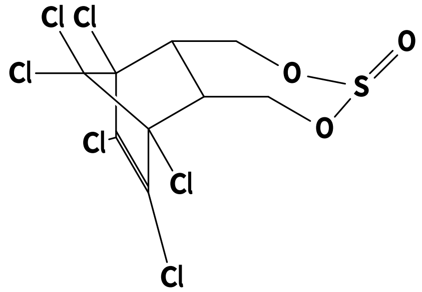
[18] Endosulfans (reference)

[18-1] *α*-Endosulfan (reference)



Molecular formula: $C_9H_6Cl_6O_3S$
CAS: 959-98-8
ENCS: No pertinence
MW: 406.93
mp: 109.2°C [16]
bp: Uncertain
sw: 0.33mg/L (25°C) [16]
Specific gravity: Uncertain
logPow: 4.7 [16]

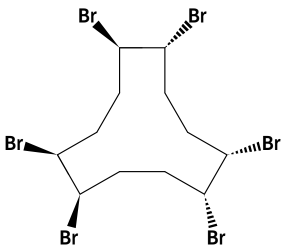
[18-2] *β*-Endosulfan (reference)



Molecular formula: $C_9H_6Cl_6O_3S$
CAS: 33213-65-9
ENCS: No pertinence
MW: 406.93
mp: 213.3°C [16]
bp: Uncertain
sw: 0.32mg/L (25°C) [16]
Specific gravity: Uncertain
logPow: 4.7 [16]

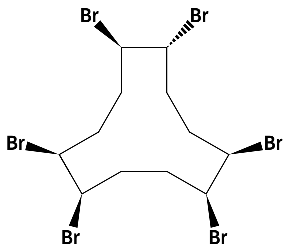
[19] 1,2,5,6,9,10-Hexabromocyclododecanes

[19-1] *α*-1,2,5,6,9,10-Hexabromocyclododecane



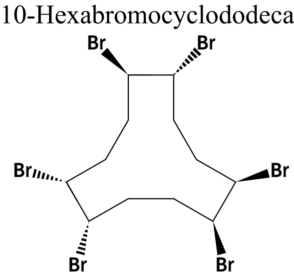
Molecular formula: $C_{12}H_{18}Br_6$
CAS: 134237-50-6
ENCS: 3-2254
MW: 641.70
mp: 179~181°C [17]
bp: Uncertain
SW: 48.8μg/L [17]
Specific gravity: Uncertain
logPow: 5.07 [17]

[19-2] *β*-1,2,5,6,9,10-Hexabromocyclododecane



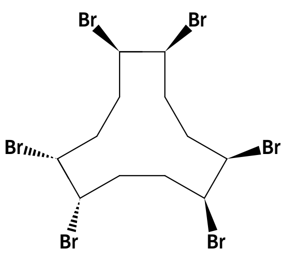
Molecular formula: $C_{12}H_{18}Br_6$
CAS: 134237-51-7
ENCS: 3-2254
MW: 641.70
mp: 170~172°C [17]
bp: Uncertain
SW: 14.7μg/L [17]
Specific gravity: Uncertain
logPow: 5.12 [17]

[19-3] *γ*-1,2,5,6,9,10-Hexabromocyclododecane



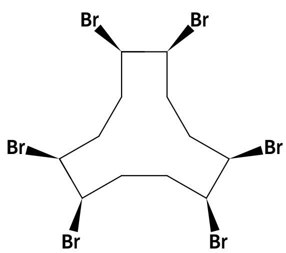
Molecular formula: $C_{12}H_{18}Br_6$
CAS: 134237-52-8
ENCS: 3-2254
MW: 641.70
mp: 207~209°C [17]
bp: Uncertain
SW: 2.1μg/L [17]
Specific gravity: Uncertain
logPow: 5.47 [17]

[19-4] *δ*-1,2,5,6,9,10-Hexabromocyclododecane (reference)



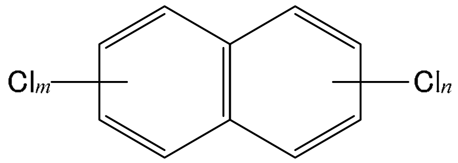
Molecular formula: $C_{12}H_{18}Br_6$
CAS: Uncertain
ENCS: 3-2254
MW: 641.70
mp: Uncertain
bp: Uncertain
SW: Uncertain
Specific gravity: Uncertain
logPow: Uncertain

[19-5] *ε*-1,2,5,6,9,10-Hexabromocyclododecane (reference)



Molecular formula: $C_{12}H_{18}Br_6$
CAS: Uncertain
ENCS: 3-2254
MW: 641.70
mp: Uncertain
bp: Uncertain
SW: Uncertain
Specific gravity: Uncertain
logPow: Uncertain

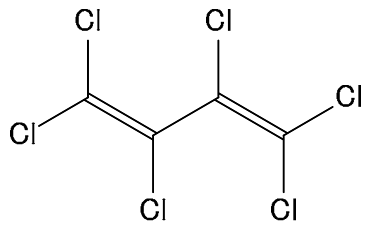
[20] Total Polychlorinated Naphthalenes



i = m+n =1〜8

Molecular formula: $C_{10}H_{(8-i)}Cl_i$ (i = m+n = 1〜8)
CAS: 25586-43-0(Cl_1), 28699-88-9(Cl_2), 1321-65-9(Cl_3), 1335-88-2(Cl_4), 1321-64-8(Cl_5), 1335-87-1(Cl_6), 32241-08-0(Cl_7), 2234-13-1(Cl_8)
ENCS: No pertinence
MW: 162.6~403.7
mp: Not specified
bp: Not specified
sw: Not specified
Specific gravity: Not specified
logPow: Not specified

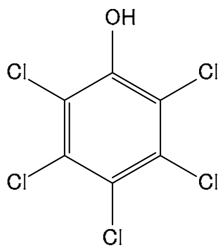
[21] Hexachlorobuta-1,3-diene



Molecular formula: C_4Cl_6
CAS: 87-68-3
ENCS: 2-121
MW: 260.76
mp: -21°C [2]
bp: 215°C [2]
sw: 0.0005% (20°C) [2]
Specific gravity: 1.682 (20/4°C) [2]
logPow: 4.9 [18]

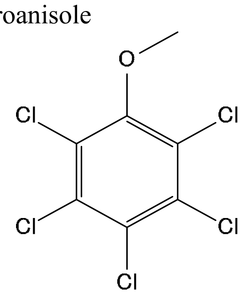
[22] Pentachlorophenol and its salts and esters

[22-1] Pentachlorophenol



Molecular formula: C_6HCl_5O
CAS: 87-86-5
ENCS: 3-2850
MW: 266.35
mp: 174°C (Monohydrate), 191°C (Anhydrous) [19]
bp: 309~310°C (Decomposition) [2]
sw: 14mg/L (26.7°C) [20]
Specific gravity: 1.978 (22°C) [2]
logPow: 5.12 [21]

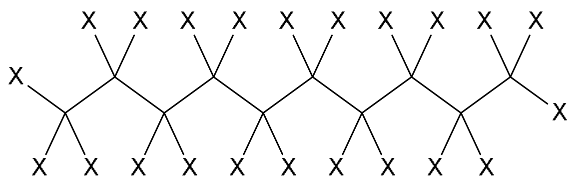
[22-2] Pentachloroanisole



Molecular formula: $C_7H_3Cl_5O$
CAS: 1825-21-4
ENCS: No pertinence
MW: 280.36
mp: 233.9°C [1]
bp: Uncertain
sw: Less than 1mg/L [22]
Specific gravity: Uncertain
logPow: 5.45 [22]

[23] Short-chain chlorinated paraffins

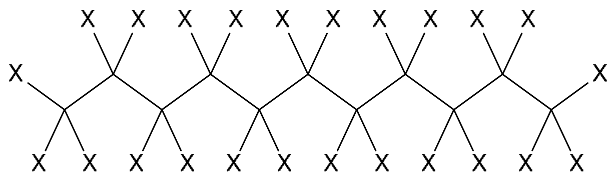
[23-1] Chlorinated decanes



X = H or Cl

Molecular formula: $C_{10}H_{(22-i)}Cl_i$ (i = 1~22)
CAS: Uncertain
ENCS: 2-68
MW: 176.73~900.07
mp: Not specified
bp: Not specified
sw: Not specified
Specific gravity: Not specified
logPow: Not specified

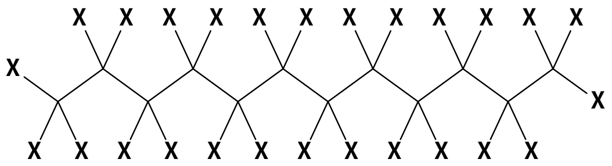
[23-2] Chlorinated undecanes



X = H or Cl

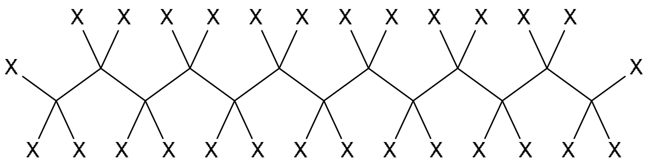
Molecular formula: $C_{11}H_{(24-i)}Cl_i$ (i = 1~24)
CAS: Uncertain
ENCS: 2-68
MW: 190.75〜982.99
mp: Not specified
bp: Not specified
sw: Not specified
Specific gravity: Not specified
logPow: Not specified

[23-3] Chlorinated dodecanes



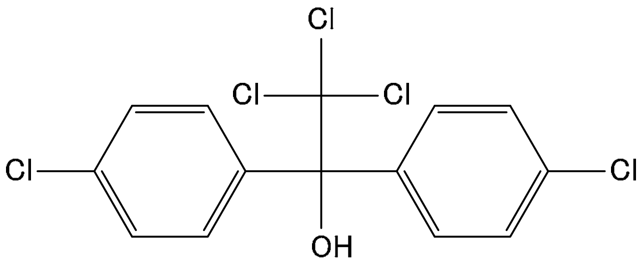
Molecular formula:	$C_{12}H_{(26-i)}Cl_i$ (i = 1~26)
CAS:	Uncertain
ENCS:	2-68
MW:	204.78~1065.91
mp:	Not specified
bp:	Not specified
sw:	Not specified
Specific gravity:	Not specified
logPow:	Not specified

[23-4] Chlorinated tridecanes



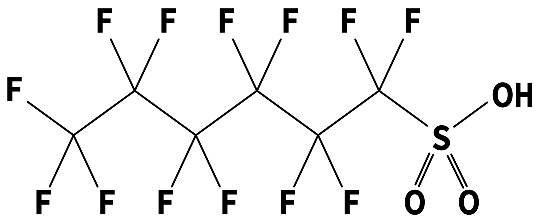
Molecular formula:	$C_{13}H_{(28-i)}Cl_i$ (i = 1~28)
CAS:	Uncertain
ENCS:	2-68
MW:	218.81~1,148.82
mp:	Not specified
bp:	Not specified
sw:	Not specified
Specific gravity:	Not specified
logPow:	Not specified

[24] Dicofol (reference)



Molecular formula:	$C_{14}H_9Cl_5O$
CAS:	115-32-2
ENCS:	4-226
MW:	370.49
mp:	77.5~79.5°C [23)]
bp:	180~225°C [23)]
sw:	0.8~1.32mg/L (25°C) [23)]
Specific gravity:	1.45g/cm^3 [23)]
logPow:	3.8～6.06 [23)]

[25] Perfluorohexane sulfonic acid (PFHxS)



Molecular formula:	$C_6HF_{13}O_3S$
CAS:	355-46-4
ENCS:	No pertinence
MW:	400.11
mp:	41°C[24)]
bp:	238～239°C[24)]
sw:	1.4g/L (20～25°C, Potassium salt)[24)]
	2.3g/L (Non-dissociation)[24)]
Specific gravity:	1.841g/cm^3 [25)]
logPow:	5.17 [24)]

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14) OECD, Perfluorooctanoic Acid & Ammonium Perfluorooctanoate, SIDS Initial Assessment Profile for 26th SIAM (2008)
15) IPCS, International Chemical Safety Cards, Perfkuorooctanoic acid, ICSC1613 (2005)
16) UNEP, Stockholm Convention on Persistent Organic Pollutants, Risk profile on endosulfan, Report of the Persistent Organic Pollutants Review Committee on the work of its fifth meeting (2009)
17) UNEP, Stockholm Convention on Persistent Organic Pollutants, Risk profile on hexabromocyclododecane, Report of the Persistent Organic Pollutants Review Committee on the work of its sixth meeting (2010)
18) IPCS, International Chemical Safety Cards, Hexachlorobutadiene ICSC0896 (1997)
19) International Agency for Research on Cancer(IARC), IARC Monographs on the Evaluation of the Carcinogenic Risk of

Chemicals to Man(1972)
20) Yalkowsky et al., Aquasol Database of Aqueous Solubility Version 5, College of Pharmacy, University of Arizona(1992)
21) Hansch et al., Exploring QSAR - Hydrophobic, Electronic and Steric Constants, American Chemical Society (1995)
22) UNEP, Stockholm Convention on Persistent Organic Pollutants, Risk profile on pentachlorophenol and its salts and esters, Report of the Persistent Organic Pollutants Review Committee on the work of its ninth meeting (2013)
23) UNEP, Stockholm Convention on Persistent Organic Pollutants, Risk profile on dicofol, Report of the Persistent Organic Pollutants Review Committee on the work of its twelfth meeting (2016)
24) UNEP, Stockholm Convention on Persistent Organic Pollutants, Persistent Organic Pollutants Review Committee, Perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS related compounds, Draft risk management evaluation (2019)
25) U.S. National Library of Medicine, Hazardous Substances Data Bank (HSDB) (https://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB)

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	Environmental Promotion Section, Environment Division, Department of Environment and Lifestyle, Hokkaido Prefectural Government and Hokkaido Research Organization Environmental and Geological Research Department Institute of Environmental Sciences	○	○	○	○
Sapporo City	Sapporo City Institute of Public Health				○
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.	Yamagata Environmental Science Research Center	○	○		○
Fukushima Pref.	Fukushima Prefectural Environmental Center	○	○		
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.	Environmental Improvement Division, Bureau of Environment, Tokyo Metropolitan Government and Tokyo Metropolitan Research Institute for Environmental Protection	○	○	○	○
Kanagawa Pref.	Kanagawa Environmental Research Center				○
Yokohama City	Yokohama Environmental Science Research Institute	○	○	○	○
Kawasaki City	Kawasaki Environment Research Institute	○	○	○	
Niigata Pref.	Niigata Prefectural Institute of Public Health and Environmental Sciences	○	○		○
Toyama Pref.	Environment Preservation Division, Living Environmental and Cultural Affairs Department, Toyama Prefectural Government and 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 and Environment		○	○	○
Yamanashi Pref.	Yamanashi Prefectural Fisheries Technology Center			○*	
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 Center, Regional Environmental measures Division, Environmental Bureau, Nagoya city			○	○
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 Health and Environmental Sciences	○	○		
Osaka Pref.	Environment Preservation Division, Environment Management Office, Department of Environment, Agriculture, Forestry and Fisheries, Osaka Prefectural Government and Research Institute of Environment, Agriculture and Fisheries, Osaka Prefecture	○	○	○	○
Osaka City	Osaka City Institute of Public Health and Environmental Sciences	○	○		

Local communities	Organisations responsible for sampling	Monitored media			
		Surface water	Sediment	Wildlife	Air
Hyogo Pref.	Water and Air Quality Control Division, Environmental Management Bureau, Agricultural and Environmental Affairs Department, Hyogo Prefectural Government and Hyogo Prefectural Institute of Environmental Sciences, Hyogo Environmental Advancement Association	○	○	○	○
Hyogo Pref.	Water and Air Quality Control Division, Environmental Management Bureau, Agricultural and Environmental Affairs Department, Hyogo Prefectural Government and Green Nature Division, Environmental Policy Office, Department of Citizen Autonomy, Itami City			○*	
Kobe City	Natural Environmental Symbiotic Division, Environmental Preservation Branch, Environment Bureau, Kobe City and Kobe Institute of Health, Welfare Bureau, Health Division, Health	○	○		○
Nara Pref.	Nara Prefecture Landscape and Environment Center		○		○
Wakayama Pref.	Wakayama Prefectural Research Center of Environment and Public Health	○	○		
Tottori Pref.	Tottori Prefectural Institute of Public Health and Environmental Science			○	
Shimane Pref.	Shimane Prefectural Institute of Public Health and Environmental Science and Oki Public Health Center				○
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.	Environmental Policy Division, Public Environmental Affairs Department, Yamaguchi Prefectural Government and Yamaguchi Prefectural Institute of Public Health and Environment	○	○		○
Tokushima Pref.	Tokushima Prefectural Pablic Health, Pharmaceutical and Environmental Sciences Center	○	○		○
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 Sciences				○
Kitakyushu City	Kitakyushu City Institute of Health and Environmental Sciences	○	○		
Fukuoka City	Fukuoka City Institute for Hygiene and the Environment		○		
Saga Pref.	Saga Prefectural Environmental Research Center	○	○		○
Nagasaki Pref.	Regional Environment Division, Environment Bureau, Nagasaki Prefecture	○	○		
Kumamoto Pref.	Kumamoto Prefectural Institute of Public-Health and Environmental Science	○			○
Oita Pref.	Environment Preservation Division, Department of Environment, Oita Prefectural Government and Oita Prefectural Institute of Health and Environment		○	○	
Miyazaki Pref.	Miyazaki Prefectural Institute for Public Health and Environment	○	○		○
Kagoshima Pref.	Kagoshima Prefectural Institute for Environmental Research and Public Health	○	○	○	○
Okinawa Pref.	Okinawa Prefectural Institute of Health and Environment	○	○	○	○

(Note 1) Organisations responsible for sampling are described by their official names in FY2019

(Note 2) *: Because there were the examples of survey that obtained the eggs in other countries, the eggs of great cormorants were taken in this survey by Yamanashi Prefectural Fisheries Technology Center and Water and Air Quality Control Division, Environmental Management Bureau, Agricultural and Environmental Affairs Department, Hyogo Prefectural Government and Green Nature Division, Environmental Policy Office, Department of Citizen Autonomy, Itami City. The results were treated as the reference values.

(2) Monitored sites (areas)

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.

The 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	12	48	1
Sediment	47	12	61	1*
Wildlife (bivalves)	3	12	3	1**
Wildlife (fish)	16	12	16	1**
Wildlife (birds)	3***	12	3***	1**
Air (warm season)	34	13	36	1 or 3****
All media	58	14	121***	

(Note 1) "*" : For sediment, at each monitoring point, three(3) specimen samples were collected. The target substances were analysed for each place with one(1) specimen sample that is a mixture of equal parts of the three(3) specimen samples.

(Note 2) "**" : For wildlife species, at each monitoring point, three(3) specimen samples were collected. The target substance group Total Polychlorinated Naphthalenes were analysed with the three(3) specimen samples for each place. The other substances were analysed for each place with one(1) specimen sample that is a mixture of equal parts of the three(3) specimen samples.

(Note 3) "***" : Samples obtained in 2 sites of the birds as wildlife eggs of Great Cormorant, and the samples were measured each the eggs yolk and the eggs white, the results were treated as a reference values.

(Note 4) "****" : The target substances other than [21] Hexachlorobuta-1,3-diene were analysed withe one (1) sample for each sit. The target substance [21] Hexachlorobuta-1,3-diene was analysed with the three(3) specimen samples for each site.

(3) Sampling method of specimens

The sampling of specimens and the preparation of samples were carried out following the "Guidelines on Conducting of Environmental Surveys and Monitoring of Chemicals" (published on March 2021) by the Environment Health and Safety Division, Environmental Health Department, Ministry of the Environment of Japan (MOE).

(4) 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: 1 bivalve (blue mussel), 7 fishes (predominantly sea bass), and 1 bird, namely, 9 species in total.

The properties of the species determined as targets in the FY2019 monitoring are shown in Table 3-2. Moreover, Table 3-1-3 summarizes the outline of the samples used for analysis.

Table 3-1-1 List of monitored sites (surface water) in the Environmental Monitoring in FY2019

Local communities	Monitored sites	Sampling dates
Hokkaido	Ishikarikakokyo Bridge, Mouth of Riv. Ishikari (Ishikari City)	November 21, 2019
Iwate Pref.	Toyosawa Bridge, Riv. Toyosawa (Hanamaki City)	December 4, 2019
Miyagi Pref.	Sendai Bay (Matsushima Bay)	October 15, 2019
Akita Pref.	Lake Hachiro	October 21, 2019
Yamagata Pref.	Mouth of Riv. Mogami (Sakata City)	December 11, 2019
Fukushima Pref.	Onahama Port	November 12, 2019
Ibaraki Pref.	Tonekamome-ohasi Bridge, Mouth of Riv. Tone (Kamisu City)	December 10, 2019
Tochigi Pref.	Tagawa Kyubun Area Head Works (Utsunomiya City)	October 30, 2019
Gunma Pref.	Tone-ozeki Weir, Riv. Tone (Chiyoda Town)	October 24, 2019
Saitama Pref.	Akigase-shusuizeki Weir, Riv. Arakawa (Shiki City)	November 27, 2019
Chiba City	Mouth of Riv. Hanami (Chiba City)	November 7, 2019
Tokyo Met.	Mouth of Riv. Arakawa (Koto Ward)	December 18, 2019
	Mouth of Riv. Sumida (Minato Ward)	December 18, 2019
Yokohama City	Yokohama Port	November 27, 2019
Kawasaki City	Keihin Canal, Port of Kawasaki	November 27, 2019
Niigata Pref.	Lower Riv. Shinano (Niigata City)	December 4, 2019
Toyama Pref.	Hagiura-bashi Bridge, Mouth of Riv. Jintsu (Toyama City)	December 10, 2019
Ishikawa Pref.	Mouth of Riv. Sai (Kanazawa City)	October 23, 2019
Fukui Pref.	Mishima-bashi Bridge, Riv. Shono (Tsuruga City)	October 23, 2019
Nagano Pref.	Lake Suwa (center)	December 3, 2019
Shizuoka Pref.	Kaketsuka-bashi Bridge, Riv. Tenryu (Iwata City)	November 27, 2019
Aichi Pref.	Nagoya Port	December 11, 2019
Mie Pref.	Yokkaichi Port	November 28, 2019
Shiga Pref.	Lake Biwa (center, offshore of Karasaki)	November 19, 2019
Kyoto Pref.	Miyazu Port	January 8, 2020
Kyoto City	Miyamae-bashi Bridge, Riv. Katsura (Kyoto City)	November 28, 2019
Osaka Pref.	Mouth of Riv. Yamato (Sakai City)	December 5, 2019
Osaka City	Osaka Port	December 3, 2019
Hyogo Pref.	Offshore of Himeji	November 13, 2019
Kobe City	Kobe Port (center)	December 10, 2019
Wakayama Pref.	Kinokawa-ohashi Bridge, Mouth of Riv. Kinokawa (Wakayama City)	October 31, 2019
Okayama Pref.	Offshore of Mizushima	October 23, 2019
Hiroshima Pref.	Kure Port	November 13, 2019
	Hiroshima Bay	November 13, 2019
Yamaguchi Pref.	Tokuyama Bay	November 12, 2019
	Offshore of Ube	November 13, 2019
	Offshore of Hagi	November 22, 2019
Tokushima Pref.	Mouth of Riv. Yoshino (Tokushima City)	November 12, 2019
Kagawa Pref.	Takamatsu Port	November 26, 2019
Kochi Pref.	Mouth of Riv. Shimanto (Shimanto City)	October 15, 2019
Kitakyushu City	Dokai Bay	November 25, 2019
Saga Pref.	Imari Bay	November 29, 2019
Nagasaki Pref.	Omura Bay	October 29, 2019
Kumamoto Pref.	Hiraki-bashi Bridge, Riv. Midori (Uto City)	October 24, 2019
Miyazaki Pref.	Mouth of Riv. Oyodo (Miyazaki City)	October 15, 2019
Kagoshima Pref.	Shinkawa-bashi Bridge, Riv. Amori (Kirishima City)	November 13, 2019
	Gotanda-bashi Bridge, Riv. Gotanda (Ichikikushikino City)	November 11, 2019
Okinawa Pref.	Naha Port	January 10, 2020

(Note) *: “Keihin Canal, Port of Kawasaki” of Environmental Monitoring and “Keihin Canal, Port of Kawasaki (front of Ogimachi)” of Detailed Environmental Survey are the same point each.

Figure 3-1-1 Monitored sites (surface water) in the Environmental Monitoring in FY2019

Table 3-1-2 List of monitored sites (sediment) in the Environmental Monitoring in FY2019

Local communities	Monitored sites	Sampling dates
Hokkaido	Ishikarikakokyo Bridge, Mouth of Riv. Ishikari (Ishikari City)	November 21, 2019
	Tomakomai Port	September 12, 2019
Iwate Pref.	Toyosawa Bridge, Riv. Toyosawa (Hanamaki City)	December 4, 2019
Miyagi Pref.	Sendai Bay (Matsushima Bay)	October 15, 2019
Sendai City	Hirose-ohashi Bridge, Riv. Hirose (Sendai City)	November 19, 2019
Akita Pref.	Lake Hachiro	October 21, 2019
Yamagata Pref.	Mouth of Riv. Mogami (Sakata City)	December 11, 2019
Fukushima Pref.	Onahama Port	November 12, 2019
Ibaraki Pref.	Tonekamome-ohasi Bridge, Mouth of Riv. Tone (Kamisu City)	December 10, 2019
Tochigi Pref.	Tagawa Kyubun Area Head Works (Utsunomiya City)	October 30, 2019
Chiba Pref.	Coast of Ichihara and Anegasaki	November 27, 2019
Chiba City	Mouth of Riv. Hanami (Chiba City)	November 7, 2019
Tokyo Met.	Mouth of Riv. Arakawa (Koto Ward)	December 18, 2019
	Mouth of Riv. Sumida (Minato Ward)	December 18, 2019
Yokohama City	Yokohama Port	November 27, 2019
Kawasaki City	Mouth of Riv. Tama (Kawasaki City)	November 27, 2019
	Keihin Canal, Port of Kawasaki	November 27, 2019
Niigata Pref.	Lower Riv. Shinano (Niigata City)	December 11, 2019
Toyama Pref.	Hagiura-bashi Bridge, Mouth of Riv. Jintsu (Toyama City)	November 13, 2019
Ishikawa Pref.	Mouth of Riv. Sai (Kanazawa City)	October 23, 2019
Fukui Pref.	Mishima-bashi Bridge, Riv. Shono (Tsuruga City)	October 23, 2019
Yamanashi Pref.	Senshu-bashi Bridge, Riv. Arakawa (Kofu City)	November 1, 2019
Nagano Pref.	Lake Suwa (center)	December 3, 2019
Shizuoka Pref.	Shimizu Port	December 4, 2019
	Kaketsuka-bashi Bridge, Riv. Tenryu (Iwata City)	November 27, 2019
Aichi Pref.	Kinuura Port	December 11, 2019
	Nagoya Port	December 11, 2019
Mie Pref.	Yokkaichi Port	November 28, 2019
	Toba Port	November 25, 2019
Shiga Pref.	Lake Biwa (center, offshore of Minamihira)	November 27, 2019
	Lake Biwa (center, offshore of Karasaki)	November 19, 2019
Kyoto Pref.	Miyazu Port	January 8, 2020
Kyoto City	Miyamae-bashi Bridge,Riv. Katsura (Kyoto City)	November 28, 2019
Osaka Pref.	Mouth of Riv. Yamato (Sakai City)	December 5, 2019
Osaka City	Kema-bashi Bridge, Riv. Oh-kawa (Osaka City)	November 28, 2019
	Mouth of Riv. Yodo (Osaka City)	December 3, 2019
	Osaka Port	December 3, 2019
	Outside Osaka Port	December 3, 2019
Hyogo Pref.	Offshore of Himeji	November 13, 2019
Kobe City	Kobe Port (center)	December 10, 2019
Nara Pref.	Taisho-bashi Bridge, Riv. Yamato (Oji Town)	December 5, 2019
Wakayama Pref.	Kinokawa-ohashi Bridge, Mouth of Riv. Kinokawa (Wakayama City)	October 31, 2019
Okayama Pref.	Offshore of Mizushima	October 23, 2019
Hiroshima Pref.	Kure Port	November 13, 2019
	Hiroshima Bay	November 13, 2019
Yamaguchi Pref.	Tokuyama Bay	November 12, 2019
	Offshore of Ube	November 13, 2019
	Offshore of Hagi	November 22, 2019
Tokushima Pref.	Mouth of Riv. Yoshino (Tokushima City)	November 12, 2019
Kagawa Pref.	Takamatsu Port	November 26, 2019
Ehime Pref.	Niihama Port	October 28, 2019
Kochi Pref.	Mouth of Riv. Shimanto (Shimanto City)	October 15, 2019
Kitakyushu City	Dokai Bay	November 25, 2019
Fukuoka City	Hakata Bay	December 5, 2019
Saga Pref.	Imari Bay	November 29, 2019
Nagasaki Pref.	Omura Bay	October 29, 2019
Oita Pref.	Mouth of Riv. Oita (Oita City)	November 21, 2019
Miyazaki Pref.	Mouth of Riv. Oyodo (Miyazaki City)	October 15, 2019
Kagoshima Pref.	Riv. Amori (Kirishima City)	November 13, 2019
	Riv. Gotanda (Ichikikushikino City)	November 11, 2019
Okinawa Pref.	Naha Port	January 10, 2020

(Note) *: "Keihin Canal, Port of Kawasaki" of Environmental Monitoring and "Keihin Canal, Port of Kawasaki (front of Ogimachi)" of Detailed Environmental Survey are the same point each.

Figure 3-1-2 Monitored sites (sediment) in the Environmental Monitoring in FY2019

Table 3-1-3 List of monitored areas (wildlife) in the Environmental Monitoring in FY2019

Local communities	Monitored sites	Sampling dates	Wildlife species	
Hokkaido	Offshore of Kushiro	November 23, 2019	Fish	Rock greenling (*Hexagrammos lagocephalus*)
Iwate Pref.	Yamada Bay	October 23, 2019	Bibalves	Blue mussel (*Mytilus galloprovincialis*)
	Yamada Bay	October 23, 2019	Fish	Greenling (*Hexagrammos otakii*)
Miyagi Pref.	Sendai Bay (Matsushima Bay)	December 18, 2019	Fish	Greenling (*Hexagrammos otakii*)
Ibaraki Pref.	Offshore of Joban	February 3, 2020	Fish	Chub mackerel (*Scomber japonicus*)
Tokyo Met.	Tokyo Bay	September 18, 2019	Fish	Sea bass (*Lateolabrax japonicus*)
Yokohama City	Yokohama Port	November 25, 2019	Bibalves	Blue mussel (*Mytilus galloprovincialis*)
Kawasaki City	Offshore of Ogishima Island, Port of Kawasaki	September 17, 2019	Fish	Sea bass (*Lateolabrax japonicus*)
Ishikawa Pref.	Coast of Noto Peninsula	July 30, 2019	Bibalves	Blue mussel (*Mytilus galloprovincialis*)
Nagoya City	Nagoya Port	September 24, 2019	Fish	Striped mullet (*Mugil cephalus*)
Shiga Pref.	Lake Biwa, Riv. Ado (Takashima City)	April 2, 2019	Fish	Dace (*Tribolodon hakonensis*)
Osaka Pref.	Osaka Bay	October 23, 2019	Fish	Sea bass (*Lateolabrax japonicus*)
Hyogo Pref.	Offshore of Himeji	December 16, 2019	Fish	Sea bass (*Lateolabrax japonicus*)
Tottori Pref.	Riv.Tenjin(Kurayoshi City)	May 8, 2019	Birds	Great Cormorant (*Phalacrocorax carbo*)
	Nakaumi	October 29, 2019	Fish	Sea bass (*Lateolabrax japonicus*)
Hiroshima City	Hiroshima Bay	November 17, 2019	Fish	Sea bass (*Lateolabrax japonicus*)
Kochi Pref.	Mouth of Riv. Shimanto (Shimanto City)	September – November, 2019*	Fish	Sea bass (*Lateolabrax japonicas*)
Oita Pref.	Mouth of Riv. Oita (Oita City)	31 January 2020	Fish	Sea bass (*Lateolabrax japonicas*)
Kagoshima Pref.	West Coast of Satsuma Peninsula	November 11 and 18, 2019	Fish	Sea bass (*Lateolabrax japonicas*)
Okinawa Pref.	Nakagusuku Bay	February 3, 2020	Fish	Okinawa seabeam (*Acanthopagrus sivicolus*)

(Note) "*" means details of the sampling date unknown.

Figure 3-1-3 Monitored areas (wildlife) in the Environmental Monitoring in FY2019

Table 3-1-4 List of monitored sites (air) in the Environmental Monitoring in FY2019

Local communities	Monitored sites	Sampling dates (Warm season)
Hokkaido	Kamikawa General Subprefectural Bureau (Asahikawa City)	October 11 - 18** or October 15 - 18*, 2019
Sapporo City	Sapporo Art Park (Sapporo City)	October 7 - 10, 2019
Iwate Pref.	Sugo Air Quality Monitoring Station (Takizawa City)	September 30 - October 3, 2019
Miyagi Pref.	Miyagi Prefectural Institute of Public Health and Environment (Sendai City)	October 4 - 11** or October 7 - 10*, 2019
Yamagata Pref.	Yamagata Institute of Environmental Sciences (Murayama City)	September 24 - October 1** or September 24 - 27*, 2019
Ibaraki Pref.	Ibaraki Kasumigaura Environmental Science Center (Tsuchiura City)	October 25 - November 1** or October 29 - November 1*, 2019
Chiba Pref.	Ichihara-Matsuzaki Air Quality Monitoring Station (Ichihara City)	October 29 - November 5** or October 30 - November 2* , 2019
Tokyo Met.	Tokyo Metropolitan Research Institute for Environmental Protection (Koto Ward)	October 25 - November 1** or October 28 - 31*, 2019
	Chichijima Island (Ogasawara Village)	October 3 - 9** or October 3 - 6*, 2019
Kanagawa Pref.	Kanagawa Environmental Research Center (Hiratsuka City)	September 24 - 27, 2019
Yokohama City	Yokohama Environmental Science Research Institute (Yokohama City)	October 29 - November 5** or October 29 - November 1*, 2019
Niigata Pref.	Oyama Air Quality Monitoring Station (Niigata City)	October 7 - 10, 2019
Toyama Pref.	Tonami Air Quality Monitoring Station (Tonami City)	October 15 - 18, 2019
Ishikawa Pref.	Ishikawa Prefectural Institute of Public Health and Environmental Science (Kanazawa City)	October 15 - 18, 2019
Yamanashi Pref.	Yamanashi Prefectural Institute of Public Health and Environment (Kofu City)	October 28 - 31, 2019
Nagano Pref.	Nagano Environmental Conservation Research Institute (Nagano City)	October 24 - 31** or October 28 - 31*, 2019
Gifu Pref.	Gifu Prefectural Research Institute for Health and Environmental Sciences (Kakamigahara City)	October 28 - 31, 2019
Nagoya City	Chikusa Ward Heiwa Park (Nagoya City)	September 24 - October 1** or September 24 - 27*, 2019
Mie Pref.	Mie Prefecture Health and Environment Research Institute (Yokkaichi City)	September 30 - October 3, 2019
Osaka Pref.	Osaka Joint Prefectural Government Building, Building 2 Annex (Osaka City)	October 15 - 18, 2019
Hyogo Pref.	Hyogo Prefectural Environmental Research Center (Kobe City)	October 15 - 18, 2019
Kobe City	Kobe Institute of Health (Kobe City)	October 7 - 10, 2019
Nara Pref.	Tenri Air Quality Monitoring Station (Tenri City)	November 5 - 8, 2019
Shimane Pref.	Oki National Acid Rain Observatory (Okinoshima Town)	October 28 - 31, 2019
Hiroshima City	Hiroshima City Kokutaiji Junior High School (Hiroshima City)	October 28 - 31, 2019
Yamaguchi Pref.	Yamaguchi Prefectural Institute of Public Health and Environment (Yamaguchi City)	September 24 - October 1** or September 24 - 27*, 2019
	Hagi Health and Welfare Center (Hagi City)	September 24 - October 1** or September 24 - 27*, 2019
Tokushima Pref.	Tokushima Prefectural Public Health, Pharmaceutical and Environmental Sciences Center (Tokushima City)	September 30 - October 3, 2019
Kagawa Pref.	Kagawa Prefectural Public Swimming Pool (Takamatsu City)	October 25 - November 1** or October 25 - 28*, 2019
Ehime Pref.	Ehime Prefectural Government Nanyo Regional Office (Uwajima City)	October 7 - 10, 2019
Fukuoka Pref.	Omuta City Government Building (Omuta City)	September 24 - 27, 2019
Saga Pref.	Saga Prefectural Environmental Research Center (Saga City)	September 24 - October 1** or September 24 - 29*, 2019
Kumamoto Pref.	Kumamoto Prefectural Institute of Public Health and Environmental Science (Udo City)	September 24 - 27, 2019
Miyazaki Pref.	Miyazaki Prefectural Institute for Public Healthand Environment (Miyazaki City)	November 5 - 12** or November 5 - 8*, 2019
Kagoshima Pref.	Kagoshima Prefectural Institute for Environmental Research and Public Health (Kagoshima City)	October 28 - 31, 2019
Okinawa Pref.	Cape Hedo (Kunigami Village)	September 24 - 27, 2019

(Note) " * " means sampling except [21] Hexachlorobuta-1,3-diene. " ** " means sampling [21] Hexachlorobuta-1,3-diene.

Figure 3-1-4 Monitored sites (air) in the Environmental Monitoring in FY2019

Table 3-2 Properties of target species

Species		Properties	Monitored areas	Aim of monitoring	Notes
Bibalves	Blue mussel (*Mytilus galloprovincialis*)	Distributed worldwide, excluding tropical zones Adheres to rocks in inner bays and to bridge piers	・Yamada bay ・Yokohama port ・Coast of Noto Peninsula	Follow-up of the environmental fate and persistency in specific areas	Monitored in the 3 areas with different levels of persistency
Fish	Greenling (*Hexagrammos otakki*)	Distributed from Hokkaido to southern Japan, the Korean Peninsula, and China Lives in shallow seas of 5-50 m depth from sea level	・Offshore of Iwanai ・Yamada bay ・Sendai Bay	Follow-up of the environmental fate and persistency in specific areas	
	Rock greenling (*Hexagrammos lagocephalus*)	Lives in cold-current areas of Hidaka and eastward (Hokkaido) 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	
	Chub mackerel (*Scomber japonicus*)	Ddistributed widely in subtropical zones and temperate zones around the world. Seasonal migration occurs with a northward migration in spring and a southward migration in autumn.	・Offshore of Joban	Follow-up of the environmental fate and persistency in specific areas	
	Sea bass (*Lateolabrax japonicus*)	Distributed around the shores of various areas in Japan, the Korean Peninsula, and the coastal areas of China Sometimes lives in a freshwater environment and brackish-water regions during its life cycle Bioaccumulation of chemicals is said to be high	・Tokyo Bay ・Offshore of Ogishima Island, Port of Kawasaki ・Osaka Bay ・Offshore of Himeji ・Nakaumi ・Hiroshima Bay ・Mouth of Riv. Shimanto ・Mouth of Riv. Oita ・West Coast of Satsuma Peninsula	Follow-up of the environmental fate and persistency in specific areas	Monitored in the 9 areas with different levels of persistency
	Striped mullet (M*ugil cephalus*)	Distributed widely in the worldwide tropical zones and subtropical zones Sometimes lives in a freshwater environment and brackish-water regions during its life cycle	・Nagoya Port	Follow-up of the environmental fate and persistency in specific areas	
	Okinawa seabeam (*Acanthopagrus sivicolus*)	Distributed around Nansei Shoto (Ryukyu Islands) Lives in coral reefs and in bays into which rivers flow	・Nakagusuku Bay	Follow-up of the environmental fate and persistency in specific areas	
	Dace (*Tribolodon hakonensis*)	Distributed widely in freshwater environments throughout Japan Preys mainly on insects	・Lake Biwa, Riv. Ado (Takashima City)	Follow-up of the environmental fate and persistency in specific areas	
Birds	Great Cormorant (immature)* (*Phalacrocorax carbo*)	Distributed widely throughout Japan Eats primarily fish Bioaccumulation of chemicals is said to be high	・Riv.Tenjin(Kurayoshi City)	Follow-up of the concentrations of chemicals in top predators	

* Because there were the examples of survey that obtained the eggs in other countries, the eggs of great cormorants were taken at tow another areas in this survey. The results were treated as the reference values.

Table 3-3-1 Basic data of specimens (bivalves as wildlife) in the Environmental Monitoring in FY 2019

Bivalve species and Area	No.	Sampling month	Sex	Number of animals	Length (cm) (Average)	Weight (g) (Average)	Water content %	Lipid content %
Blue mussel (*Mytilus galloprovincialis*) Yamada Bay	1	October, 2019	Uncertain	100	6.4 - 11.1 (9.5)	49.7 - 103.7 (73.3)	84	1.8
	2		Uncertain	176	7.6 - 8.6 (8.1)	26.9 - 65.1 (43.4)	84	1.7
	3		Uncertain	310	6.3 - 7.6 (7.2)	20.1 - 45.5 (31.5)	84	1.7
Blue mussel (*Mytilus galloprovincialis*) Yokohama Port	1	November, 2019	Mixed	121	2.8 - 5.5 (3.8)	2.3 - 14.9 (6.5)	87	0.4
	2		Mixed	90	3.5 - 5.00 (4.2)	4.9 - 12.1 (8.3)	87	0.4
	3		Mixed	131	3.3 - 4.9 (3.7)	2.7 - 12.9 (5.9)	91	0.4
Blue mussel (*Mytilus galloprovincialis*) Coast of Noto Peninsula	1	July, 2019	Uncertain	42	11.8 - 15.4 (13.2)	125 - 210 (154)	78	1.8
	2		Uncertain	67	10.8 - 13.6 (11.7)	106 - 151 (126)	77	2.1
	3		Uncertain	86	8.0 - 10.5 (9.3)	57.5 - 97.3 (73.8)	76	2.0

Table 3-3-2 Basic data of specimens (fish as wildlife) in the Environmental Monitoring in FY 2019

Fish species and Area	No.	Sampling month	Sex	Number of animals	Length (cm) (Average)	Weight (g) (Average)	Water content %	Lipid content %
Rock greenling (*Hexagrammos lagocephalus*) Offshore of Kushiro	1	November, 2019	Mixed	5	40.5 - 45.5 (42.7)	950 - 1,280 (1,070)	79	0.79
	2		Mixed	4	42.0 - 44.0 (43.0)	980 - 1,260 (1,110)	79	0.99
	3		Mixed	4	43.5 - 48.5 (45.5)	1,080 - 1,650 (1,273)	79	1.8
Greenling (*Hexagrammos otakii*) Yamada Bay	1	October, 2019	Uncertain	4	45.0 - 48.5 (46.8)	1,286 - 1,893 (1,496)	76	6.3
	2		Uncertain	6	35.5 - 44.0 (39.9)	810 - 1,102 (959)	79	3.0
	3		Uncertain	8	33.0 - 40.2 (37.2)	399 - 824 (701)	77	5.0
Greenling (*Hexagrammos otakii*) Sendai Bay (Matsushima Bay)	1	December, 2019	Mixed	15	14.3 - 23.4 (17.6)	53.0 - 229.52 (103)	74	0.67
	2		Mixed	4	24.2 - 28.2 (26.7)	241 - 417 (371)	76	0.60
	3		Mixed	3	31.3 - 34.1 (33.0)	597 - 782 (675)	76	0.05
Chub mackerel (*Scomber japonicus*) Offshore of Joban	1	February, 2020	Mixed	12	25 - 30 (28)	214 - 315 (270)	37	8.3
	2		Mixed	11	28 - 30 (30)	321 - 372 (353)	31	15
	3		Mixed	10	30 - 32 (31)	377 - 470 (413)	39	5.0
Sea bass (*Lateolabrax japonicus*) Tokyo Bay	1	September, 2019	Mixed	3	46.2 - 52.9 (49.6)	1,370 - 2,050 (1,710)	77	1.8
	2		Mixed	4	43.3 - 47.2 (45.5)	1,150 - 1,370 (1,261)	78	1.2
	3		Mixed	4	41.0 - 43.8 (42.5)	925 - 1,100 (1,029)	77	1.4
Sea bass (*Lateolabrax japonicus*) Offshore of Ogishima Island, Port of Kawasaki	1	September, 2019	Female	14	25.1 - 38.3 (29.1)	257 - 473 (343)	52	0.9
	2		Male	17	25.1 - 28.7 (27.1)	254 - 381 (321)	54	0.8
	3		Male	17	28.9 - 32.9 (30.6)	325 - 540 (421)	49	0.7
Striped mullet (*Mugil cephalus*) Nagoya Port	1	September, 2019	Uncertain	6	28.9 - 38.0 (31.5)	423 - 967 (584)	-	-
	2		Uncertain	7	28.2 - 30.2 (29.1)	382 - 479 (432)	-	-
	3		Uncertain	7	27.3 - 28.6 (27.9)	350 - 427 (384)	-	-
Dace (*Tribolodon hakonensis*) Lake Biwa, Riv. Ado (Takashima City)	1	April, 2019	Female	24	22.5 - 29.5 (24.7)	142 - 349 (195)	76	2.7
	2		Male	26	22.1 - 27.8 (24.1)	121 - 291 (183)	75	3.3
	3		Female	25	22.4 - 25.7 (23.6)	134 - 236 (166)	76	3.1
Sea bass (*Lateolabrax japonicus*) Osaka Bay	1	October, 2019	Uncertain	10	43.0 - 46.7 (45.1)	686 - 941 (835)	75	2.4
	2		Uncertain	10	30.8 - 46.3 (42.7)	332 - 984 (790)	76	2.9
	3		Uncertain	10	33.5 - 46.4 (43.2)	357 - 886 (774)	77	2.8
Sea bass (*Lateolabrax japonicus*) Offshore of Himeji	1	December, 2019	Male	1	59	1,400	84	0.42
	2		Male	1	63	2,000	79	1.2
	3		Female	1	67	3,100	78	3.8
Sea bass (*Lateolabrax japonicus*) Nakaumi	1	October, 2019	Mixed	10	36.5 - 41.8 (38.8)	510 - 885 (646)	80	0.85
	2		Mixed	10	33.9 - 40.2 (36.6)	386 - 601 (486)	79	0.82
	3		Mixed	12	30.1 - 34.4 (32.4)	301 - 438 (376)	78	0.83
Sea bass (*Lateolabrax japonicus*) Hiroshima Bay	1	November, 2019	Male	3	42.5 - 46.5 (44.7)	925 - 1,717 (1,264)	74	-
	2		Male	4	40.0 - 46.0 (41.6)	932 - 1,456 (1,075)	74	-
	3		Mixed	4	41.0 - 48.0 (44.3)	997 - 1,758 (1,366)	76	-
Sea bass (*Lateolabrax japonicus*) Mouth of Riv. Shimanto (Shimanto City)	1	September-November, 2019	Uncertain	16	13.0 - 31.0 (20.8)	41.7 - 492 (212)	73	0.81
	2		Uncertain	16	14.5 - 29.0 (20.9)	56.4 - 440 (207)	72	0.73
	3		Uncertain	17	14.5 - 28.0 (20.2)	56.3 - 415 (197)	73	0.94
Sea bass (*Lateolabrax japonicus*) Mouth of Riv. Oita (Oita City)	1	January, 2020	Mixed	2	50.5 - 63.0 (56.8)	1,320 - 2,800 (2,060)	82	0.73
	2		Male	2	53.0 - 58.5 (55.8)	1,820 - 1,840 (1,830)	81	0.64
	3		Mixed	2	52.5 - 61.5 (57.0)	1,640 - 2,360 (2,000)	79	1.1
Sea bass (*Lateolabrax japonicus*) West Coast of Satsuma Peninsula)	1	November, 2019	Mixed	9	24.0 - 34.5 (26.7	247 - 749 (359)	78	0.6
	2		Mixed	10	23.5 - 33.3 (26.5	220 - 734 (333)	78	0.6
	3		Mixed	9	24.0 - 33.0 (27.1	243 - 771 (393)	80	1.4
Okinawa seabeam (*Acanthopagrus sivicolus*) Nakagusuku Bay	1	February, 2020	Male	3	31.5 - 35.0 (32.8	1,017 - 1,241 (1,131)	73	1.9
	2		Female	4	27.5 - 32.5 (29.8	683 - 1,074 (820)	73	1.5
	3		Male	2	27.5 - 28.5 (28.0	787 - 815 (801)	70	1.3

Table 3-3-3 Basic data of specimens (birds as wildlife) in the Environmental Monitoring in FY 2019

Bird species (Area)	No.	Sampling month	Sex	Number of animals	Length (cm)	Weight (g)	Water content %	Lipid content %
Great Cormorant (immature) (*Phalacrocorax carbo*) Riv.Tenjin (Kurayoshi City)	1	May, 2019	Male	2	90.0 - 97.5 (93.8)	1,560 - 2,360 (1,960)	70	3.5
	2		Male	1	88.0	2,700		
	3		Male	1	99.0	2,200		

(Note) The great cormorants (immature) killed as harmful birds were used as specimens.

4. Method for regression analysis and testing

The analysis procedure and the evaluation for the analysis result shown in Fig.2 were carried out by the following method.

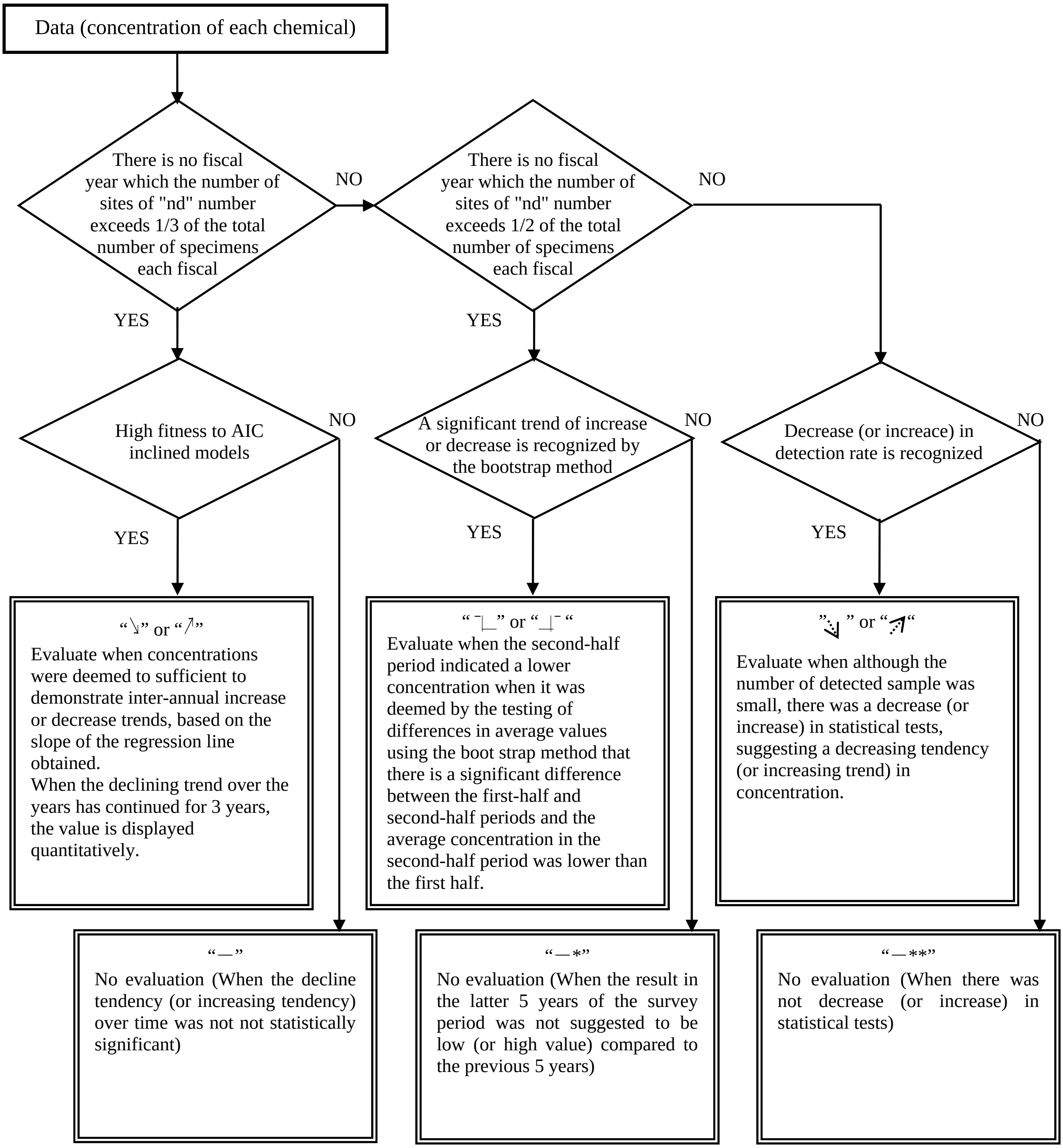

Figure 2 Method for regression analysis and testing

5. Summary of monitoring results

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

The substances which were moniterd FY2019 and past years on the same media, were statistically analysed in order to detect inter-annual trends of increase or decrease. The results of the analyses are shown in Table 3-6

〇Data were carefully handled on the basis of following points.

・For sediment

At each monitoring point, three (3) specimen samples were collected. And the substances were analysed for each place with one specimen sample that is a mixture of equal parts of the three (3) specimen samples.

・For wildlife

At each monitoring point, three (3) specimen samples were collected in principle. And the substances were analysed for each place with one specimen sample that is a mixture of equal parts of the three (3) specimen samples.

・For air

At each monitored site, the sampling was for the monitoring in the warm season (September 24, 2019 ~ November 11, 2019).

Table 3-4-1 List of the detection ranges in the Environmental Monitoring in FY2019 (Part 1)

No.	Target chemicals	Surface water (pg/L) Range (Frepuency)	Surface water (pg/L) Av.	Sediment (pg/g-dry) Range (Frepuency)	Sediment (pg/g-dry) Av.
[1]	Total PCBs	tr(6.6) - 3,400 (48/48)	120	37 - 640,000 (61/61)	5,700
[2]	HCB	nd - 630 (46/48)	10	4.5 - 10,000 (61/61)	88
[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] Parlar-26				
	[9-2] Parlar-50				
	[9-3] Parlar-62				
[10]	Mirex				
[11]	HCHs				
	[11-1] α-HCH	tr(2) - 640 (48/48)	35	1.3 - 2,600 (61/61)	67
	[11-2] β-HCH	17 - 570 (48/48)	100	4.0 - 4,100 (61/61)	130
	[11-3] γ-HCH (synonym:Lindane)	nd - 480 (47/48)	14	tr(0.6) - 2,100 (61/61)	23
	[11-4] δ-HCH	nd - 85 (46/48)	5.1	tr(0.2) - 2,500 (61/61)	22
[12]	Chlordecone				
[13]	Hexabromobiphenyls				

(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) "[grey box]" means the medium was not monitored.
(Note 3) "tr(X)" indicates that X was below the quantification limit and over the detection limit.

Table 3-4-2 List of the detection ranges in the Environmental Monitoring in FY2019 (Part 2)

No.	Target chemicals	Surface water (pg/L)		Sediment (pg/g-dry)	
		Range (Frepuency)	Av.	Range (Frepuency)	Av.
[14]	Polybromodiphenyl ethers (Br_4 - Br_{10})				
	[14-1] Tetrabromodiphenyl ethers	nd - 320 (39/48)	tr(6)	nd - 710 (58/61)	15
	[14-2] Pentabromodiphenyl ethers	nd - 69 (19/48)	nd	nd - 740 (52/61)	9
	[14-3] Hexabromodiphenyl ethers	nd - 8 (5/48)	nd	nd - 690 (41/61)	14
	[14-4] Heptabromodiphenyl ethers	nd - 6 (2/48)	nd	nd - 1,400 (39/61)	15
	[14-5] Octabromodiphenyl ethers	nd - 14 (12/48)	nd	nd - 2,000 (50/61)	33
	[14-6] Nonabromodiphenyl ethers	nd - 150 (27/48)	tr(7)	nd - 40,000 (59/61)	310
	[14-7] Decabromodiphenyl ether	tr(10) - 2,200 (48/48)	110	14 - 560,000 (61/61)	4,400
[15]	Perfluorooctane sulfonic acid (PFOS)	nd - 2,500 (47/48)	290	nd - 460 (60/61)	44
[16]	Perfluorooctanoic acid (PFOA)	160 - 11,000 (48/48)	1,000	tr(3) - 190 (61/61)	21
[17]	Pentachlorobenzene	tr(2) - 360 (48/48)	9	1.2 - 3,300 (61/61)	29
[18]	Endosulfans				
	[18-1] α-Endosulfan				
	[18-2] β-Endosulfan				
[19]	1,2,5,6,9,10-Hexabromo cyclododecanes				
	[19-1] α-1,2,5,6,9,10-Hexabromo cyclododecane				
	[19-2] β-1,2,5,6,9,10-Hexabromo cyclododecane				
	[19-3] γ-1,2,5,6,9,10-Hexabromo cyclododecane				
	[19-4] δ-1,2,5,6,9,10-Hexabromo cyclododecane				
	[19-5] ε-1,2,5,6,9,10-Hexabromo cyclododecane				
[20]	Total Polychlorinated Naphthalenes	nd - 260 (32/48)	tr(14)	13 - 58,000 (61/61)	600
[21]	Hexachlorobuta-1,3-diene				
[22]	Pentachlorophenol and its salts and esters				
	[22-1] Pentachlorophenol	nd - 3,500 (32/48)	tr(60)	7 - 6,200 (61/61)	260
	[22-2] Pentachloroanisole	nd - 210 (20/48)	tr(10)	nd - 140 (60/61)	14
[23]	Short-chain chlorinated paraffins				
	[23-1] Chlorinated decanes	nd - 2,300 (17/48)	nd	nd - 2,600 (8/61)	nd
	[23-2] Chlorinated undecanes	nd - 5,000 (19/48)	nd	nd - 5,900 (22/61)	nd
	[23-3] Chlorinated dodecanes	nd - 34,000 (20/48)	nd	nd - 83,000 (27/61)	tr(1,100)
	[23-4] Chlorinated tridecanes	nd - 38,000 (17/48)	nd	nd - 60,000 (39/61)	tr(1,700)
[24]	Dicofol	nd - 40 (3/48)	nd	nd - 84 (40/61)	4
[25]	Perfluorohexane sulfonic acid (PFHxS)	nd - 1,800 (45/48)	150	nd - 15 (10/61)	nd

(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) "▒" means the medium was not monitored.

(Note 3) "tr(X)" indicates that X was below the quantification limit and over the detection limit.

(Note 4) Chlorinated paraffins with 5 - 9 chlorines are target chemicals. The results of short-chain chlorinated paraffins are tentative values obtained in trials among various problems in the measurement method.

Table 3-4-3 List of the detection ranges in the Environmental Monitoring in FY2019 (Part 3)

No.	Target chemicals	Wildlife (pg/g-wet)						Air (pg/m^3)	
		Bibalves		Fish		Bibalves		Fish	
		Range (Frepuency)	Av.	Range (Frepuency)	Av.	Range (Frepuency)	Av.	Range (Frepuency)	Av.
[1]	Total PCBs	350 - 17,000 (3/3)	2,200	1,000 - 160,000 (16/16)	12,000	190,000 (1/1)	---	27 - 340 (36/36)	89
[2]	HCB	12 - 65 (3/3)	23	12 - 1,100 (16/16)	100	3,200 (1/1)	---	67 - 130 (36/36)	96
[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] Parlar-26								
	[9-2] Parlar-50								
	[9-3] Parlar-62								
[10]	Mirex								
[11]	HCHs								
	[11-1] α-HCH	4 - 14 (3/3)	9	nd - 130 (12/16)	8	63 (1/1)	---	6.3 - 230 (36/36)	21
	[11-2] β-HCH	11 - 33 (3/3)	23	3 - 400 (16/16)	27	950 (1/1)	---	0.38 - 29 (36/36)	2.3
	[11-3] γ-HCH (synonym:Lindane)	nd - 7 (2/3)	tr(2)	nd - 34 (13/16)	tr(3)	7 (1/1)	---	0.88 - 49 (36/36)	6.4
	[11-4] δ-HCH	nd (0/3)	nd	nd - 5 (6/16)	nd	4 (1/1)	---	tr(0.02) - 19 (36/36)	0.46
[12]	Chlordecone								
[13]	Hexabromobiphenyls								

(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) "▭" means the medium was not monitored.
(Note 3) "tr(X)" indicates that X was below the quantification limit and over the detection limit.

Table 3-4-3 List of the detection ranges in the Environmental Monitoring in FY2019 (Part 4)

No.	Target chemicals	Wildlife (pg/g-wet)						Air (pg/m^3)	
		Bibalves		Fish		Bibalves		Fish	
		Range (Frepuency)	Av.	Range (Frepuency)	Av.	Range (Frepuency)	Av.	Range (Frepuency)	Av.
[14]	Polybromodiphenyl ethers (Br_4 - Br_{10})								
	[14-1] Tetrabromodiphenyl ethers	tr(15) - 68 (3/3)	26	tr(10) - 210 (16/16)	57	210 (1/1)	---	tr(0.03) - 5.5 (36/36)	0.25
	[14-2] Pentabromodiphenyl ethers	tr(5) - 28 (3/3)	12	tr(4) - 58 (16/16)	17	150 (1/1)	---	nd - 6.1 (27/36)	tr(0.10)
	[14-3] Hexabromodiphenyl ethers	nd - 24 (1/3)	nd	tr(12) - 290 (16/16)	42	480 (1/1)	---	nd - 0.79 (15/36)	tr(0.05)
	[14-4] Heptabromodiphenyl ethers	nd - tr(18) (1/3)	nd	nd - 82 (9/16)	tr(10)	260 (1/1)	---	nd - 2.7 (24/36)	tr(0.1)
	[14-5] Octabromodiphenyl ethers	nd - 39 (1/3)	tr(8)	nd - 120 (8/16)	tr(8)	330 (1/1)	---	nd - 2.6 (32/36)	tr(0.2)
	[14-6] Nonabromodiphenyl ethers	nd - 81 (1/3)	tr(20)	nd (0/16)	nd	nd (0/1)	---	nd - 3.1 (34/36)	0.5
	[14-7] Decabromodiphenyl ether	nd - tr(180) (1/3)	nd	nd (0/16)	nd	nd (0/1)	---	nd - 14 (32/36)	1.8
[15]	Perfluorooctane sulfonic acid (PFOS)	tr(2) - 140 (3/3)	10	tr(3) - 3,600 (16/16)	67	360 (1/1)	---	1.3 - 7.8 (36/36)	3.8
[16]	Perfluorooctanoic acid (PFOA)	tr(2) - tr(5) (3/3)	tr(3)	nd - 18 (12/16)	tr(3)	27 (1/1)	---	5.5 - 46 (36/36)	14
[17]	Pentachlorobenzene	7 - 14 (3/3)	10	3 - 280 (16/16)	20	470 (1/1)	---	36 - 110 (36/36)	64
[18]	Endosulfans								
	[18-1] α-Endosulfan								
	[18-2] β-Endosulfan								
[19]	1,2,5,6,9,10-Hexabromo cyclododecanes								
	[19-1] α-1,2,5,6,9,10-Hexabromo cyclododecane	68 - 260 (3/3)	140	nd - 980 (15/16)	79	1,100 (1/1)	---	nd - 4.1 (35/36)	0.5
	[19-2] β-1,2,5,6,9,10-Hexabromo cyclododecane	nd - tr(22) (1/3)	nd	nd (0/16)	nd	nd (0/1)	---	nd - 1.2 (26/36)	tr(0.13)
	[19-3] γ-1,2,5,6,9,10-Hexabromo cyclododecane	tr(13) - 140 (3/3)	34	nd - 62 (9/16)	tr(12)	nd (0/1)	---	nd - 1.5 (15/36)	nd
	[19-4] δ-1,2,5,6,9,10-Hexabromo cyclododecane								
	[19-5] ε-1,2,5,6,9,10-Hexabromo cyclododecane								
[20]	Total Polychlorinated Naphthalenes	nd - 820 (2/3)	84	nd - 270 (12/16)	46	170 (1/1)	---	6.5 - 1,100 (36/36)	100
[21]	Hexachlorobuta-1,3-diene (reference)							nd - 5,800 (35/36)	1,500
[22]	Pentachlorophenol and its salts and esters								
	[22-1] Pentachlorophenol	13 - 54 (3/3)	26	nd - 57 (14/16)	17	430 (1/1)	---	0.6 - 22 (36/36)	4.1
	[22-2] Pentachloroanisole	tr(2) - 15 (3/3)	4	tr(1) - 59 (16/16)	5	91 (1/1)	---	4.3 - 180 (36/36)	30
[23]	Short-chain chlorinated paraffins								
	[23-1] Chlorinated decanes	nd (0/3)	nd	nd - tr(700) (5/16)	nd	tr(600) (1/1)	---	tr(100) - 1,500 (36/36)	400
	[23-2] Chlorinated undecanes	nd - 600 (1/3)	nd	nd - 1,100 (11/16)	tr(300)	1,400 (1/1)	---	tr(100) - 2,300 (36/36)	400
	[23-3] Chlorinated dodecanes	nd (0/3)	nd	nd - tr(900) (2/16)	nd	tr(500) (1/1)	---	nd - 1,600 (23/36)	tr(140)
	[23-4] Chlorinated tridecanes	tr(300) - 1,100 (3/3)	500	nd - 1,300 (11/16)	tr(200)	1,300 (1/1)	---	nd - 1,600 (19/36)	tr(90)
[24]	Dicofol	nd - tr(10) (1/3)	nd	nd - 120 (12/16)	tr(10)	nd (0/1)	---	nd - 0.4 (5/36)	nd
[25]	Perfluorohexane sulfonic acid (PFHxS)								

(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) "   " means the medium was not monitored.
(Note 3) "tr(X)" indicates that X was below the quantification limit and over the detection limit.
(Note 4) Hexachlorobuta-1,3-diene in air was analysed with the three(3) specimen samples for each place. "Range" is based on the concentrations of the samples and "Frequency" is based on the number of sites or areas.
(Note 5) Chlorinated paraffins with 5 - 9 chlorines are target chemicals in wildlife, and Chlorinated paraffins with 4 - 7 chlorines are target chemicals in air. The results of short-chain chlorinated paraffins are tentative values obtained in trials among various problems in the measurement method.

Table 3-5-1 List of the quantification [detection] limits in the Environmental Monitoring in FY2019 (Part 1)

No.	Target chemicals	Surface water (pg/L)	Sediment (pg/g-dry)	Wildlife (pg/g-wet)	Air (pg/m^3)
[1]	Total PCBs	12 [4.7]	8.5 [3.3]	33 [11]	2.1 [0.8]
[2]	HCB	8 [3]	0.9 [0.4]	3 [1]	0.14 [0.06]
[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] Parlar-26				
	[9-2] Parlar-50				
	[9-3] Parlar-62				
[10]	Mirex				
[11]	HCHs				
	[11-1] α-HCH	4 [2]	1.1 [0.4]	4 [2]	0.12 [0.05]
	[11-2] β-HCH	3 [1]	1.2 [0.5]	3 [1]	0.06 [0.02]
	[11-3] γ-HCH (synonym:Lindane)	4 [2]	1.0 [0.4]	4 [1]	0.12 [0.05]
	[11-4] δ-HCH	1.0 [0.4]	0.5 [0.2]	4 [2]	0.04 [0.02]
[12]	Chlordecone				
[13]	Hexabromobiphenyls				

(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) “ ” means the medium was not monitored.

Table 3-5-2 List of the quantification [detection] limits in the Environmental Monitoring in FY2019 (Part 2)

No.	Target chemicals	Surface water (pg/L)	Sediment (pg/g-dry)	Wildlife (pg/g-wet)	Air (pg/m^3)
[14]	Polybromodiphenyl ethers (Br_4~Br_{10})				
	[14-1] Tetrabromodiphenyl ethers	11 [4]	5 [2]	18 [7]	0.04 [0.01]
	[14-2] Pentabromodiphenyl ethers	6 [2]	3 [1]	10 [4]	0.12 [0.05]
	[14-3] Hexabromodiphenyl ethers	2 [1]	4 [2]	21 [8]	0.13 [0.05]
	[14-4] Heptabromodiphenyl ethers	4 [2]	6 [3]	24 [9]	0.3 [0.1]
	[14-5] Octabromodiphenyl ethers	3 [1]	3 [1]	17 [7]	0.3 [0.1]
	[14-6] Nonabromodiphenyl ethers	8 [3]	5 [2]	50 [20]	0.3 [0.1]
	[14-7] Decabromodiphenyl ether	14 [6]	4 [2]	190 [70]	0.3 [0.1]
[15]	Perfluorooctane sulfonic acid (PFOS)	80 [30]	9 [4]	6 [2]	0.8 [0.3]
[16]	Perfluorooctanoic acid (PFOA)	90 [40]	5 [2]	6 [2]	0.8 [0.3]
[17]	Pentachlorobenzene	6 [2]	0.9 [0.4]	3 [1]	0.09 [0.04]
[18]	Endosulfans				
	[18-1] α-Endosulfan				
	[18-2] β-Endosulfan				
[19]	1,2,5,6,9,10-Hexabromo cyclododecanes				
	[19-1] α-1,2,5,6,9,10-Hexabromo cyclododecane			24 [9]	0.3 [0.1]
	[19-2] β-1,2,5,6,9,10-Hexabromo cyclododecane			24 [9]	0.21 [0.08]
	[19-3] γ-1,2,5,6,9,10-Hexabromo cyclododecane			22 [9]	0.4 [0.2]
	[19-4] δ-1,2,5,6,9,10-Hexabromo cyclododecane				
	[19-5] ε-1,2,5,6,9,10-Hexabromo cyclododecane				
[20]	Total Polychlorinated Naphthalenes	24 [7.5]	7.3 [2.7]	40 [15]	0.6 [0.2]
[21]	Hexachlorobuta-1,3-diene (reference)				50 [20]
[22]	Pentachlorophenol and its salts and esters				
	[22-1] Pentachlorophenol	60 [20]	6 [2]	10 [4]	0.6 [0.2]
	[22-2] Pentachloroanisole	30 [10]	2.1 [0.8]	3 [1]	0.3 [0.1]
[23]	Short-chain chlorinated paraffins				
	[23-1] Chlorinated decanes	600 [200]	2,000 [1,000]	900 [300]	400 [100]
	[23-2] Chlorinated undecanes	1,400 [500]	2,000 [1,000]	500 [200]	300 [100]
	[23-3] Chlorinated dodecanes	1,000 [400]	2,000 [1,000]	1,200 [500]	260 [90]
	[23-4] Chlorinated tridecanes	1,300 [500]	2,000 [1,000]	400 [200]	250 [80]
[24]	Dicofol	13 [8]	4 [2]	30 [10]	0.4 [0.2]
[25]	Perfluorohexane sulfonic acid (PFHxS)	60 [30]	13 [5]		

(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) "   " means the medium was not monitored.

Table 3-6-1 Results of inter-annual trend analysis from FY2002 to FY2019 (Surface water)

No	Name	Surface water	River area	Lake area	Mouth area	Sea area
[1]	Total PCBs	↘ Half-life : 7 years [6~10 years]	↘ Half-life : 8 years [7~10 years]	↘ Half-life : 7 years [5~11 years]	↘ Half-life : 10 years [7~18 years]	-
[2]	HCB	↘ Half-life : 13 years [10~18 years]	↘	-	↘ Half-life : 9 years [7~11 years]	⊥
[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] Parlar-26					
	[9-2] Parlar-50					
	[9-3] Parlar-62					
[10]	Mirex					
[11]	HCHs					
	[11-1] α-HCH	↘ Half-life : 9 years [7〜13 years]	↘	-	↘	↘
	[11-2] β-HCH	↘ Half-life : 13 years [10〜18 years]	↘	↘ Half-life : 8 years [6〜10 years]	↘	↘ Half-life : 24 years [18〜38 years]
	[11-3] γ-HCH (synonym:Lindane)	↘ Half-life : 6 years [5〜8 years]	↘ Half-life : 5 years [4〜8 years]	↘ Half-life : 7 years [5〜11 years]	↘ Half-life : 11 years [9〜14 years]	↘ Half-life : 6 years [5〜6 years]
	[11-4] δ-HCH	⊥	↘	-	-*	-**

No	Name	Surface water	River area	Lake area	Mouth area	Sea area
[14]	Polybromodiphenyl ethers(Br_4~Br_{10})					
	[14-1] Tetrabromodiphenyl ethers	⇘	⇘	-**	-*	⇘
	[14-2] Pentabromodiphenyl ethers	⇘	⇘	-**	⇘	⇘
	[14-3] Hexabromodiphenyl ether	-**	⇘	-**	⇘	⇘
	[14-4] Heptabromodiphenyl ethers	-**	⇘	-**	⇘	⇘
	[14-5] Octabromodiphenyl ethers	⇘	-**	-**	-**	-**
	[14-6] Nonabromodiphenyl ethers	-*	-*	-**	-	-**
	[14-7] Decabromodiphenyl ether	-*	-*	-**	-	-**
[15]	Perfluorooctane sulfonic acid (PFOS)	-	-	↘ Half-life : 10 years [6～22 years]	-	-
[16]	Perfluorooctanoic acid (PFOA)	↘	-	-	↘ Half-life : 9 years [7～14 years]	-
[17]	Pentachlorobenzene	-	-	-	-	-

(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.

"⇘": Although the number of detections was small, the detection rate was decreased, it suggested a reduction tendency.

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

"-*": In case of using the bootstrap methods, there was not a significant difference between the values of first-half and second-half periods.

"-**": The detection rate was not decreased, there was not a reduction tendency.

(Note 3) "▒": The inter-annual trend analysis was not analysed because not conducted the survey in FY2019.

(Note 4) The half-life describes the half-life in the environment based on the survey results when the decrease tendency continues for 3 years or more by the maximum likelihood estimation that does not assume parametric residual distribution. The results in [ ] indicate that the values in the 95% confidence interval.

(Note 5) The classification of monitored sites with area are shown in Table 3-7

(Note 6) Polybromodiphenyl ethers, Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA): the results of the inter-annual trend analysis from FY2009 to FY2019. Pentachlorobenzene: the results of the inter-annual trend analysis from FY2010 to FY2019.

Table 3-6-2 Results of inter-annual trend analysis from FY2002 to FY2019 (Sediment)

No	Name	Sediment				
			River area	Lake area	Mouth area	Sea area
[1]	Total PCBs	↘ Half-life : 19 years [14~30 years]	↘ Half-life : 14 years [10~25 years]	-	-	↘ Half-life : 22 years [16~38 years]
[2]	HCB	↘ Half-life : 17 years [12~33 years]	↘ Half-life : 12 years [8~23 years]	-	-	-
[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] Parlar-26					
	[9-2] Parlar-50					
	[9-3] Parlar-62					
[10]	Mirex					
[11]	HCHs					
	[11-1] α-HCH	↘	↘	-	-	-
	[11-2] β-HCH	-	-	-	↘ Half-life : 13 years [9~22 years]	-
	[11-3] γ-HCH (synonym:Lindane)	↘	↘	-	-	-
	[11-4] δ-HCH	↘	-	-	↘ Half-life : 18 years [12~38 years]	-

No	Name	Sediment	River area	Lake area	Mouth area	Sea area
[14]	Polybromodiphenyl ethers(Br_4~Br_{10})					
	[14-1] Tetrabromodiphenyl ethers	-*	⇘	-	-*	-
	[14-2] Pentabromodiphenyl ethers	-*	⇘	-	-	-
	[14-3] Hexabromodiphenyl ether	-*	⇘	-	-	-
	[14-4] Heptabromodiphenyl ethers	-*	⇘	-*	-	-*
	[14-5] Octabromodiphenyl ethers	-*	⇘	-	-	-
	[14-6] Nonabromodiphenyl ethers	-	-*	-	-	-
	[14-7] Decabromodiphenyl ether	-	-	-	-	-
[15]	Perfluorooctane sulfonic acid (PFOS)	↘	-	-	↘	↘
[16]	Perfluorooctanoic acid (PFOA)	-	-	-	↘	-
[17]	Pentachlorobenzene	-	-	-	-	-

(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.

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

"⇘": Although the number of detections was small, the detection rate was decreased, it suggested a reduction tendency.

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

"-*": In case of using the bootstrap methods, there was not a significant difference between the values of first-half and second-half periods.

"-**": The detection rate was not decreased, there was not a reduction tendency.

(Note 3) "▒": The inter-annual trend analysis was not analysed because not conducted the survey in FY2019.

(Note 4) The half-life describes the half-life in the environment based on the survey results when the decrease tendency continues for 3 years or more by the maximum likelihood estimation that does not assume parametric residual distribution. The results in [ ] indicate that the values in the 95% confidence interval.

(Note 5) The classification of monitored sites with area are shown in Table 3-7

(Note 6) Polybromodiphenyl ethers, Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA): the results of the inter-annual trend analysis from FY2009 to FY2019. Pentachlorobenzene: the results of the inter-annual trend analysis from FY2010 to FY2019.

Table 3-6-3 Results of inter-annual trend analysis from FY2002 to FY2019 (Wildlife)

No	Name	Bivalves	Fish
[1]	Total PCBs	↘ Half-life : 15 years [9~43 years]	-
[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		
[9]	Toxaphenes		
	[9-1] Parlar-26		
	[9-2] Parlar-50		
	[9-3] Parlar-62		
[10]	Mirex		
[11]	HCHs		
	[11-1] *α*-HCH	↘ Half-life : 10 years [7~18 years]	↘
	[11-2] *β*-HCH	-	↘
	[11-3] *γ*-HCH (synonym:Lindane)	↘	-⊥
	[11-4] *δ*-HCH	-**	-**

No	Name	Bivalves	Fish
[14]	Polybromodiphenyl ethers(Br_4~Br_{10})		
	[14-1] Tetrabromodiphenyl ethers	↘ Half-life : 7 years [6~9 years]	-
	[14-2] Pentabromodiphenyl ethers	-	↘
	[14-3] Hexabromodiphenyl ether	-**	-
	[14-4] Heptabromodiphenyl ethers	-**	-**
	[14-5] Octabromodiphenyl ethers	-**	-**
	[14-6] Nonabromodiphenyl ethers	-**	⇘
	[14-7] Decabromodiphenyl ether	-**	⇘
[15]	Perfluorooctane sulfonic acid (PFOS)	-**	-
[16]	Perfluorooctanoic acid (PFOA)	-**	⇘
[17]	Pentachlorobenzene	-**	-*
[19]	1,2,5,6,9,10-Hexabromo cyclododecanes		
	[19-1] *α*-1,2,5,6,9,10- Hexabromo cyclododecane	↘	↘
	[19-2] *β*-1,2,5,6,9,10- Hexabromo cyclododecane	⇘	⇘
	[19-3] *γ*-1,2,5,6,9,10- Hexabromo cyclododecane	↘	-*

(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.
"⇘": Although the number of detections was small, the detection rate was decreased, it suggested a reduction tendency.
" - ": An inter-annual trend was not found.
"-*": In case of using the bootstrap methods, there was not a significant difference between the values of first-half and second-half periods.
"-**": The detection rate was not decreased, there was not a reduction tendency.

(Note 3) "■": The inter-annual trend analysis was not analysed because not conducted the survey in FY2019.

(Note 4) The half-life describes the half-life in the environment based on the survey results when the decrease tendency continues for 3 years or more by the maximum likelihood estimation that does not assume parametric residual distribution. The results in [ ] indicate that the values in the 95% confidence interval.

(Note 5) The classification of monitored sites with area are shown in Table 3-7

(Note 6) Polybromodiphenyl ethers: the results of the inter-annual trend analysis from FY2008 to FY2019. Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA): the results of the inter-annual trend analysis from FY2009 to FY2019. Pentachlorobenzene: the results of the inter-annual trend analysis from FY2010 to FY2019. 1,2,5,6,9,10-Hexabromo cyclododecanes: the results of the inter-annual trend analysis from FY2011 to FY2019.

Table 3-6-4 Results of inter-annual trend analysis from FY2002 to FY2019 (Air)

No	Name	Air
		Warm season
[1]	Total PCBs	↘ Half-life : 15 years [10~27 years]
[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	
[9]	Toxaphenes	
	[9-1] Parlar-26	
	[9-2] Parlar-50	
	[9-3] Parlar-62	
[10]	Mirex	
[11]	HCHs	
	[11-1] *α*-HCH	↘
	[11-2] *β*-HCH	↘ Half-life : 10 years [7~15 years]
	[11-3] *γ*-HCH (synonym:Lindane)	↘ Half-life : 9 years [7~15 years]
	[11-4] *δ*-HCH	— Note 7

No	Name	Air
		Warm season
[14]	Polybromodiphenyl ethers(Br_4~Br_{10})	
	[14-1] Tetrabromodiphenyl ethers	↘ Half-life : 6 years [5~8 years]
	[14-2] Pentabromodiphenyl ethers	⇲
	[14-3] Hexabromodiphenyl ether	⇲
	[14-4] Heptabromodiphenyl ethers	⇲
	[14-5] Octabromodiphenyl ethers	⇲
	[14-6] Nonabromodiphenyl ethers	⇲
	[14-7] Decabromodiphenyl ether	⇲
[15]	Perfluorooctane sulfonic acid (PFOS)	↘
[16]	Perfluorooctanoic acid (PFOA)	-
[17]	Pentachlorobenzene	-

(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.
"⇲": Although the number of detections was small, the detection rate was decreased, it suggested a reduction tendency.
" - ": An inter-annual trend was not found.
"-*": In case of using the bootstrap methods, there was not a significant difference between the values of first-half and second-half periods.
"-**": The detection rate was not decreased, there was not a reduction tendency.

(Note 3) "■": The inter-annual trend analysis was not analysed because not conducted the survey in FY2019.

(Note 4) The half-life describes the half-life in the environment based on the survey results when the decrease tendency continues for 3 years or more by the maximum likelihood estimation that does not assume parametric residual distribution. The results in [ ] indicate that the values in the 95% confidence interval.

(Note 5) The classification of monitored sites with area are shown in Table 3-7

(Note 6) Polybromodiphenyl ethers: the results of the inter-annual trend analysis from FY2009 to FY2019. Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA): the results of the inter-annual trend analysis from FY2010 to FY2019. Pentachlorobenzene: the results of the inter-annual trend analysis from FY2007 to FY2019.

(Note 7) Monitored sites where the temperature dropped significantly compared to the previous time were excluded from the analysis.

Table 3-7 The classification of monitored sites with area at inter-annual trend analysis from FY2002 to FY2019

Classification	Local Communities	Monitored sites	Monitored media	
			Surface water	Sediment
River area	Hokkaido	Suzuran-ohashi Bridge, Riv Tokachi(Obihiro City)	○	
		Ishikarikakokyo Bridge, Mouth of Riv. Ishikari(Ishikari City)	○	○
	Iwate Pref.	Riv. Toyosawa(Hanamaki City)	○	○
	Sendai City	Hirose-ohashi Bridge, Riv. Hirose(Sendai City)		○
	Yamagata Pref.	Mouth of Riv. Mogami(Sakata City)	○	○
	Ibaraki Pref.	Tonekamome-ohasi Bridge, Mouth of Riv. Tone(Kamisu City)	○	○
	Tochigi Pref.	Riv. Tagawa(Utsunomiya City)	○	○
	Saitama Pref.	Akigaseshusui of Riv. Arakawa	○	
	Niigata Pref.	Lower Riv. Shinano(Niigata City)	○	○
	Toyama Pref.	Hagiura-bashi Bridge, Mouth of Riv. Jintsu(Toyama City)	○	○
	Fukui Pref.	Mishima-bashi Bridge, Riv. Shono(Tsuruga City)	○	○
	Yamanashi Pref.	Senshu-bashi Bridge, Riv. Arakawa(Kofu City)		○
	Shizuoka Pref.	Riv. Tenryu(Iwata City)	○	○
	Kyoto City	Miyamae-bashi Bridge, Riv. Katsura(Kyoto City)	○	○
	Osaka City	Osaka Port	○	○
		Kema-bashi Bridge, Riv. Oh-kawa (Osaka City)		○
	Nara Pref.	Riv. Yamato(Oji Town)		○
	Wakayama Pref.	Kinokawa-ohashi Bridge, Mouth of Riv. Kinokawa(Wakayama City)	○	○
	Kochi Pref.	Mouth of Riv. Shimanto(Shimanto City)	○	○
	Kumamoto Pref.	Hiraki-bashi Bridge, Riv. Midori(Uto City)	○	
	Miyazaki Pref.	Mouth of Riv. Oyodo(Miyazaki City)	○	○
	Kagoshima Pref.	Riv. Amori(Kirishima City)	○	○
		Gotanda-bashi Bridge, Riv. Gotanda(Ichikikushikino City)	○	○
Lake area	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	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)		○
	Ishikawa Pref.	Mouth of Riv. Sai(Kanazawa City)	○	○
	Aichi Pref.	Kinuura Port		○
	Mie Pref.	Toba Port		○
	Osaka Pref.	Mouth of Riv. Yamato(Sakai City)	○	○
	Osaka City	Mouth of Riv. Yodo(Osaka City)		○
	Tokushima Pref.	Mouth of Riv. Yoshino(Tokushima City)	○	○
	Kagawa Pref.	Takamatsu Port	○	○
	Kitakyushu City	Dokai Bay	○	○
	Oita Pref.	Mouth of Riv. Oita(Oita City)		○
	Okinawa Pref.	Naha Port	○	○
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.	Nagoya Port	○	○
	Mie Pref.	Yokkaichi Port	○	○
	Kyoto Pref.	Miyazu Port	○	○
	Osaka City	Outside Osaka Port		○
	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	○	○
	Ehime Pref.	Niihama Port		○
	Fukuoka City	Hakata Bay		○
	Saga Pref.	Imari Bay	○	○
	Nagasaki Pref.	Omura Bay	○	○

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

In the wake of the monitoring surveys of FY2002~2019, high-sensitivity analysis of PCBs, and HCB were conducted. All these chemicals were detected.

High-sensitivity analysis of HCHs, Polybromodiphenyl ethers (Br_4~Br_{10}), Perfluorooctane sulfonic acid (PFOS), Perfluorooctanoic acid (PFOA), Pentachlorobenzene, 1,2,5,6,9,10-Hexabromocyclododecanes, Polychlorinated naphthalenes, Hexachlorobuta-1,3-diene, Pentachlorophenol and its salts and esters, Short-chain chlorinated paraffins, Dicofol and Perfluorohexane sulfonic acid (PFHxS) were also conducted in FY2019. Except for cases of undetected *δ*-HCH in wildlife (bivalves), Nonabromodiphenyl ethers and Decabromodiphenyl ethers in wildlife (fish and bivalves), *α*-1,2,5,6,9,10-Hexabromocyclododecane in wildlife (fish, birds), *β*-1,2,5,6,9,10-Hexabromocyclododecane in wildlife (birds), Chlorinated undecanes and Chlorinated dodecanes in wildlife (bivalves), Dicofol in wildlife (bivalves), in all chemicals were detected.

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

[1] Total PCBs

・ History and state of monitoring

Polychlorinated biphenyls (PCBs) were used in industry as heat exchange fluids, 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. Also the substances are one of the original twelve POPs covered by the Stockholm Convention.

In previous monitoring series, the substances were monitored in wildlife (bivalves, fish and birds) during the period of FY1978~2001 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 FY1996 and FY1997, and surface water, sediment, wildlife (fish) and air were the monitored media in FY2000 and FY2001.

Under the framework of the Environmental Monitoring, the substances in surface water, sediment, wildlife (bivalves, fish and birds) and air have been monitored since FY2002.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 48 sites, and it was detected at all 48 valid sites adopting the detection limit of 4.7pg/L, and the detection range was tr(6.6)~3,400pg/L.

As results of the inter-annual trend analysis from FY2002 to FY2019, reduction tendencies in specimens from river areas, lake areas and river mouth areas were identified as statistically significant and a reduction tendency in specimens from the overall areas in surface water was also identified as statistically significant.

Stocktaking of the detection of Total PCBs (total amount) in surface water during FY2002~2019

Total PCBs (total amount)	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] Limit**	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	470	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
	2010	120	99	2,200	nd	73 [24]	41/49	41/49
	2011	150	130	2,100	16	4.5 [1.7]	49/49	49/49
	2012	400	280	6,500	72	44 [15]	48/48	48/48
	2013	140	110	2,600	tr(13)	25 [8]	48/48	48/48
	2014	150	120	4,800	16	8.2 [2.9]	48/48	48/48
	2015	200	160	4,200	34	21 [7.3]	48/48	48/48
	2016	140	120	3,100	tr(7.2)	8.4 [2.8]	48/48	48/48
	2017	84	79	2,400	nd	16[5.5]	46/47	46/47
	2018	150	140	2,600	tr(11)	14 [5]	47/47	47/47
	2019	120	90	3,400	tr(6.6)	12 [4.7]	48/48	48/48

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.

(Note 2) " ** " indicates the sum value of the Quantification [Detection] limits of each congener.

<Sediment>

The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 3.3pg/g-dry, and the detection range was 37~640,000pg/g-dry.

As results of the inter-annual trend analysis from FY2002 to FY2019, reduction tendencies in specimens from river areas and sea areas were identified as statistically significant and a reduction tendency in specimens from the overall areas in sediment was also identified as statistically significant.

Stocktaking of the detection of Total PCBs (total amount) in sediment during FY2002~2019

Total PCBs (total amount)	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] Limit**	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	11,000	11,000	630,000	39	10 [3.5]	189/189	63/63
	2003	9,400	9,500	5,600,000	39	10 [3.2]	186/186	62/62
	2004	8,400	7,600	1,300,000	38	7.9 [2.6]	189/189	63/63
	2005	8,600	7,100	690,000	42	6.3 [2.1]	189/189	63/63
	2006	8,800	6,600	690,000	36	4 [1]	192/192	64/64
	2007	7,400	6,800	820,000	19	4.7 [1.5]	192/192	64/64
	2008	8,700	8,900	630,000	22	3.3 [1.2]	192/192	64/64
	2009	7,600	7,100	1,700,000	17	5.1 [2.1]	192/192	64/64
	2010	6,500	7,800	710,000	nd	660 [220]	56/64	56/64
	2011	6,300	7,400	950,000	24	12 [4.5]	64/64	64/64
	2012	5,700	6,700	640,000	tr(32)	51 [18]	63/63	63/63
	2013	6,200	8,000	650,000	tr(43)	44 [13]	62/62	62/62
	2014	4,900	5,500	440,000	tr(35)	61 [21]	63/63	63/63
	2015	6,400	7,500	1,100,000	nd	62 [22]	61/62	61/62
	2016	5,300	5,300	770,000	tr(21)	53 [18]	62/62	62/62
	2017	4,600	6,200	610,000	nd	14 [5.0]	61/62	61/62
	2018	5,900	6,500	720,000	nd	170 [55]	58/61	58/61
	2019	5,700	7,900	640,000	37	8.5 [3.3]	61/61	61/61

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002~2009.

(Note 2) " ** " indicates the sum value of the Quantification [Detection] limits of each congener.

<Wildlife>

The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 11pg/g-wet, and the detection range was 350~17,000pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 11pg/g-wet, and the detection range was 1,000~160,000pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 11pg/g-wet, and the detected concentration was 190,000pg/g-wet.

As results of the inter-annual trend analysis from FY2002 to FY2019, a reduction tendency in specimens from bivalves was identified as statistically significant.

Stocktaking of the detection of Total PCBs (total amount) in wildlife (bivalves, fish and birds) during FY2002~2019

Total PCBs (total amount)	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] Limit**	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	8,800	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	11,000	11,000	150,000	1,500	85 [29]	31/31	7/7
	2005	11,000	13,000	85,000	920	69 [23]	31/31	7/7
	2006	8,500	8,600	77,000	690	42 [14]	31/31	7/7
	2007	9,000	11,000	66,000	980	46 [18]	31/31	7/7
	2008	8,600	8,600	69,000	870	47 [17]	31/31	7/7
	2009	8,700	11,000	62,000	780	32 [11]	31/31	7/7
	2010	9,200	11,000	46,000	1,500	52 [20]	6/6	6/6
	2011	8,900	17,000	65,000	820	220 [74]	4/4	4/4
	2012	6,600	12,000	34,000	680	34 [11]	5/5	5/5
	2013	5,200	7,800	44,000	730	44 [14]	5/5	5/5
	2014	2,900	2,600	15,000	600	95 [31]	3/3	3/3
	2015	2,400	2,500	9,600	580	52 [17]	3/3	3/3
	2016	2,300	2,300	12,000	420	60 [20]	3/3	3/3
	2017	2,500	1,600	19,000	500	68 [23]	3/3	3/3
	2018	2,000	900	12,000	740	63 [21]	3/3	3/3
	2019	2,200	1,900	17,000	350	33 [11]	3/3	3/3
Fish (pg/g-wet)	2002	17,000	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	14,000	8,600	540,000	800	69 [23]	80/80	16/16
	2006	13,000	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	12,000	9,100	330,000	1,200	47 [17]	85/85	17/17
	2009	12,000	12,000	290,000	840	32 [11]	90/90	18/18
	2010	13,000	10,000	260,000	880	52 [20]	18/18	18/18
	2011	14,000	12,000	250,000	900	220 [74]	18/18	18/18
	2012	13,000	14,000	130,000	920	34 [11]	19/19	19/19
	2013	14,000	13,000	270,000	1,000	44 [14]	19/19	19/19
	2014	13,000	10,000	230,000	940	95 [31]	19/19	19/19
	2015	11,000	7,700	180,000	1,300	52 [17]	19/19	19/19
	2016	11,000	8,400	150,000	1,200	60 [20]	19/19	19/19
	2017	10,000	8,300	160,000	860	68 [23]	19/19	19/19
	2018	12,000	12,000	280,000	1,200	63 [21]	18/18	18/18
	2019	12,000	12,000	160,000	1,000	33 [11]	16/16	16/16
Birds (pg/g-wet)	2002	12,000	14,000	22,000	4,800	25 [8.4]	10/10	2/2
	2003	19,000	22,000	42,000	6,800	50 [17]	10/10	2/2
	2004	9,000	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	12,000	9,800	48,000	5,600	42 [14]	10/10	2/2
	2007	7,600	7,800	15,000	3,900	46 [18]	10/10	2/2
	2008	9,700	7,400	56,000	3,000	47 [17]	10/10	2/2
	2009	5,900	5,700	9,500	3,900	32 [11]	10/10	2/2
	2010	7,700	---	9,100	6,600	52 [20]	2/2	2/2
	2011	---	---	5,400	5,400	220 [74]	1/1	1/1
	2012	5,900	---	6,200	5,600	34 [11]	2/2	2/2
	2013***	360,000	---	510,000	250,000	44 [14]	2/2	2/2
	2014***	46,000	---	140,000	15,000	95 [31]	2/2	2/2
	2015***	---	---	5,000	5,000	52 [17]	1/1	1/1
	2016***	31,000	---	100,000	9,800	60 [20]	2/2	2/2
	2017***	39,000	---	380,000	4,000	68 [23]	2/2	2/2
	2018***	110,000	---	130,000	85,000	63 [21]	2/2	2/2
	2019***	---	---	190,000	190,000	33 [11]	1/1	1/1

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002~2009.

(Note 2) “ ** ” indicates the sum value of the Quantification [Detection] limits of each congener.

(Note 3) “ *** ” indicates there is no consistency between the results of the ornithological survey after FY2013 and those in previous years because of the changes in the survey sites and target species.

<Air>

The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.8pg/m^3, and the detection range was 27~340pg/m^3.

As results of the inter-annual trend analysis from FY2003 to FY2019, a reduction tendency in specimens from warm season was identified as statistically significant.

Stocktaking of the detection of Total PCBs (total amount) in air during FY2002~2019

Total PCBs (total amount)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit*	Detection Frequency Sample	Detection Frequency 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
	2010 Warm season	160	150	970	36	7.3 [2.5]	35/35	35/35
	2010 Cold season	84	86	630	19		35/35	35/35
	2011 Warm season	150	160	660	32	18 [5.9]	35/35	35/35
	2011 Cold season	76	66	320	tr(17)		37/37	37/37
	2012 Warm season	130	130	840	27	26 [8.5]	35/35	35/35
	2012 Cold season	54	62	280	tr(16)		35/35	35/35
	2013 Warm season	140	130	1,100	24	20 [6.5]	35/35	35/35
	2013 Cold season	57	55	300	tr(19)		35/35	35/35
	2014 Warm season	140	150	1,300	28	4.1 [1.4]	36/36	36/36
	2015 Warm season	98	110	950	17	5.9 [2.0]	35/35	35/35
	2016 Warm season	130	140	1,300	16	7.8 [2.7]	37/37	37/37
	2017 Warm season	120	110	3,300	26	7.0 [2.3]	37/37	37/37
	2018 Warm season	110	100	750	20	2.4 [0.8]	37/37	37/37
	2019 Warm season	89	90	340	27	2.1 [0.8]	36/36	36/36

(Note 1) “ * ” :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 was used as pesticidal material and was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in August 1979. Also the substance is one of the original twelve POPs covered by the Stockholm Convention.

In previous monitoring series, the substance was monitored in wildlife (bivalves, fish and birds) during the period of FY1978~1996 and in FY1998, FY2000 and FY2001 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 FY1986~1998 and FY1986~2001, 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 FY2002.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 48 sites, and it was detected at 46 of the 48 valid sites adopting the detection limit of 3pg/L, and none of the detected concentrations exceeded 630pg/L.

As results of the inter-annual trend analysis from FY2002 to FY2019, reduction tendencies in specimens from river areas and river mouth areas were identified as statistically significant, and the last 6 years period was indicated lower concentration than the period before the last 6 years in specimens from sea areas in surface water as statistically significant. And a reduction tendency in specimens from the overall areas in surface water was also identified as statistically significant.

Stocktaking of the detection of Hexachlorobenzene in surface water during FY2002~2019

HCB	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2002	37	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
	2010	tr(10)	tr(8)	120	nd	13 [4]	39/49	39/49
	2011	13	12	140	tr(3)	5 [2]	49/49	49/49
	2012	29	23	330	8.1	2.2 [0.7]	48/48	48/48
	2013	14	11	260	tr(4)	7 [2]	48/48	48/48
	2014	12	9.7	200	2.7	0.9 [0.4]	48/48	48/48
	2015	15	13	140	4.2	1.8 [0.6]	48/48	48/48
	2016	13	11	130	4.2	0.9 [0.3]	48/48	48/48
	2017	12	10	180	2.9	2.1 [0.8]	47/47	47/47
	2018	16	11	380	4.0	1.5 [0.6]	47/47	47/47
	2019	10	10	630	nd	8 [3]	46/48	46/48

(Note) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.

<Sediment>

The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 0.4pg/g-dry, and the detection range was 4.5~10,000pg/g-dry.

As results of the inter-annual trend analysis from FY2002 to FY2019, a reduction tendency in specimens from river areas was identified as statistically significant and a reduction tendency in specimens from the overall areas in sediment water was also identified as statistically significant.

Stocktaking of the detection of Hexachlorobenzene in sediment during FY2002~2019

HCB	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	240	200	19,000	7.6	0.9 [0.3]	189/189	63/63
	2003	160	120	42,000	5	4 [2]	186/186	62/62
	2004	140	100	25,000	tr(6)	7 [3]	189/189	63/63
	2005	170	130	22,000	13	3 [1]	189/189	63/63
	2006	180	120	19,000	10	2.9 [1.0]	192/192	64/64
	2007	140	110	65,000	nd	5 [2]	191/192	64/64
	2008	160	97	29,000	4.4	2.0 [0.8]	192/192	64/64
	2009	150	120	34,000	nd	1.8 [0.7]	190/192	64/64
	2010	130	96	21,000	4	3 [1]	64/64	64/64
	2011	150	110	35,000	11	7 [3]	64/64	64/64
	2012	100	110	12,000	3	3 [1]	63/63	63/63
	2013	120	91	6,600	7.2	5.3 [1.8]	63/63	63/63
	2014	95	85	5,600	tr(4)	6 [2]	63/63	63/63
	2015	100	90	17,000	4	3 [1]	62/62	62/62
	2016	84	74	6,400	4	3 [1]	62/62	62/62
	2017	82	65	11,000	3	3 [1]	62/62	62/62
	2018	100	79	8,900	3.1	1.3 [0.5]	61/61	61/61
	2019	88	85	10,000	4.5	0.9 [0.4]	61/61	61/61

(Note) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

<Wildlife>

The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 12~65pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 12~1,100pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 1pg/g-wet, and the detected concentration was 3,200pg/g-wet.

Stocktaking of the detection of Hexachlorobenzene in wildlife (bivalves, fish and birds) during FY2002~2019

HCB	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] Limit**	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	21	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	32	31	80	14	14 [4.6]	31/31	7/7
	2005	51	28	450	19	11 [3.8]	31/31	7/7
	2006	46	28	340	11	3 [1]	31/31	7/7
	2007	37	22	400	11	7 [3]	31/31	7/7
	2008	38	24	240	13	7 [3]	31/31	7/7
	2009	34	32	200	12	4 [2]	31/31	7/7
	2010	34	48	210	tr(4)	5 [2]	6/6	6/6
	2011	45	34	920	4	4 [1]	4/4	4/4
	2012	39	38	340	10	8.4 [2.8]	5/5	5/5
	2013	32	39	250	nd	31 [10]	4/5	4/5
	2014	34	26	100	15	10 [3]	3/3	3/3
	2015	35	26	120	tr(14)	20 [6.5]	3/3	3/3
	2016	38	22	150	17	8.1 [2.7]	3/3	3/3
	2017	41	26	99	26	3.9 [1.3]	3/3	3/3
	2018	21	23	28	14	3.3 [1.1]	3/3	3/3
	2019	23	16	65	12	3 [1]	3/3	3/3

HCB	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] Limit**	Detection Frequency	
							Sample	Site
Fish (pg/g-wet)	2002	140	180	910	19	0.18 [0.06]	70/70	14/14
	2003	180	170	1,500	28	23 [7.5]	70/70	14/14
	2004	230	210	1,800	26	14 [4.6]	70/70	14/14
	2005	180	160	1,700	29	11 [3.8]	80/80	16/16
	2006	180	220	1,400	25	3 [1]	80/80	16/16
	2007	160	140	1,500	17	7 [3]	80/80	16/16
	2008	170	210	1,500	25	7 [3]	85/85	17/17
	2009	210	180	30,000	29	4 [2]	90/90	18/18
	2010	240	280	1,700	36	5 [2]	18/18	18/18
	2011	260	320	1,500	34	4 [1]	18/18	18/18
	2012	200	300	1,100	33	8.4 [2.8]	19/19	19/19
	2013	240	220	1,500	36	31 [10]	19/19	19/19
	2014	280	340	1,900	37	10 [3]	19/19	19/19
	2015	170	150	1,700	43	20 [6.5]	19/19	19/19
	2016	150	150	1,300	24	8.1 [2.7]	19/19	19/19
	2017	190	180	1,100	33	3.9 [1.3]	19/19	19/19
	2018	140	150	900	25	3.3 [1.1]	18/18	18/18
	2019	100	99	1,100	12	3 [1]	16/16	16/16
Birds (pg/g-wet)	2002	1,000	1,200	1,600	560	0.18 [0.06]	10/10	2/2
	2003	1,800	2,000	4,700	790	23 [7.5]	10/10	2/2
	2004	980	1,300	2,200	410	14 [4.6]	10/10	2/2
	2005	1,000	1,100	2,500	400	11 [3.8]	10/10	2/2
	2006	970	1,100	2,100	490	3 [1]	10/10	2/2
	2007	960	1,100	2,000	420	7 [3]	10/10	2/2
	2008	880	1,100	2,500	240	7 [3]	10/10	2/2
	2009	850	910	1,500	400	4 [2]	10/10	2/2
	2010	970	---	1,900	500	5 [2]	2/2	2/2
	2011	---	---	460	460	4 [1]	1/1	1/1
	2012	840	---	1,500	470	8.4 [2.8]	2/2	2/2
	2013**	3,900	---	5,200	2,900	31 [10]	2/2	2/2
	2014**	420	---	5,600	32	10 [3]	2/2	2/2
	2015**	---	---	760	760	20 [6.5]	1/1	1/1
	2016**	1,700	---	5,300	550	8.1 [2.7]	2/2	2/2
	2017**	1,100	---	4,900	230	3.9 [1.3]	2/2	2/2
	2018**	2,800	---	3,100	2,600	3.3 [1.1]	2/2	2/2
	2019**	---	---	3,200	3,200	3 [1]	1/1	1/1

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) “ ** ” indicates there is no consistency between the results of the ornithological survey after FY2013 and those in previous years because of the changes in the survey sites and target species.

<Air>

The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.06pg/m^3, and the detection range was 67~130pg/m^3.

Stocktaking of the detection of Hexachlorobenzene in air during FY2002~2019

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
	2010 Warm season	120	120	160	73	1.8 [0.7]	37/37	37/37
	2010 Cold season	100	96	380	56		37/37	37/37
	2011 Warm season	120	110	180	87	2.3 [0.75]	35/35	35/35
	2011 Cold season	96	96	160	75		37/37	37/37
	2012 Warm season	120	110	150	84	4.3 [1.4]	36/36	36/36
	2012 Cold season	97	95	150	68		36/36	36/36
	2013 Warm season	110	110	180	52	3.8 [1.3]	36/36	36/36
	2013 Cold season	97	97	180	73		36/36	36/36
	2014 Warm season	150	160	240	84	1.4 [0.5]	36/36	36/36
	2015 Warm season	120	130	170	74	0.5 [0.2]	35/35	35/35
	2016 Warm season	130	130	220	79	0.8 [0.3]	37/37	37/37
	2017 Warm season	130	120	550	73	0.5 [0.2]	37/37	37/37
	2018 Warm season	100	100	140	72	0.4 [0.2]	37/37	37/37
	2019 Warm season	96	99	130	67	0.14 [0.06]	36/36	36/36

[3] Aldrin (references)

・ History and state of monitoring

Aldrin had been used as a soil insecticide until FY1971 when the application of the substance was substantially stopped. Its registration under the Agricultural Chemicals Regulation Law was expired in FY1975. It was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in October 1981. Also the substance is the initial POPs under the Stockholm Convention since 2004.

In previous monitoring series until FY2001, the substance was monitored in wildlife (bivalves, fish and birds) during the period of FY1978~1989, FY1991 and FY1993 under the framework of "the Wildlife Monitoring."

Under the framework of the Environmental Monitoring, the substance had been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air from FY2002 to FY2009, in wildlife (bivalves, fish and birds) and air in FY2014, in sediment in FY2018.

No monitoring was conducted in FY2019. For reference, the monitoring results up to FY2018 are given below.

・ Monitoring results until FY2018

<Surface Water>

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	0.8	0.9	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

(Note) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.

<Sediment>

Stocktaking of the detection of Aldrin in sediment during FY2002~2018

Aldrin	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	14	12	570	nd	6 [2]	149/189	56/63
	2003	19	18	1,000	nd	2 [0.6]	178/186	60/62
	2004	10	10	390	nd	2 [0.6]	170/189	62/63
	2005	8.4	7.1	500	nd	1.4 [0.5]	173/189	62/63
	2006	10	9.3	330	nd	1.9 [0.6]	184/192	64/64
	2007	7.5	6.7	330	nd	1.8 [0.6]	172/192	60/64
	2008	6	6	370	nd	3 [1]	153/192	56/64
	2009	8.9	7.8	540	nd	0.5 [0.2]	180/192	64/64
	2018	3.7	3.8	270	nd	1.6 [0.6]	50/61	50/61

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) No monitoring was conducted in FY2010 ~ FY2017.

<Wildlife>

Stocktaking of the detection of Aldrin in wildlife (bivalves, fish and birds) during FY2002~2014

Aldrin	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	tr(1.6)	nd	34	nd	4.2 [1.4]	12/38	4/8
	2003	tr(1.7)	tr(0.85)	51	nd	2.5 [0.84]	15/30	3/6
	2004	tr(2.5)	tr(1.6)	46	nd	4.0 [1.3]	16/31	4/7
	2005	tr(1.8)	nd	84	nd	3.5 [1.2]	11/31	3/7
	2006	tr(2)	nd	19	nd	4 [2]	11/31	3/7
	2007	tr(2)	nd	26	nd	5 [2]	5/31	2/7
	2008	tr(2)	nd	20	nd	5 [2]	5/31	3/7
	2009	tr(1.6)	tr(0.8)	89	nd	2.1 [0.8]	16/31	6/7
	2014	nd	nd	nd	nd	1.8 [0.7]	0/3	0/3
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	4.0 [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
	2014	nd	nd	2.4	nd	1.8 [0.7]	4/19	4/19
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	4.0 [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
	2014**	nd	---	nd	nd	1.8 [0.7]	0/2	0/2

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) " ** " indicates there is no consistency between the results of the ornithological survey in FY2014 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted during FY2010~2013.

<Air>

Stocktaking of the detection of Aldrin in air during FY2002~2014

Aldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2002	tr(0.030)	nd	3.2	nd	0.060 [0.020]	41/102	19/34
	2003Warm season	1.5	1.9	28	nd	0.023 [0.0077]	34/35	34/35
	2003Cold season	0.55	0.44	6.9	0.030		34/34	34/34
	2004Warm season	tr(0.12)	nd	14	nd	0.15 [0.05]	15/37	15/37
	2004Cold season	tr(0.08)	nd	13	nd		14/37	14/37
	2005Warm season	0.33	0.56	10	nd	0.08 [0.03]	29/37	29/37
	2005Cold season	tr(0.04)	nd	1.8	nd		9/37	9/37
	2006Warm season	0.30	0.35	8.5	nd	0.14 [0.05]	31/37	31/37
	2006Cold season	tr(0.05)	nd	1.1	nd		16/37	16/37
	2007Warm season	0.58	0.48	19	nd	0.05 [0.02]	35/36	35/36
	2007Cold season	0.14	0.15	2.1	nd		34/36	34/36
	2008Warm season	0.27	0.30	9.4	tr(0.02)	0.04 [0.02]	25/25	25/25
	2008Cold season	0.09	0.08	1.3	nd		22/25	22/25
	2009Warm season	0.07	nd	10	nd	0.04 [0.02]	10/25	10/25
	2009Cold season	tr(0.03)	nd	1.8	nd		8/24	8/24
	2014Warm season	nd	nd	17	nd	12 [4]	6/34	6/34

(Note) No monitoring was conducted during FY2010~2013.

[4] Dieldrin (references)

・ 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 FY1975. 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. Also the substance is one of the original twelve POPs covered by the Stockholm Convention.

In previous monitoring series until FY2001, the substance was monitored in wildlife (bivalves, fish and birds) during the period of FY1978~1996, FY1998, FY2000 and FY2001 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 FY1986~1998 and FY1986~2001, respectively.

Under the framework of the Environmental Monitoring, the substance had been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air from FY2002 to FY2009 and in FY2011 and in surface water, wildlife (bivalves, fish and birds) and air in FY2014, in sediment in FY2018.

No monitoring was conducted in FY2019. For reference, the monitoring results up to FY2018 are given below.

・ Monitoring results until FY2018

<Surface Water>

Stocktaking of the detection of Dieldrin in surface water during FY2002~2014

Dieldrin	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	42	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
	2011	33	38	300	2.1	1.6 [0.6]	49/49	49/49
	2014	28	27	200	2.7	0.5 [0.2]	48/48	48/48

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.
(Note 2) No monitoring was conducted in FY2010, FY2012 and FY2013.

<Sediment>

Stocktaking of the detection of Dieldrin in sediment during FY2002~2018

Dieldrin	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	70	51	2,300	4	3 [1]	189/189	63/63
	2003	66	56	9,100	nd	4 [2]	184/186	62/62
	2004	65	62	3,700	tr(1.9)	3 [0.9]	189/189	63/63
	2005	61	55	4,200	tr(2)	3 [1]	189/189	63/63
	2006	61	54	1,500	tr(1.7)	2.9 [1.0]	192/192	64/64
	2007	49	40	2,700	tr(1.2)	2.7 [0.9]	192/192	64/64
	2008	48	43	2,900	tr(0.7)	1.2 [0.5]	192/192	64/64
	2009	51	47	3,000	1.1	0.8 [0.3]	192/192	64/64
	2011	47	44	2,200	2	5 [2]	64/64	64/64
	2018	33	33	860	nd	1.6[0.6]	60/61	60/61

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.
(Note 2) No monitoring was conducted in FY2010.

<Wildlife>

Stocktaking of the detection of Dieldrin in wildlife (bivalves, fish and birds) during FY2002~2014

Dieldrin	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	440	390	190,000	tr(7)	12 [4]	38/38	8/8
	2003	440	160	78,000	46	4.8 [1.6]	30/30	6/6
	2004	630	270	69,000	42	31 [10]	31/31	7/7
	2005	500	140	39,000	34	9.4 [3.4]	31/31	7/7
	2006	450	120	47,000	30	7 [3]	31/31	7/7
	2007	380	110	77,000	37	9 [3]	31/31	7/7
	2008	430	150	24,000	47	9 [3]	31/31	7/7
	2009	490	230	28,000	48	7 [2]	31/31	7/7
	2011	390	690	3,800	16	3 [1]	4/4	4/4
	2014	180	300	490	41	3 [1]	3/3	3/3
Fish (pg/g-wet)	2002	290	270	2,400	46	12 [4]	70/70	14/14
	2003	220	200	1,000	29	4.8 [1.6]	70/70	14/14
	2004	250	230	2,800	tr(23)	31 [10]	70/70	14/14
	2005	230	250	1,400	21	9.4 [3.4]	80/80	16/16
	2006	230	220	1,400	19	7 [3]	80/80	16/16
	2007	250	210	1,900	23	9 [3]	80/80	16/16
	2008	240	240	1,300	15	9 [3]	85/85	17/17
	2009	240	190	1,400	29	7 [2]	90/90	18/18
	2011	270	340	1,100	17	3 [1]	18/18	18/18
	2014	270	310	1,000	27	3 [1]	19/19	19/19
Birds (pg/g-wet)	2002	1,100	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	600	610	960	370	31 [10]	10/10	2/2
	2005	830	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	680	620	1,300	260	9 [3]	10/10	2/2
	2009	470	420	890	330	7 [2]	10/10	2/2
	2011	---	---	770	770	3 [1]	1/1	1/1
	2014**	320	---	530	190	3 [1]	2/2	2/2

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) “ ** ” indicates there is no consistency between the results of the ornithological survey in FY2014 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2010, FY2012 and FY2013.

<Air>

Stocktaking of the detection of Dieldrin in air during FY2002~2014

Dieldrin	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2002	5.6	5.4	110	0.73	0.60 [0.20]	102/102	34/34
	2003Warm season	19	22	260	2.1	2.1 [0.70]	35/35	35/35
	2003Cold season	5.7	5.2	110	tr(0.82)		34/34	34/34
	2004Warm season	17	22	280	1.1	0.33 [0.11]	37/37	37/37
	2004Cold season	5.5	6.9	76	0.81		37/37	37/37
	2005Warm season	14	12	200	1.5	0.54 [0.24]	37/37	37/37
	2005Cold season	3.9	3.6	50	0.88		37/37	37/37
	2006Warm season	15	14	290	1.5	0.3 [0.1]	37/37	37/37
	2006Cold season	4.5	4.2	250	0.7		37/37	37/37
	2007Warm season	19	22	310	1.3	0.18 [0.07]	36/36	36/36
	2007Cold season	4.5	3.7	75	0.96		36/36	36/36
	2008Warm season	14	16	220	1.6	0.24 [0.09]	37/37	37/37
	2008Cold season	4.9	3.8	72	0.68		37/37	37/37
	2009Warm season	13	13	150	0.91	0.06 [0.02]	37/37	37/37
	2009Cold season	4.5	4.0	80	0.52		37/37	37/37
	2011Warm season	12	15	230	0.80	0.42 [0.14]	35/35	35/35
	2011Cold season	4.3	4.9	96	0.52		37/37	37/37
	2014Warm season	11	9.9	160	0.89	0.34 [0.11]	36/36	36/36

(Note) No monitoring was conducted in FY2010, FY2012 and FY2013.

[5] Endrin (references)

・ 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 FY1975. It was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in October 1981. Also the substance is one of the original twelve POPs covered by the Stockholm Convention.

In previous monitoring series until FY2001, the substance was monitored in wildlife (bivalves, fish and birds) during the periods of FY1978~1989 and FY1991~1993 under the framework of “the Wildlife Monitoring”.

Under the framework of the Environmental Monitoring, the substance has been monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air from FY2002 to FY2009, and in surface water, wildlife (bivalves, fish and birds) and air in FY2014, in sediment in FY2018.

No monitoring was conducted in FY2019. For reference, the monitoring results up to FY2018 are given below.

・ Monitoring results until FY2018

<Surface Water>

Stocktaking of the detection of Endrin in surface water during FY2002~2014

Endrin	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	tr(4.8)	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
	2011	3.8	4.6	71	nd	1.6 [0.6]	47/49	47/49
	2014	2.5	2.2	25	tr(0.4)	0.5 [0.2]	48/48	48/48

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.
(Note 2) No monitoring was conducted in FY2010, FY2012 and FY2013.

<Sediment>

Stocktaking of the detection of Endrin in sediment during FY2002~2018

Endrin	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	10	10	19,000	nd	6 [2]	141/189	54/63
	2003	12	11	29,000	nd	5 [2]	150/186	53/62
	2004	15	13	6,900	nd	3 [0.9]	182/189	63/63
	2005	12	11	19,000	nd	2.6 [0.9]	170/189	61/63
	2006	12	10	61,000	nd	4 [1]	178/192	63/64
	2007	11	9	61,000	nd	5 [2]	151/192	55/64
	2008	11	11	38,000	nd	1.9 [0.7]	168/192	61/64
	2009	9.6	8.4	11,000	nd	1.6 [0.6]	168/192	63/64
	2011	8.8	14	1,100	nd	1.1 [0.4]	59/64	59/64
	2018	6.4	5.9	7,500	nd	2.4 [0.9]	48/61	48/61

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.
(Note 2) No monitoring was conducted in FY2010, FY2012~FY2017.

<Wildlife>

Stocktaking of the detection of Endrin in wildlife (bivalves, fish and birds) during FY2002~2014

Endrin	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	42	27	12,000	nd	18 [6]	35/38	7/8
	2003	38	21	5,000	6.3	4.8 [1.6]	30/30	6/6
	2004	65	25	4,600	tr(5.7)	12 [4.2]	31/31	7/7
	2005	39	19	2,100	nd	17 [5.5]	27/31	7/7
	2006	40	15	3,100	tr(5)	11 [4]	31/31	7/7
	2007	28	12	3,000	tr(6)	9 [3]	31/31	7/7
	2008	30	10	1,500	tr(6)	8 [3]	31/31	7/7
	2009	38	19	1,400	tr(5)	7 [3]	31/31	7/7
	2011	33	62	110	tr(3)	4 [2]	4/4	4/4
	2014	23	17	84	8	3 [1]	3/3	3/3
Fish (pg/g-wet)	2002	20	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	19	tr(16)	2,100	nd	17 [5.5]	58/80	12/16
	2006	13	tr(10)	150	nd	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
	2011	18	19	160	nd	4 [2]	16/18	16/18
	2014	16	16	140	nd	3 [1]	18/19	18/19
Birds (pg/g-wet)	2002	28	52	99	nd	18 [6]	7/10	2/2
	2003	22	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	18	28	64	nd	17 [5.5]	7/10	2/2
	2006	16	23	57	tr(4)	11 [4]	10/10	2/2
	2007	17	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
	2011	---	---	tr(3)	tr(3)	4 [2]	1/1	1/1
	2014**	4	---	5	4	3 [1]	2/2	2/2

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) " ** " indicates there is no consistency between the results of the ornithological survey in FY2014 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2010, FY2012 and FY2013.

<Air>

Stocktaking of the detection of Endrin in air during FY2002~2014

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
	2003Warm season	0.74	0.95	6.2	0.081	0.042 [0.014]	35/35	35/35
	2003Cold season	0.23	0.20	2.1	0.042		34/34	34/34
	2004Warm season	0.64	0.68	6.5	tr(0.054)	0.14 [0.048]	37/37	37/37
	2004Cold season	0.23	0.26	1.9	nd		36/37	36/37
	2005Warm season	tr(0.4)	tr(0.3)	2.9	nd	0.5 [0.2]	27/37	27/37
	2005Cold season	nd	nd	0.7	nd		8/37	8/37
	2006Warm season	0.31	0.32	5.4	nd	0.30 [0.10]	32/37	32/37
	2006Cold season	nd	nd	5.0	nd		7/37	7/37
	2007Warm season	0.69	0.73	6.3	tr(0.06)	0.09 [0.04]	36/36	36/36
	2007Cold season	0.16	0.13	1.5	nd		33/36	33/36
	2008Warm season	0.53	0.68	4.6	tr(0.06)	0.10 [0.04]	37/37	37/37
	2008Cold season	0.18	0.18	1.8	nd		35/37	35/37
	2009Warm season	0.49	0.51	3.4	nd	0.09 [0.04]	36/37	36/37
	2009Cold season	0.17	0.15	1.8	nd		36/37	36/37
	2011Warm season	0.46	0.62	5.1	nd	0.09 [0.04]	34/35	34/35
	2011Cold season	0.16	0.16	1.8	nd		33/37	33/37
	2014Warm season	0.39	0.48	2.9	nd	0.20 [0.07]	32/36	32/36

(Note) No monitoring was conducted in FY2010, FY2012 and FY2013.

[6] DDTs (references)

・ 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 FY1971. *p,p′*-DDT was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in October 1981. Also the substances are one of the original twelve POPs covered by the Stockholm Convention.

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 FY1978.

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 FY1978~2001 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 FY1986~1998 and FY1986~2001, 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 FY1978~1996 and in FY1998, FY2000 and FY2001 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 from FY2002 to FY2010, wildlife (bivalves, fish and birds) and air in FY2013, surface water and sediment in FY2014 and air in FY2015, wildlife (bivalves, fish and birds) and air in FY2018.

No monitoring was conducted in FY2019. For reference, the monitoring results up to FY2018 are given below.

・ Monitoring results until FY2018

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

<Surface Water>

Stocktaking of the detection of *p,p′*-DDT, *p,p′*-DDE and *p,p′*-DDD in surface water during FY2002~2014

p,p′-DDT	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	13	11	440	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
	2010	8.5	7.6	7,500	tr(1.0)	2.4 [0.8]	49/49	49/49
	2014	4.4	3.9	380	nd	0.4 [0.1]	47/48	47/48
p,p′-DDE	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	25	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
	2010	14	12	1,600	2.4	2.3 [0.8]	49/49	49/49
	2014	16	17	610	1.9	0.5 [0.2]	48/48	48/48

p,p′-DDD	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	16	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
	2010	12	10	970	1.6	0.20 [0.08]	49/49	49/49
	2014	9.0	8.7	87	1.0	1.0 [0.4]	48/48	48/48

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.
(Note 2) No monitoring was conducted during FY2011~2013.

<Sediment>

Stocktaking of the detection of *p,p′*-DDT, *p,p′*-DDE and *p,p′*-DDD in sediment during FY2002~2014

p,p′-DDT	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	380	240	97,000	tr(5)	6 [2]	189/189	63/63
	2003	290	220	55,000	3	2 [0.4]	186/186	62/62
	2004	460	230	98,000	7	2 [0.5]	189/189	63/63
	2005	360	230	1,700,000	5.1	1.0 [0.34]	189/189	63/63
	2006	310	240	130,000	4.5	1.4 [0.5]	192/192	64/64
	2007	210	150	130,000	3	1.3 [0.5]	192/192	64/64
	2008	270	180	1,400,000	4.8	1.2 [0.5]	192/192	64/64
	2009	250	170	2,100,000	1.9	1.0 [0.4]	192/192	64/64
	2010	230	200	220,000	9.3	2.8 [0.9]	64/64	64/64
	2014	140	140	12,000	tr(0.2)	0.4 [0.2]	63/63	63/63
p,p′-DDE	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	780	630	23,000	8.4	2.7 [0.9]	189/189	63/63
	2003	790	780	80,000	9.5	0.9 [0.3]	186/186	62/62
	2004	720	700	39,000	8	3 [0.8]	189/189	63/63
	2005	710	730	64,000	8.4	2.7 [0.94]	189/189	63/63
	2006	710	820	49,000	5.8	1.0 [0.3]	192/192	64/64
	2007	670	900	61,000	3.2	1.1 [0.4]	192/192	64/64
	2008	920	940	96,000	9.0	1.7 [0.7]	192/192	64/64
	2009	700	660	50,000	6.7	0.8 [0.3]	192/192	64/64
	2010	680	790	40,000	11	5 [2]	64/64	64/64
	2014	530	610	64,000	11	1.8 [0.6]	63/63	63/63
p,p′-DDD	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	640	690	51,000	tr(2.2)	2.4 [0.8]	189/189	63/63
	2003	670	580	32,000	3.7	0.9 [0.3]	186/186	62/62
	2004	650	550	75,000	4	2 [0.7]	189/189	63/63
	2005	600	570	210,000	5.2	1.7 [0.64]	189/189	63/63
	2006	560	540	53,000	2.2	0.7 [0.2]	192/192	64/64
	2007	520	550	80,000	3.5	1.0 [0.4]	192/192	64/64
	2008	740	660	300,000	2.8	1.0 [0.4]	192/192	64/64
	2009	540	560	300,000	3.9	0.4 [0.2]	192/192	64/64
	2010	510	510	78,000	4.4	1.4 [0.5]	64/64	64/64
	2014	330	410	21,000	4.9	4.2 [1.4]	63/63	63/63

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.
(Note 2) No monitoring was conducted during FY2011~2013.

<Wildlife>

Stocktaking of the detection of *p,p′*-DDT, *p,p′*-DDE and *p,p′*-DDD in wildlife (bivalves, fish and birds) during FY2002~2018

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	360	340	2,600	48	3.2 [1.1]	31/31	7/7
	2005	240	170	1,300	66	5.1 [1.7]	31/31	7/7
	2006	250	220	1,100	56	6 [2]	31/31	7/7
	2007	240	150	1,200	49	5 [2]	31/31	7/7
	2008	160	100	1,400	12	5 [2]	31/31	7/7
	2009	240	170	9,600	46	3 [1]	31/31	7/7
	2010	180	280	470	43	3 [1]	6/6	6/6
	2013	190	210	890	46	3.3 [1.1]	5/5	5/5
	2018	70	39	280	32	3 [1]	3/3	3/3
Fish (pg/g-wet)	2002	430	450	24,000	6.8	4.2 [1.4]	70/70	14/14
	2003	220	400	1,900	tr(3.7)	11 [3.5]	70/70	14/14
	2004	410	330	53,000	5.5	3.2 [1.1]	70/70	14/14
	2005	280	330	8,400	tr(3.8)	5.1 [1.7]	80/80	16/16
	2006	300	340	3,000	tr(5)	6 [2]	80/80	16/16
	2007	260	320	1,800	9	5 [2]	80/80	16/16
	2008	280	310	2,900	7	5 [2]	85/85	17/17
	2009	250	300	2,000	4	3 [1]	90/90	18/18
	2010	240	280	2,100	7	3 [1]	18/18	18/18
	2013	280	250	3,300	5.2	3.3 [1.1]	19/19	19/19
	2018	150	150	4,800	tr (2)	3 [1]	18/18	18/18
Birds (pg/g-wet)	2002	440	510	1,300	76	4.2 [1.4]	10/10	2/2
	2003	610	620	1,400	180	11 [3.5]	10/10	2/2
	2004	340	320	700	160	3.2 [1.1]	10/10	2/2
	2005	430	550	900	180	5.1 [1.7]	10/10	2/2
	2006	580	490	1,800	110	6 [2]	10/10	2/2
	2007	480	350	1,900	160	5 [2]	10/10	2/2
	2008	160	170	270	56	5 [2]	10/10	2/2
	2009	300	190	2,900	85	3 [1]	10/10	2/2
	2010	3	---	15	nd	3 [1]	1/2	1/2
	2013**	14	---	46	4.3	3.3 [1.1]	2/2	2/2
	2018**	43	---	63	29	3[1]	2/2	2/2

p,p′-DDE	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	1,000	1,700	6,000	140	2.4 [0.8]	38/38	8/8
	2003	1,200	1,000	6,500	190	5.7 [1.9]	30/30	6/6
	2004	1,300	1,400	8,400	220	8.2 [2.7]	31/31	7/7
	2005	1,200	1,600	6,600	230	8.5 [2.8]	31/31	7/7
	2006	1,000	1,200	6,000	160	1.9 [0.7]	31/31	7/7
	2007	1,100	1,200	5,600	180	3 [1]	31/31	7/7
	2008	900	1,100	5,800	120	3 [1]	31/31	7/7
	2009	940	1,100	6,400	150	4 [1]	31/31	7/7
	2010	1,100	1,300	6,300	230	3 [1]	6/6	6/6
	2013	790	1,600	3,000	170	4.3 [1.4]	5/5	5/5
	2018	420	230	2,200	150	3 [1]	3/3	3/3
Fish (pg/g-wet)	2002	2,900	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	3,000	2,100	52,000	390	8.2 [2.7]	70/70	14/14
	2005	2,400	2,400	73,000	230	8.5 [2.8]	80/80	16/16
	2006	2,200	2,600	28,000	280	1.9 [0.7]	80/80	16/16
	2007	2,200	2,000	22,000	160	3 [1]	80/80	16/16
	2008	2,500	2,000	53,000	320	3 [1]	85/85	17/17
	2009	2,300	2,100	20,000	260	4 [1]	90/90	18/18
	2010	2,300	2,100	13,000	260	3 [1]	18/18	18/18
	2013	2,900	2,800	16,000	430	4.3 [1.4]	19/19	19/19
	2018	1,900	1,700	16,000	290	3 [1]	18/18	18/18

p,p′-DDE	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Birds (pg/g-wet)	2002	36,000	60,000	170,000	8,100	2.4 [0.8]	10/10	2/2
	2003	66,000	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	38,000	57,000	160,000	5,900	1.9 [0.7]	10/10	2/2
	2007	40,000	56,000	320,000	6,700	3 [1]	10/10	2/2
	2008	51,000	79,000	160,000	7,500	3 [1]	10/10	2/2
	2009	30,000	64,000	220,000	4,300	4 [1]	10/10	2/2
	2010	32,000	---	160,000	6,300	3 [1]	2/2	2/2
	2013**	170,000	---	170,000	170,000	4.3 [1.4]	2/2	2/2
	2018**	80,000	---	290,000	22,000	3 [1]	2/2	2/2

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	390	640	2,600	tr(7.5)	9.9 [3.3]	30/30	6/6
	2004	440	240	8,900	7.8	2.2 [0.70]	31/31	7/7
	2005	370	800	1,700	13	2.9 [0.97]	31/31	7/7
	2006	300	480	1,400	7.3	2.4 [0.9]	31/31	7/7
	2007	310	360	1,500	7	3 [1]	31/31	7/7
	2008	280	280	1,300	6	3 [1]	31/31	7/7
	2009	220	170	2,400	5.8	2.4 [0.9]	31/31	7/7
	2010	180	330	960	11	1.3 [0.5]	6/6	6/6
	2013	270	520	1,300	19	1.9 [0.7]	5/5	5/5
Fish (pg/g-wet)	2002	750	680	14,000	80	5.4 [1.8]	70/70	14/14
	2003	510	520	3,700	43	9.9 [3.3]	70/70	14/14
	2004	770	510	9,700	56	2.2 [0.70]	70/70	14/14
	2005	510	650	6,700	29	2.9 [0.97]	80/80	16/16
	2006	520	580	4,300	60	2.4 [0.9]	80/80	16/16
	2007	470	490	4,100	36	3 [1]	80/80	16/16
	2008	460	440	4,100	33	3 [1]	85/85	17/17
	2009	440	460	2,500	57	2.4 [0.9]	90/90	18/18
	2010	560	610	2,900	57	1.3 [0.5]	18/18	18/18
	2013	500	500	4,700	68	1.9 [0.7]	19/19	19/19
Birds (pg/g-wet)	2002	580	740	3,900	140	5.4 [1.8]	10/10	2/2
	2003	640	860	3,900	110	9.9 [3.3]	10/10	2/2
	2004	330	520	1,400	52	2.2 [0.70]	10/10	2/2
	2005	310	540	1,400	45	2.9 [0.97]	10/10	2/2
	2006	410	740	1,800	55	2.4 [0.9]	10/10	2/2
	2007	440	780	2,300	70	3 [1]	10/10	2/2
	2008	240	490	1,100	35	3 [1]	10/10	2/2
	2009	280	430	3,400	31	2.4 [0.9]	10/10	2/2
	2010	440	---	1,600	120	1.3 [0.5]	2/2	2/2
	2013**	140	---	270	70	1.9 [0.7]	2/2	2/2

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) ”**” There is no consistency between the results of the ornithological survey in FY2013 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2011, FY2012, FY2014~FY2017.

<Air>

Stocktaking of the detection of *p,p'*-DDT, *p,p'*-DDE and *p,p'*-DDD in air during FY2002~2015

p,p'-DDT	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2002	1.9	1.8	22	0.25	0.24 [0.08]	102/102	34/34
	2003Warm season	5.8	6.6	24	0.75	0.14 [0.046]	35/35	35/35
	2003Cold season	1.7	1.6	11	0.31		34/34	34/34
	2004Warm season	4.7	5.1	37	0.41	0.22 [0.074]	37/37	37/37
	2004Cold season	1.8	1.7	13	0.29		37/37	37/37
	2005Warm season	4.1	4.2	31	0.44	0.16 [0.054]	37/37	37/37
	2005Cold season	1.1	0.99	4.8	0.25		37/37	37/37
	2006Warm season	4.2	3.8	51	0.35	0.17 [0.06]	37/37	37/37
	2006Cold season	1.4	1.2	7.3	0.29		37/37	37/37
	2007Warm season	4.9	5.2	30	0.6	0.07 [0.03]	36/36	36/36
	2007Cold season	1.2	1.2	8.8	0.23		36/36	36/36
	2008Warm season	3.6	3.0	27	0.76	0.07 [0.03]	37/37	37/37
	2008Cold season	1.2	1.0	15	0.22		37/37	37/37
	2009Warm season	3.6	3.6	28	0.44	0.07 [0.03]	37/37	37/37
	2009Cold season	1.1	1.0	8.0	0.20		37/37	37/37
	2010Warm season	3.5	3.1	56	0.28	0.10 [0.03]	37/37	37/37
	2010Cold season	1.3	0.89	16	0.30		37/37	37/37
	2013Warm season	2.8	3.6	17	0.20	0.11 [0.04]	36/36	36/36
	2013Cold season	0.65	0.53	4.5	0.18		36/36	36/36
	2015Warm season	1.5	1.8	13	0.18	0.15 [0.05]	35/35	35/35

p,p'-DDE	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2002	2.8	2.7	28	0.56	0.09 [0.03]	102/102	34/34
	2003Warm season	7.2	7.0	51	1.2	0.40 [0.13]	35/35	35/35
	2003Cold season	2.8	2.4	22	1.1		34/34	34/34
	2004Warm season	6.1	6.3	95	0.62	0.12 [0.039]	37/37	37/37
	2004Cold season	2.9	2.6	43	0.85		37/37	37/37
	2005Warm season	5.0	5.7	42	1.2	0.14 [0.034]	37/37	37/37
	2005Cold season	1.7	1.5	9.9	0.76		37/37	37/37
	2006Warm season	5.0	4.7	49	1.7	0.10 [0.03]	37/37	37/37
	2006Cold season	1.9	1.7	9.5	0.52		37/37	37/37
	2007Warm season	6.4	6.1	120	0.54	0.04 [0.02]	36/36	36/36
	2007Cold season	2.1	1.9	39	0.73		36/36	36/36
	2008Warm season	4.8	4.4	96	0.98	0.04 [0.02]	37/37	37/37
	2008Cold season	2.2	2.0	22	0.89		37/37	37/37
	2009Warm season	4.9	4.8	130	0.87	0.08 [0.03]	37/37	37/37
	2009Cold season	2.1	1.9	100	0.60		37/37	37/37
	2010Warm season	4.9	4.1	200	tr(0.41)	0.62 [0.21]	37/37	37/37
	2010Cold season	2.2	1.8	28	tr(0.47)		37/37	37/37
	2013Warm season	4.1	4.3	37	0.2	0.10 [0.03]	36/36	36/36
	2013Cold season	1.6	1.5	11	0.6		36/36	36/36
	2015Warm season	2.4	2.6	34	0.31	0.12 [0.04]	35/35	35/35

p,p′-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Air (pg/m^3)	2002	0.12	0.13	0.76	nd	0.018 [0.006]	101/102	34/34
	2003Warm season	0.30	0.35	1.4	0.063	0.054 [0.018]	35/35	35/35
	2003Cold season	0.13	0.14	0.52	tr(0.037)		34/34	34/34
	2004Warm season	0.24	0.27	1.4	tr(0.036)	0.053 [0.018]	37/37	37/37
	2004Cold season	0.12	0.12	0.91	tr(0.025)		37/37	37/37
	2005Warm season	0.24	0.26	1.3	tr(0.07)	0.16 [0.05]	37/37	37/37
	2005Cold season	tr(0.06)	tr(0.07)	0.29	nd		28/37	28/37
	2006Warm season	0.28	0.32	1.3	nd	0.13 [0.04]	36/37	36/37
	2006Cold season	0.14	tr(0.12)	0.99	nd		36/37	36/37
	2007Warm season	0.26	0.27	1.4	0.046	0.011 [0.004]	36/36	36/36
	2007Cold season	0.093	0.087	0.5	0.026		36/36	36/36
	2008Warm season	0.17	0.17	1.1	0.037	0.025 [0.009]	37/37	37/37
	2008Cold season	0.091	0.081	0.31	0.036		37/37	37/37
	2009Warm season	0.17	0.18	0.82	0.03	0.03 [0.01]	37/37	37/37
	2009Cold season	0.08	0.08	0.35	tr(0.02)		37/37	37/37
	2010Warm season	0.20	0.17	1.7	0.04	0.02 [0.01]	37/37	37/37
	2010Cold season	0.10	0.09	0.41	0.02		37/37	37/37
	2013Warm season	0.16	0.18	0.80	0.027	0.018 [0.007]	36/36	36/36
	2013Cold season	0.056	0.054	0.14	tr(0.015)		36/36	36/36
	2015Warm season	nd	nd	tr(0.31)	nd	0.33 [0.11]	17/35	17/35

(Note) No monitoring was conducted in FY2011, FY2012 and FY2014.

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

<Surface Water>

Stocktaking of the detection of *o,p′*-DDT, *o,p′*-DDE and *o,p′*-DDD in surface water during FY2002~2014

o,p′-DDT	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface Water (pg/L)	2002	5.4	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
	2010	1.5	tr(1.2)	700	nd	1.5 [0.5]	43/49	43/49
	2014	1.0	1.0	63	nd	0.4 [0.2]	42/48	42/48

o,p′-DDE	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface Water (pg/L)	2002	2.4	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
	2010	0.97	0.65	180	tr(0.13)	0.24 [0.09]	49/49	49/49
	2014	0.6	0.6	560	nd	0.3 [0.1]	36/48	36/48

o,p′-DDD	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	5.6	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
	2010	4.6	3.8	170	tr(0.5)	0.6 [0.2]	49/49	49/49
	2014	3.7	3.2	38	0.33	0.20 [0.08]	48/48	48/48

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.

(Note 2) No monitoring was conducted during FY2011~2013.

<Sediment>

Stocktaking of the detection of *o,p′*-DDT, *o,p′*-DDE and *o,p′*-DDD in sediment during FY2002~2014

o,p′-DDT	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	76	47	27,000	nd	6 [2]	183/189	62/63
	2003	50	43	3,200	nd	0.8 [0.3]	185/186	62/62
	2004	69	50	17,000	tr(1.1)	2 [0.6]	189/189	63/63
	2005	58	46	160,000	0.8	0.8 [0.3]	189/189	63/63
	2006	57	52	18,000	tr(0.8)	1.2 [0.4]	192/192	64/64
	2007	38	31	27,000	nd	1.8 [0.6]	186/192	63/64
	2008	51	40	140,000	tr(0.7)	1.5 [0.6]	192/192	64/64
	2009	44	30	100,000	nd	1.2 [0.5]	190/192	64/64
	2010	40	33	13,000	1.4	1.1 [0.4]	64/64	64/64
	2014	26	24	2,400	nd	0.4 [0.2]	62/63	62/63

o,p′-DDE	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	54	37	16,000	nd	3 [1]	188/189	63/63
	2003	48	39	24,000	tr(0.5)	0.6 [0.2]	186/186	62/62
	2004	40	34	28,000	nd	3 [0.8]	184/189	63/63
	2005	40	32	31,000	nd	2.6 [0.9]	181/189	62/63
	2006	42	40	27,000	tr(0.4)	1.1 [0.4]	192/192	64/64
	2007	37	41	25,000	nd	1.2 [0.4]	186/192	63/64
	2008	50	48	37,000	nd	1.4 [0.6]	186/192	63/64
	2009	37	31	33,000	nd	0.6 [0.2]	191/192	64/64
	2010	37	32	25,000	tr(0.7)	1.2 [0.5]	64/64	64/64
	2014	30	32	41,000	tr(0.5)	0.8 [0.3]	63/63	63/63

o,p′-DDD	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	160	150	14,000	nd	6 [2]	184/189	62/63
	2003	160	130	8,800	tr(1.0)	2 [0.5]	186/186	62/62
	2004	140	120	16,000	tr(0.7)	2 [0.5]	189/189	63/63
	2005	130	110	32,000	tr(0.8)	1.0 [0.3]	189/189	63/63
	2006	120	110	13,000	tr(0.3)	0.5 [0.2]	192/192	64/64
	2007	110	130	21,000	tr(0.5)	1.0 [0.4]	192/192	64/64
	2008	170	150	50,000	0.5	0.3 [0.1]	192/192	64/64
	2009	120	120	24,000	0.5	0.5 [0.2]	192/192	64/64
	2010	130	130	6,900	tr(0.8)	0.9 [0.4]	64/64	64/64
	2014	74	85	3,200	tr(0.7)	1.2 [0.5]	63/63	63/63

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) No monitoring was conducted during FY2011~2013.

<Wildlife>

Stocktaking of the detection of *o,p'*-DDT, *o,p'*-DDE and *o,p'*-DDD in wildlife (bivalves, fish and birds) during FY2002~2018

o,p'-DDT	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2002	110	83	480	22	12 [4]	38/38	8/8
	2003	130	120	480	35	2.9 [0.97]	30/30	6/6
	2004	160	140	910	20	1.8 [0.61]	31/31	7/7
	2005	98	57	440	29	2.6 [0.86]	31/31	7/7
	2006	92	79	380	24	3 [1]	31/31	7/7
	2007	79	52	350	20	3 [1]	31/31	7/7
	2008	58	37	330	5	3 [1]	31/31	7/7
	2009	74	48	2,500	17	2.2 [0.8]	31/31	7/7
	2010	51	67	160	15	3 [1]	6/6	6/6
	2013	49	51	180	12	3 [1]	5/5	5/5
	2018	24	12	120	10	2.7 [0.9]	3/3	3/3
Fish (pg/g-wet)	2002	130	130	2,300	tr(6)	12 [4]	70/70	14/14
	2003	85	120	520	2.9	2.9 [0.97]	70/70	14/14
	2004	160	140	1,800	3.7	1.8 [0.61]	70/70	14/14
	2005	100	110	1,500	5.8	2.6 [0.86]	80/80	16/16
	2006	100	110	700	6	3 [1]	80/80	16/16
	2007	69	90	430	3	3 [1]	80/80	16/16
	2008	72	92	720	3	3 [1]	85/85	17/17
	2009	61	73	470	2.4	2.2 [0.8]	90/90	18/18
	2010	58	71	550	5	3 [1]	18/18	18/18
	2013	58	76	310	4	3 [1]	19/19	19/19
	2018	34	34	1,500	tr(1.1)	2.7 [0.9]	18/18	18/18
Birds (pg/g-wet)	2002	12	tr(10)	58	nd	12 [4]	8/10	2/2
	2003	24	16	66	8.3	2.9 [0.97]	10/10	2/2
	2004	8.5	13	43	tr(0.87)	1.8 [0.61]	10/10	2/2
	2005	11	14	24	3.4	2.6 [0.86]	10/10	2/2
	2006	14	10	120	3	3 [1]	10/10	2/2
	2007	9	9	26	tr(2)	3 [1]	10/10	2/2
	2008	4	6	16	nd	3 [1]	8/10	2/2
	2009	6.3	7.6	12	tr(1.4)	2.2 [0.8]	10/10	2/2
	2010	nd	---	nd	nd	3 [1]	0/2	0/2
	2013**	nd	---	tr(1)	nd	3 [1]	1/2	1/2
	2018**	tr(1.1)	---	tr(2.5)	nd	2.7 [0.9]	1/2	1/2

o,p'-DDE	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2002	83	66	1,100	13	3.6 [1.2]	38/38	8/8
	2003	85	100	460	17	3.6 [1.2]	30/30	6/6
	2004	86	69	360	19	2.1 [0.69]	31/31	7/7
	2005	70	89	470	12	3.4 [1.1]	31/31	7/7
	2006	62	81	340	12	3 [1]	31/31	7/7
	2007	56	69	410	8.9	2.3 [0.9]	31/31	7/7
	2008	49	52	390	8	3 [1]	31/31	7/7
	2009	46	58	310	8	3 [1]	31/31	7/7
	2010	46	58	160	7.8	1.5 [0.6]	6/6	6/6
	2013	28	31	260	4	4 [1]	5/5	5/5
	2018	20	15	250	tr(2)	3 [1]	3/3	3/3
Fish (pg/g-wet)	2002	91	50	13,000	3.6	3.6 [1.2]	70/70	14/14
	2003	51	54	2,500	nd	3.6 [1.2]	67/70	14/14
	2004	76	48	5,800	tr(0.89)	2.1 [0.69]	70/70	14/14
	2005	54	45	12,000	tr(1.4)	3.4 [1.1]	80/80	16/16
	2006	56	43	4,800	tr(1)	3 [1]	80/80	16/16
	2007	45	29	4,400	nd	2.3 [0.9]	79/80	16/16
	2008	50	37	13,000	tr(1)	3 [1]	85/85	17/17
	2009	46	33	4,300	tr(1)	3 [1]	90/90	18/18
	2010	47	37	2,800	tr(1.2)	1.5 [0.6]	18/18	18/18
	2013	51	40	3,000	tr(1)	4 [1]	19/19	19/19
	2018	32	27	2,000	nd	3 [1]	17/18	17/18

o,p′-DDE	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Birds (pg/g-wet)	2002	28	26	49	20	3.6 [1.2]	10/10	2/2
	2003	tr(2.3)	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(1.2)	tr(1.9)	tr(2.9)	nd	3.4 [1.1]	7/10	2/2
	2006	tr(1)	tr(2)	3	tr(1)	3 [1]	10/10	2/2
	2007	tr(1.0)	tr(1.4)	2.8	nd	2.3 [0.9]	6/10	2/2
	2008	tr(1)	nd	3	nd	3 [1]	5/10	1/2
	2009	nd	tr(1)	tr(2)	nd	3 [1]	6/10	2/2
	2010	tr(1.1)	---	3.7	nd	1.5 [0.6]	1/2	1/2
	2013**	nd	---	tr(1)	nd	4 [1]	1/2	1/2
	2018**	tr(1)	tr(1)	tr(1)	tr(1)	3 [1]	2/2	2/2

o,p′-DDD	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	120	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	220	130	2,800	6.0	5.7 [1.9]	31/31	7/7
	2005	170	280	1,800	10	3.3 [1.1]	31/31	7/7
	2006	150	200	1,000	7	4 [1]	31/31	7/7
	2007	150	200	1,200	6	3 [1]	31/31	7/7
	2008	130	140	1,100	5	4 [2]	31/31	7/7
	2009	95	51	1,000	5	3 [1]	31/31	7/7
	2010	57	50	400	5.8	0.6 [0.2]	6/6	6/6
	2013	100	74	1,800	7.8	1.8 [0.7]	5/5	5/5
	2018	46	27	720	4.9	2.4 [0.9]	3/3	3/3
Fish (pg/g-wet)	2002	95	90	1,100	nd	12 [4]	66/70	14/14
	2003	75	96	920	nd	6.0 [2.0]	66/70	14/14
	2004	120	96	1,700	nd	5.7 [1.9]	68/70	14/14
	2005	83	81	1,400	nd	3.3 [1.1]	79/80	16/16
	2006	80	86	1,100	tr(1)	4 [1]	80/80	16/16
	2007	66	62	1,300	nd	3 [1]	78/80	16/16
	2008	65	74	1,000	nd	4 [2]	80/85	16/17
	2009	63	64	760	nd	3 [1]	87/90	18/18
	2010	75	99	700	2.6	0.6 [0.2]	18/18	18/18
	2013	70	85	940	nd	1.8 [0.7]	18/19	18/19
	2018	40	39	1,100	nd	2.4 [0.9]	17/18	17/18
Birds (pg/g-wet)	2002	15	15	23	tr(8)	12 [4]	10/10	2/2
	2003	15	14	36	tr(5.0)	6.0 [2.0]	10/10	2/2
	2004	6.1	5.7	25	nd	5.7 [1.9]	9/10	2/2
	2005	7.3	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
	2010	6.3	---	11	3.6	0.6 [0.2]	2/2	2/2
	2013**	5.4	---	12	2.4	1.8 [0.7]	2/2	2/2
	2018**	6.1	6.8	9.9	3.7	2.4 [0.9]	2/2	2/2

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note2)"**" There is no consistency between the results of the ornithological survey in FY2013 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2011 and FY2012, FY2014~FY2017.

<Air>

Stocktaking of the detection of *o,p'*-DDT, *o,p'*-DDE and *o,p'*-DDD in air during FY2002~2015

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
	2003Warm season	6.9	7.7	38	0.61	0.12 [0.040]	35/35	35/35
	2003Cold season	1.6	1.4	6.4	0.43		34/34	34/34
	2004Warm season	5.1	5.4	22	0.54	0.093 [0.031]	37/37	37/37
	2004Cold season	1.5	1.4	9.4	0.35		37/37	37/37
	2005Warm season	3.0	3.1	14	0.67	0.10 [0.034]	37/37	37/37
	2005Cold season	0.76	0.67	3.0	0.32		37/37	37/37
	2006Warm season	2.5	2.4	20	0.55	0.09 [0.03]	37/37	37/37
	2006Cold season	0.90	0.79	3.9	0.37		37/37	37/37
	2007Warm season	2.9	2.6	19	0.24	0.03 [0.01]	36/36	36/36
	2007Cold season	0.77	0.63	3.4	0.31		36/36	36/36
	2008Warm season	2.3	2.1	18	0.33	0.03 [0.01]	37/37	37/37
	2008Cold season	0.80	0.62	6.5	0.32		37/37	37/37
	2009Warm season	2.3	2.2	14	0.33	0.019 [0.008]	37/37	37/37
	2009Cold season	0.80	0.71	3.7	0.20		37/37	37/37
	2010Warm season	2.2	1.9	26	0.19	0.14 [0.05]	37/37	37/37
	2010Cold season	0.81	0.69	5.5	0.22		37/37	37/37
	2013Warm season	1.7	1.7	12	0.15	0.054 [0.018]	36/36	36/36
	2013Cold season	0.47	0.44	2.4	0.20		36/36	36/36
	2015Warm season	0.99	1.2	6.8	0.14	0.12 [0.04]	35/35	35/35

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
	2003Warm season	1.4	1.5	7.5	0.17	0.020 [0.0068]	35/35	35/35
	2003Cold season	0.50	0.47	1.7	0.18		34/34	34/34
	2004Warm season	1.1	1.2	8.9	0.14	0.037 [0.012]	37/37	37/37
	2004Cold season	0.53	0.49	3.9	0.14		37/37	37/37
	2005Warm season	1.6	1.5	7.9	0.33	0.074 [0.024]	37/37	37/37
	2005Cold season	0.62	0.59	2.0	0.24		37/37	37/37
	2006Warm season	1.1	1.1	7.4	nd	0.09 [0.03]	36/37	36/37
	2006Cold season	0.65	0.56	2.6	0.19		37/37	37/37
	2007Warm season	0.66	0.67	7	0.096	0.017 [0.007]	36/36	36/36
	2007Cold season	0.3	0.29	3.7	0.12		36/36	36/36
	2008Warm season	0.48	0.52	5.0	0.11	0.025 [0.009]	37/37	37/37
	2008Cold season	0.30	0.24	1.1	0.15		37/37	37/37
	2009Warm season	0.51	0.46	6.7	0.098	0.016 [0.006]	37/37	37/37
	2009Cold season	0.27	0.24	23	0.072		37/37	37/37
	2010Warm season	0.49	0.41	9.0	0.09	0.04 [0.01]	37/37	37/37
	2010Cold season	0.27	0.23	2.3	0.08		37/37	37/37
	2013Warm season	0.38	0.35	3.3	0.051	0.023 [0.009]	36/36	36/36
	2013Cold season	0.21	0.19	0.65	0.097		36/36	36/36
	2015Warm season	0.25	0.24	1.1	nd	0.18 [0.06]	34/35	34/35

o,p′-DDD	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2002	0.14	0.18	0.85	nd	0.021 [0.007]	97/102	33/34
	2003Warm season	0.37	0.42	1.3	0.059	0.042 [0.014]	35/35	35/35
	2003Cold season	0.15	0.14	0.42	0.062		34/34	34/34
	2004Warm season	0.31	0.33	2.6	tr(0.052)	0.14 [0.048]	37/37	37/37
	2004Cold season	0.14	tr(0.13)	0.86	nd		35/37	35/37
	2005Warm season	0.22	0.19	0.90	tr(0.07)	0.10 [0.03]	37/37	37/37
	2005Cold season	tr(0.07)	tr(0.07)	0.21	nd		35/37	35/37
	2006Warm season	0.28	0.28	1.4	tr(0.05)	0.10 [0.03]	37/37	37/37
	2006Cold season	0.12	0.11	0.79	nd		34/37	34/37
	2007Warm season	0.28	0.29	1.9	0.05	0.05 [0.02]	36/36	36/36
	2007Cold season	0.095	0.09	0.33	tr(0.03)		36/36	36/36
	2008Warm season	0.19	0.16	1.6	0.05	0.04 [0.01]	37/37	37/37
	2008Cold season	0.10	0.09	0.26	0.04		37/37	37/37
	2009Warm season	0.20	0.19	0.90	0.04	0.03 [0.01]	37/37	37/37
	2009Cold season	0.08	0.08	0.28	tr(0.02)		37/37	37/37
	2010Warm season	0.21	0.19	1.8	0.04	0.03 [0.01]	37/37	37/37
	2010Cold season	0.10	0.09	0.48	tr(0.02)		37/37	37/37
	2013Warm season	0.17	0.18	1.2	tr(0.03)	0.05 [0.02]	36/36	36/36
	2013Cold season	0.06	0.06	0.17	nd		35/36	35/36
	2015Warm season	tr(0.09)	tr(0.10)	0.37	nd	0.20 [0.07]	25/35	25/35

(Note) No monitoring was conducted in FY2011, FY2012 and FY2014.

[7] Chlordanes (references)

・ History and state of monitoring

Chlordane was used as insecticides on a range of agricultural crops, but the registration of Chlordanes under the Agricultural Chemicals Regulation Law was expired in FY1968. 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. Also *cis*-Chlordane and *trans*-Chlordane are one of the original twelve POPs covered by the Stockholm Convention.

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 FY1983, 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 FY1982 High-Precision Environmental Survey.

In previous monitoring series, Chlordanes had been monitored in wildlife (bivalves, fish and birds) during the period of FY1978~2001 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 FY1986~1998 and FY1986~2001, 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 from FY2002~2013, FY2016 and FY2017.

No monitoring was conducted in FY2018 and FY2019. For reference, the monitoring results up to FY2017 are given below.

・ Monitoring results until FY2017

〇 *cis*-Chlordane and *trans*-Chlordane

<Surface Water>

Stocktaking of the detection of *cis*-Chlordane and *trans*-Chlordane in surface water FY2002~2017

cis-Chlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	42	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
	2010	19	14	170	nd	11 [4]	47/49	47/49
	2011	20	16	500	3.8	1.4 [0.6]	49/49	49/49
	2012	43	37	350	10	1.6 [0.6]	48/48	48/48
	2013	18	16	260	2.9	2.7 [0.9]	48/48	48/48
	2017	19	19	210	2	2 [1]	47/47	47/47

trans-Chlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	33	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
	2010	15	tr(11)	310	nd	13 [4]	44/49	44/49
	2011	16	13	470	3.2	1.0 [0.4]	49/49	49/49
	2012	41	33	300	12	2.5 [0.8]	48/48	48/48
	2013	15	13	200	3	3 [1]	48/48	48/48
	2017	15	15	150	tr(2)	3 [1]	47/47	47/47

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.
(Note 2) No monitoring was conducted during FY2014~2016.

<Sediment>

Stocktaking of the detection of *cis*-Chlordane and *trans*-Chlordane in sediment FY2002~2017

cis-Chlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	140	98	18,000	1.8	0.9 [0.3]	189/189	63/63
	2003	190	140	19,000	tr(3.6)	4 [2]	186/186	62/62
	2004	160	97	36,000	4	4 [2]	189/189	63/63
	2005	150	100	44,000	3.3	1.9 [0.64]	189/189	63/63
	2006	100	70	13,000	tr(0.9)	2.4 [0.8]	192/192	64/64
	2007	82	55	7,500	nd	5 [2]	191/192	64/64
	2008	100	63	11,000	tr(2.3)	2.4 [0.9]	192/192	64/64
	2009	84	61	8,600	2.0	0.7 [0.3]	192/192	64/64
	2010	82	62	7,200	tr(4)	6 [2]	64/64	64/64
	2011	70	58	4,500	1.7	1.1 [0.4]	64/64	64/64
	2012	69	61	11,000	tr(2.6)	2.9 [1.0]	63/63	63/63
	2013	65	55	5,400	tr(1.9)	2.0 [0.8]	63/63	63/63
	2017	47	36	2,800	nd	4.8 [1.6]	61/62	61/62
trans-Chlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	150	110	16,000	2.1	1.8 [0.6]	189/189	63/63
	2003	130	100	13,000	tr(2.4)	4 [2]	186/186	62/62
	2004	110	80	26,000	3	3 [0.9]	189/189	63/63
	2005	110	81	32,000	3.4	2.3 [0.84]	189/189	63/63
	2006	110	76	12,000	2.2	1.1 [0.4]	192/192	64/64
	2007	82	58	7,500	nd	2.2 [0.8]	191/192	64/64
	2008	110	66	10,000	2.4	2.0 [0.8]	192/192	64/64
	2009	91	68	8,300	2.1	1.7 [0.7]	192/192	64/64
	2010	95	69	8,000	tr(4)	11 [4]	64/64	64/64
	2011	73	64	4,300	3.2	1.3 [0.5]	64/64	64/64
	2012	80	71	13,000	tr(2.9)	4.0 [1.3]	63/63	63/63
	2013	74	65	5,600	2.5	1.8 [0.7]	63/63	63/63
	2017	53	41	3,000	tr(1)	4 [1]	62/62	62/62

(Note) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

<Wildlife>

Stocktaking of the detection of *cis*-Chlordane and *trans*-Chlordane in wildlife (bivalves, fish and birds) FY2002~2016

cis-Chlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	730	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	1,300	1,600	14,000	91	18 [5.8]	31/31	7/7
	2005	1,000	960	13,000	78	12 [3.9]	31/31	7/7
	2006	970	1,100	18,000	67	4 [1]	31/31	7/7
	2007	870	590	19,000	59	5 [2]	31/31	7/7
	2008	750	560	11,000	85	5 [2]	31/31	7/7
	2009	1,200	1,100	16,000	83	4 [2]	31/31	7/7
	2010	1,600	2,300	15,000	67	4 [2]	6/6	6/6
	2011	790	880	3,400	160	3 [1]	4/4	4/4
	2012	710	500	3,500	180	5 [2]	5/5	5/5
	2013	410	410	2,000	75	13 [4]	5/5	5/5
	2016	220	260	500	80	3 [1]	3/3	3/3
Fish (pg/g-wet)	2002	610	550	6,900	57	2.4 [0.8]	70/70	14/14
	2003	510	400	4,400	43	3.9 [1.3]	70/70	14/14
	2004	620	490	9,800	68	18 [5.8]	70/70	14/14
	2005	520	600	8,000	42	12 [3.9]	80/80	16/16
	2006	520	420	4,900	56	4 [1]	80/80	16/16
	2007	430	360	5,200	30	5 [2]	80/80	16/16
	2008	430	340	3,500	36	5 [2]	85/85	17/17
	2009	430	450	3,200	41	4 [2]	90/90	18/18
	2010	450	630	3,400	51	4 [2]	18/18	18/18
	2011	580	660	3,800	79	3 [1]	18/18	18/18
	2012	580	550	3,100	98	5 [2]	19/19	19/19
	2013	540	450	5,700	65	13 [4]	19/19	19/19
	2016	340	440	2,200	67	3 [1]	19/19	19/19
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	53	120	340	tr(5.8)	12 [3.9]	10/10	2/2
	2006	32	83	250	5	4 [1]	10/10	2/2
	2007	29	83	230	tr(4)	5 [2]	10/10	2/2
	2008	24	87	280	tr(3)	5 [2]	10/10	2/2
	2009	21	48	130	4	4 [2]	10/10	2/2
	2010	27	---	180	4	4 [2]	2/2	2/2
	2011	---	---	6	6	3 [1]	1/1	1/1
	2012	23	---	110	5	5 [2]	2/2	2/2
	2013**	37	---	140	tr(10)	13 [4]	2/2	2/2
	2016**	38	---	110	13	3 [1]	2/2	2/2

trans-Chlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	390	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	560	770	2,800	53	48 [16]	31/31	7/7
	2005	470	660	2,400	40	10 [3.5]	31/31	7/7
	2006	470	580	2,800	41	4 [2]	31/31	7/7
	2007	440	460	1,500	34	6 [2]	31/31	7/7
	2008	360	410	1,300	52	7 [3]	31/31	7/7
	2009	540	560	16,000	48	4 [1]	31/31	7/7
	2010	520	640	5,500	31	3 [1]	6/6	6/6
	2011	490	470	2,900	150	4 [1]	4/4	4/4
	2012	390	310	1,300	140	7 [2]	5/5	5/5
	2013	280	230	1,700	58	16 [5.2]	5/5	5/5
	2016	120	99	330	56	6 [2]	3/3	3/3

trans-Chlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Fish (pg/g-wet)	2002	190	160	2,700	20	2.4 [0.8]	70/70	14/14
	2003	160	120	1,800	9.6	7.2 [2.4]	70/70	14/14
	2004	200	130	5,200	tr(17)	48 [16]	70/70	14/14
	2005	160	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	130	100	2,100	8	6 [2]	80/80	16/16
	2008	120	71	1,300	14	7 [3]	85/85	17/17
	2009	130	140	1,300	10	4 [1]	90/90	18/18
	2010	120	170	1,100	9	3 [1]	18/18	18/18
	2011	180	240	1,300	20	4 [1]	18/18	18/18
	2012	170	140	1,100	19	7 [2]	19/19	19/19
	2013	160	170	2,700	tr(14)	16 [5.2]	19/19	19/19
	2016	100	110	800	12	6 [2]	19/19	19/19
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	nd	nd	tr(26)	nd	48 [16]	5/10	1/2
	2005	11	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(5)	9	27	nd	7 [3]	7/10	2/2
	2009	6	7	13	tr(3)	4 [1]	10/10	2/2
	2010	4	---	10	tr(2)	3 [1]	2/2	2/2
	2011	---	---	5	5	4 [1]	1/1	1/1
	2012	tr(6)	---	10	tr(4)	7 [2]	2/2	2/2
	2013**	26	---	68	tr(10)	16 [5.2]	2/2	2/2
	2016**	18	---	46	7	6 [2]	2/2	2/2

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) " ** " : There is no consistency between the results of the ornithological survey after FY2013 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted during FY2014~2015.

<Air>

Stocktaking of the detection of *cis*-Chlordane and *trans*-Chlordane in air FY2002~2016

cis-Chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Air (pg/m^3)	2002	31	40	670	0.86	0.60 [0.20]	102/102	34/34
	2003Warm season	110	120	1,600	6.4	0.51 [0.17]	35/35	35/35
	2003Cold season	30	38	220	2.5		34/34	34/34
	2004Warm season	92	160	1,000	2.3	0.57 [0.19]	37/37	37/37
	2004Cold season	29	49	290	1.2		37/37	37/37
	2005Warm season	92	120	1,000	3.4	0.16 [0.054]	37/37	37/37
	2005Cold season	16	19	260	1.4		37/37	37/37
	2006Warm season	82	110	760	2.9	0.13 [0.04]	37/37	37/37
	2006Cold season	19	19	280	2.0		37/37	37/37
	2007Warm season	90	120	1,100	3.3	0.10 [0.04]	36/36	36/36
	2007Cold season	17	20	230	1.4		36/36	36/36
	2008Warm season	75	120	790	1.9	0.14 [0.05]	37/37	37/37
	2008Cold season	21	34	200	1.5		37/37	37/37
	2009Warm season	67	110	790	2.7	0.16 [0.06]	37/37	37/37
	2009Cold season	19	22	180	0.65		37/37	37/37
	2010Warm season	68	100	700	2.2	0.9 [0.3]	37/37	37/37
	2010Cold season	20	27	130	tr(0.8)		37/37	37/37
	2011Warm season	66	95	700	1.5	1.3 [0.42]	35/35	35/35
	2011Cold season	20	31	240	tr(0.88)		37/37	37/37
	2012Warm season	61	98	650	2.9	1.5 [0.51]	36/36	36/36
	2012Cold season	10	14	74	nd		35/36	35/36
	2013Warm season	58	97	580	1.5	0.7 [0.2]	36/36	36/36
	2013Cold season	11	15	86	tr(0.5)		36/36	36/36
	2016Warm season	53	86	810	0.9	0.9 [0.3]	37/37	37/37

trans-Chlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Air (pg/m^3)	2002	36	48	820	0.62	0.60 [0.20]	102/102	34/34
	2003Warm season	130	150	2,000	6.5	0.86 [0.29]	35/35	35/35
	2003Cold season	37	44	290	2.5		34/34	34/34
	2004Warm season	110	190	1,300	2.2	0.69 [0.23]	37/37	37/37
	2004Cold season	35	60	360	1.5		37/37	37/37
	2005Warm season	100	130	1,300	3.2	0.34 [0.14]	37/37	37/37
	2005Cold season	19	23	310	1.9		37/37	37/37
	2006Warm season	96	140	1,200	3.4	0.17 [0.06]	37/37	37/37
	2006Cold season	22	21	350	2.0		37/37	37/37
	2007Warm season	100	140	1,300	3.8	0.12 [0.05]	36/36	36/36
	2007Cold season	20	24	300	1.5		36/36	36/36
	2008Warm season	87	130	990	2.5	0.17 [0.06]	37/37	37/37
	2008Cold season	25	41	250	1.8		37/37	37/37
	2009Warm season	79	120	960	2.6	0.12 [0.05]	37/37	37/37
	2009Cold season	23	30	210	0.68		37/37	37/37
	2010Warm season	79	120	820	2.0	1.2 [0.4]	37/37	37/37
	2010Cold season	24	34	150	tr(1.0)		37/37	37/37
	2011Warm season	76	110	810	tr(1.4)	1.6 [0.53]	35/35	35/35
	2011Cold season	24	37	290	tr(0.70)		37/37	37/37
	2012Warm season	70	120	780	2.8	2.1 [0.7]	36/36	36/36
	2012Cold season	12	18	95	nd		35/36	35/36
	2013Warm season	64	120	690	1.7	0.8 [0.3]	36/36	36/36
	2013Cold season	13	18	110	tr(0.4)		36/36	36/36
	2016Warm season	61	95	1,100	tr(0.7)	1.0 [0.3]	37/37	37/37

(Note) No monitoring was conducted in FY2014 and FY2015.

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

<Surface Water>

Stocktaking of the detection of Oxychlordane, *cis*-Nonachlor and *trans*-Nonachlor in surface water FY2002~2017

Oxychlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface Water (pg/L)	2002	2.7	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
	2010	1.5	1.3	45	nd	0.7 [0.3]	47/49	47/49
	2011	1.9	1.8	34	nd	1.3 [0.5]	44/49	44/49
	2012	2.2	2.3	17	nd	0.9 [0.4]	44/48	44/48
	2013	1.8	1.8	12	nd	0.9 [0.4]	41/48	41/48
	2017	nd	nd	12	nd	4 [2]	19/47	19/47

cis-Nonachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Surface Water (pg/L)	2002	7.9	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
	2010	5.4	3.9	40	tr(0.9)	1.3 [0.4]	49/49	49/49
	2011	5.0	4.3	130	0.8	0.6 [0.2]	49/49	49/49
	2012	6.4	5.9	58	1.1	0.8 [0.3]	48/48	48/48
	2013	5.1	4.6	74	tr(0.7)	0.8 [0.3]	48/48	48/48
	2017	4.6	4.6	36	tr(0.6)	1.5 [0.6]	47/47	47/47

trans-Nonachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	30	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
	2010	12	11	93	nd	8 [3]	45/49	45/49
	2011	15	12	480	2.6	1.3 [0.5]	49/49	49/49
	2012	30	26	210	7.9	1.5 [0.6]	48/48	48/48
	2013	14	11	170	2.3	1.5 [0.6]	48/48	48/48
	2017	13	14	120	tr(2)	3 [1]	47/47	47/47

(Note) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.

<Sediment>

Stocktaking of the detection of Oxychlordane, *cis*-Nonachlor and *trans*-Nonachlor in sediment FY2002~2017

Oxychlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	2.7	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(2.1)	tr(1.3)	140	nd	3 [0.8]	129/189	54/63
	2005	2.3	tr(1.9)	160	nd	2.0 [0.7]	133/189	51/63
	2006	tr(2.5)	tr(1.7)	280	nd	2.9 [1.0]	141/192	54/64
	2007	tr(2.1)	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
	2010	1.7	1.2	60	nd	1.0 [0.4]	56/64	56/64
	2011	tr(1.6)	tr(1.2)	83	nd	2.2 [0.9]	36/64	36/64
	2012	tr(1.4)	tr(1.0)	75	nd	1.7 [0.7]	38/63	38/63
	2013	1.5	1.3	54	nd	1.3 [0.5]	50/63	50/63
	2017	tr(1)	tr(1)	78	nd	3 [1]	41/62	41/62
cis-Nonachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	76	66	7,800	nd	2.1 [0.7]	188/189	63/63
	2003	66	50	6,500	nd	3 [0.9]	184/186	62/62
	2004	53	34	9,400	tr(0.8)	2 [0.6]	189/189	63/63
	2005	56	42	9,900	tr(1.1)	1.9 [0.64]	189/189	63/63
	2006	58	48	5,800	tr(0.6)	1.2 [0.4]	192/192	64/64
	2007	48	35	4,200	nd	1.6 [0.6]	191/192	64/64
	2008	57	42	5,100	1.1	0.6 [0.2]	192/192	64/64
	2009	53	38	4,700	1.4	1.0 [0.4]	192/192	64/64
	2010	53	45	3,600	2.3	0.9 [0.3]	64/64	64/64
	2011	41	38	2,900	nd	1.1 [0.4]	63/64	63/64
	2012	44	35	4,900	tr(1)	3 [1]	63/63	63/63
	2013	41	31	3,100	tr(0.6)	0.7 [0.3]	63/63	63/63
	2017	31	25	1,500	nd	1.7 [0.7]	61/62	61/62

trans-Nonachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	130	83	13,000	3.1	1.5 [0.5]	189/189	63/63
	2003	110	78	11,000	2	2 [0.6]	186/186	62/62
	2004	94	63	23,000	3	2 [0.6]	189/189	63/63
	2005	99	72	24,000	2.4	1.5 [0.54]	189/189	63/63
	2006	100	65	10,000	3.4	1.2 [0.4]	192/192	64/64
	2007	78	55	8,400	tr(1.6)	1.7 [0.6]	192/192	64/64
	2008	91	53	8,400	tr(1.6)	2.2 [0.8]	192/192	64/64
	2009	85	58	7,800	2.0	0.9 [0.3]	192/192	64/64
	2010	80	65	6,200	tr(3)	6 [2]	64/64	64/64
	2011	68	52	4,500	1.7	0.8 [0.3]	64/64	64/64
	2012	69	62	10,000	2.5	2.4 [0.8]	63/63	63/63
	2013	67	54	4,700	2.2	1.2 [0.4]	63/63	63/63
	2017	47	39	2,600	nd	6 [2]	61/62	61/62

(Note) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

<Wildlife>

Stocktaking of the detection of Oxychlordane, *cis*-Nonachlor and *trans*-Nonachlor in wildlife (bivalves, fish and birds) FY2002~2016

Oxychlordane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	71	83	5,600	nd	3.6 [1.2]	37/38	8/8
	2003	93	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	99	79	1,400	12	9.3 [3.1]	31/31	7/7
	2006	91	90	2,400	7	7 [3]	31/31	7/7
	2007	70	43	2,200	8	6 [2]	31/31	7/7
	2008	64	55	1,100	7	7 [2]	31/31	7/7
	2009	100	89	820	10	4 [1]	31/31	7/7
	2010	240	390	3,300	11	8 [3]	6/6	6/6
	2011	68	100	260	8	3 [1]	4/4	4/4
	2012	66	80	450	12	3 [1]	5/5	5/5
	2013	42	44	210	8	3 [1]	5/5	5/5
	2016	27	40	43	11	3 [1]	3/3	3/3
Fish (pg/g-wet)	2002	170	140	3,900	16	3.6 [1.2]	70/70	14/14
	2003	150	160	820	30	8.4 [2.8]	70/70	14/14
	2004	160	140	1,500	25	9.2 [3.1]	70/70	14/14
	2005	150	150	1,900	20	9.3 [3.1]	80/80	16/16
	2006	150	120	3,000	28	7 [3]	80/80	16/16
	2007	120	100	1,900	17	6 [2]	80/80	16/16
	2008	130	130	2,200	15	7 [2]	85/85	17/17
	2009	120	99	2,400	23	4 [1]	90/90	18/18
	2010	120	140	1,000	33	8 [3]	18/18	18/18
	2011	140	130	2,300	33	3 [1]	18/18	18/18
	2012	140	180	390	28	3 [1]	19/19	19/19
	2013	130	130	560	31	3 [1]	19/19	19/19
	2016	96	80	950	31	3 [1]	19/19	19/19
Birds (pg/g-wet)	2002	640	630	890	470	3.6 [1.2]	10/10	2/2
	2003	760	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	610	660	860	390	9.3 [3.1]	10/10	2/2
	2006	510	560	720	270	7 [3]	10/10	2/2
	2007	440	400	740	290	6 [2]	10/10	2/2
	2008	560	530	960	290	7 [2]	10/10	2/2
	2009	300	290	540	190	4 [1]	10/10	2/2
	2010	400	---	510	320	8 [3]	2/2	2/2
	2011	---	---	590	590	3 [1]	1/1	1/1
	2012	250	---	360	170	3 [1]	2/2	2/2
	2013**	2,500	---	3,400	1,900	3 [1]	2/2	2/2
	2016**	580	---	1,400	240	3 [1]	2/2	2/2

cis-Nonachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	170	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	320	380	1,800	43	3.4 [1.1]	31/31	7/7
	2005	270	220	1,300	27	4.5 [1.5]	31/31	7/7
	2006	270	180	1,500	31	3 [1]	31/31	7/7
	2007	250	250	1,000	26	3 [1]	31/31	7/7
	2008	210	210	780	33	4 [1]	31/31	7/7
	2009	300	310	10,000	31	3 [1]	31/31	7/7
	2010	280	310	1,300	35	3 [1]	6/6	6/6
	2011	250	280	1,300	77	1.8 [0.7]	4/4	4/4
	2012	200	190	670	52	2 [1]	5/5	5/5
	2013	150	140	900	38	2.2 [0.7]	5/5	5/5
	2016	72	46	220	37	1.4 [0.6]	3/3	3/3
Fish (pg/g-wet)	2002	460	420	5,100	46	1.2 [0.4]	70/70	14/14
	2003	360	360	2,600	19	4.8 [1.6]	70/70	14/14
	2004	430	310	10,000	48	3.4 [1.1]	70/70	14/14
	2005	380	360	6,200	27	4.5 [1.5]	80/80	16/16
	2006	370	330	3,300	33	3 [1]	80/80	16/16
	2007	320	280	3,700	16	3 [1]	80/80	16/16
	2008	350	300	3,200	46	4 [1]	85/85	17/17
	2009	340	340	2,600	27	3 [1]	90/90	18/18
	2010	320	370	2,200	23	3 [1]	18/18	18/18
	2011	440	450	2,900	45	1.8 [0.7]	18/18	18/18
	2012	420	450	2,200	33	2 [1]	19/19	19/19
	2013	430	420	3,000	34	2.2 [0.7]	19/19	19/19
	2016	300	170	1,900	53	1.4 [0.6]	19/19	19/19
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	140	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	130	140	300	42	3 [1]	10/10	2/2
	2008	140	150	410	37	4 [1]	10/10	2/2
	2009	81	85	160	44	3 [1]	10/10	2/2
	2010	100	---	190	57	3 [1]	2/2	2/2
	2011	---	---	76	76	1.8 [0.7]	1/1	1/1
	2012	75	---	100	56	2 [1]	2/2	2/2
	2013**	270	---	970	74	2.2 [0.7]	2/2	2/2
	2016**	240	---	770	74	1.4 [0.6]	2/2	2/2

trans-Nonachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2002	450	1,100	1,800	21	2.4 [0.8]	38/38	8/8
	2003	800	700	3,800	140	3.6 [1.2]	30/30	6/6
	2004	780	870	3,400	110	13 [4.2]	31/31	7/7
	2005	700	650	3,400	72	6.2 [2.1]	31/31	7/7
	2006	660	610	3,200	85	3 [1]	31/31	7/7
	2007	640	610	2,400	71	7 [3]	31/31	7/7
	2008	510	510	2,000	94	6 [2]	31/31	7/7
	2009	780	680	33,000	79	3 [1]	31/31	7/7
	2010	790	870	6,000	84	4 [2]	6/6	6/6
	2011	640	680	3,000	200	3 [1]	4/4	4/4
	2012	530	400	1,800	190	4 [1]	5/5	5/5
	2013	380	370	2,000	98	10 [3.4]	5/5	5/5
	2016	200	150	520	97	3 [1]	3/3	3/3

trans-Nonachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Fish (pg/g-wet)	2002	1,000	900	8,300	98	2.4 [0.8]	70/70	14/14
	2003	920	840	5,800	85	3.6 [1.2]	70/70	14/14
	2004	1,100	760	21,000	140	13 [4.2]	70/70	14/14
	2005	970	750	13,000	80	6.2 [2.1]	80/80	16/16
	2006	940	680	6,900	120	3 [1]	80/80	16/16
	2007	800	680	7,900	71	7 [3]	80/80	16/16
	2008	860	750	6,900	87	6 [2]	85/85	17/17
	2009	810	720	7,400	68	3 [1]	90/90	18/18
	2010	800	1,000	4,700	110	4 [2]	18/18	18/18
	2011	1,100	1,000	5,000	190	3 [1]	18/18	18/18
	2012	1,100	1,300	4,200	140	4 [1]	19/19	19/19
	2013	1,100	1,100	7,800	150	10 [3.4]	19/19	19/19
	2016	690	410	3,400	170	3 [1]	19/19	19/19
Birds (pg/g-wet)	2002	890	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	690	780	1,200	390	13 [4.2]	10/10	2/2
	2005	870	880	2,000	440	6.2 [2.1]	10/10	2/2
	2006	650	620	1,500	310	3 [1]	10/10	2/2
	2007	590	680	1,400	200	7 [3]	10/10	2/2
	2008	740	850	2,600	180	6 [2]	10/10	2/2
	2009	400	430	730	220	3 [1]	10/10	2/2
	2010	510	---	880	290	4 [2]	2/2	2/2
	2011	---	---	400	400	3 [1]	1/1	1/1
	2012	360	---	480	270	4 [1]	2/2	2/2
	2013**	55	---	170	18	10 [3.4]	2/2	2/2
	2016**	60	---	130	28	3 [1]	2/2	2/2

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) " ** " : There is no consistency between the results of the ornithological survey after FY2013 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted during FY2014~2015.

<Air>

Stocktaking of the detection of Oxychlordane, *cis*-Nonachlor and *trans*-Nonachlor in air FY2002~2016

Oxychlordane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2002	0.96	0.98	8.3	nd	0.024 [0.008]	101/102	34/34
	2003Warm season	2.5	2.7	12	0.41	0.045 [0.015]	35/35	35/35
	2003Cold season	0.87	0.88	3.2	0.41		34/34	34/34
	2004Warm season	1.9	2.0	7.8	0.41	0.13 [0.042]	37/37	37/37
	2004Cold season	0.80	0.76	3.9	0.27		37/37	37/37
	2005Warm season	1.9	2.0	8.8	0.65	0.16 [0.054]	37/37	37/37
	2005Cold season	0.55	0.50	2.2	0.27		37/37	37/37
	2006Warm season	1.8	1.9	5.7	0.47	0.23 [0.08]	37/37	37/37
	2006Cold season	0.54	0.56	5.1	tr(0.13)		37/37	37/37
	2007Warm season	1.9	1.8	8.6	0.56	0.05 [0.02]	36/36	36/36
	2007Cold season	0.61	0.63	2.4	0.26		36/36	36/36
	2008Warm season	1.7	1.7	7.1	0.50	0.04 [0.01]	37/37	37/37
	2008Cold season	0.61	0.63	1.8	0.27		37/37	37/37
	2009Warm season	1.7	1.8	6.5	0.38	0.04 [0.02]	37/37	37/37
	2009Cold season	0.65	0.61	2.7	0.24		37/37	37/37
	2010Warm season	1.5	1.5	6.2	0.44	0.03 [0.01]	37/37	37/37
	2010Cold season	0.56	0.55	2.3	0.26		37/37	37/37
	2011Warm season	1.5	1.5	5.2	0.28	0.07 [0.03]	35/35	35/35
	2011Cold season	0.61	0.57	2.6	0.21		37/37	37/37
	2012Warm season	1.4	1.6	6.7	0.34	0.08 [0.03]	36/36	36/36
	2012Cold season	0.41	0.38	1.0	0.22		36/36	36/36
	2013Warm season	1.4	1.5	4.7	0.36	0.03 [0.01]	36/36	36/36
	2013Cold season	0.43	0.41	1.0	0.20		36/36	36/36
	2016Warm season	1.4	1.4	8.9	0.19	0.16 [0.06]	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
	2003Warm season	12	15	220	0.81	0.026 [0.0088]	35/35	35/35
	2003Cold season	2.7	3.5	23	0.18		34/34	34/34
	2004Warm season	10	15	130	0.36	0.072 [0.024]	37/37	37/37
	2004Cold season	2.7	4.4	28	0.087		37/37	37/37
	2005Warm season	10	14	160	0.30	0.08 [0.03]	37/37	37/37
	2005Cold season	1.6	1.6	34	0.08		37/37	37/37
	2006Warm season	11	12	170	0.28	0.15 [0.05]	37/37	37/37
	2006Cold season	2.4	2.0	41	tr(0.14)		37/37	37/37
	2007Warm season	10	14	150	0.31	0.03 [0.01]	36/36	36/36
	2007Cold season	1.6	1.7	22	0.09		36/36	36/36
	2008Warm season	7.9	12	87	0.18	0.03 [0.01]	37/37	37/37
	2008Cold season	2.0	2.7	19	0.16		37/37	37/37
	2009Warm season	7.5	10	110	0.33	0.04 [0.02]	37/37	37/37
	2009Cold season	1.9	2.1	18	0.07		37/37	37/37
	2010Warm season	7.5	10	68	0.23	0.11 [0.04]	37/37	37/37
	2010Cold season	1.8	2.1	13	tr(0.06)		37/37	37/37
	2011Warm season	7.4	8.8	89	0.24	0.15 [0.051]	35/35	35/35
	2011Cold season	1.9	2.9	28	nd		36/37	36/37
	2012Warm season	6.9	11	89	0.29	0.12 [0.05]	36/36	36/36
	2012Cold season	0.98	1.1	10	tr(0.05)		36/36	36/36
	2013Warm season	6.4	10	72	0.15	0.07 [0.02]	36/36	36/36
	2013Cold season	1.0	1.4	12	tr(0.06)		36/36	36/36
	2016Warm season	6.1	9.9	120	tr(0.13)	0.14 [0.05]	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
	2003Warm season	87	100	1,200	5.1	0.35 [0.12]	35/35	35/35
	2003Cold season	24	28	180	2.1		34/34	34/34
	2004Warm season	72	120	870	1.9	0.48 [0.16]	37/37	37/37
	2004Cold season	23	39	240	0.95		37/37	37/37
	2005Warm season	75	95	870	3.1	0.13 [0.044]	37/37	37/37
	2005Cold season	13	16	210	1.2		37/37	37/37
	2006Warm season	68	91	800	3.0	0.10 [0.03]	37/37	37/37
	2006Cold season	16	15	240	1.4		37/37	37/37
	2007Warm season	72	96	940	2.5	0.09 [0.03]	36/36	36/36
	2007Cold season	13	15	190	1.1		36/36	36/36
	2008Warm season	59	91	650	1.5	0.09 [0.03]	37/37	37/37
	2008Cold season	17	25	170	1.3		37/37	37/37
	2009Warm season	54	81	630	2.2	0.07 [0.03]	37/37	37/37
	2009Cold season	16	19	140	0.75		37/37	37/37
	2010Warm season	52	78	520	1.7	0.8 [0.3]	37/37	37/37
	2010Cold season	15	17	89	tr(0.7)		37/37	37/37
	2011Warm season	53	72	550	1.2	1.1 [0.35]	35/35	35/35
	2011Cold season	16	24	210	tr(0.70)		37/37	37/37
	2012Warm season	49	79	510	2.5	1.2 [0.41]	36/36	36/36
	2012Cold season	8.1	10	61	tr(0.50)		36/36	36/36
	2013Warm season	46	78	470	1.2	0.5 [0.2]	36/36	36/36
	2013Cold season	8.5	12	75	0.5		36/36	36/36
	2016Warm season	42	69	650	0.8	0.7 [0.2]	37/37	37/37

(Note) No monitoring was conducted in FY2014 and FY2015.

[8] Heptachlors (references)

・ History and state of monitoring

Heptachlor and its metabolite, heptachlor epoxide, used to kill soil insects and termites, heptachlor has also been used more widely to kill cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes. The substances were not registrated under the Agricultural Chemicals Regulation Law in FY1975. 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. Also Heptachlors are one of the original twelve POPs covered by the Stockholm Convention.

In previous monitoring series before FY2001, heptachlor and heptachlor epoxide were measured in FY1982 (in surface water, sediment and fish) and in FY1986 (in air) under the framework of “the Environmental Survey and Monitoring of Chemicals.”

Under the framework of the Environmental Monitoring, Heptachlor in surface water, sediment, wildlife (bibalves, fish and birds) and air had been monitored since FY2002, and *cis*-Heptachlor epoxide and *trans*-Heptachlor epoxide had also been monitored since FY2003. After FY2012, the substances has been monitored in sediment, wildlife (bivalves, fish and birds) and air in FY2012, FY2013, FY2015 and FY2016 and in surface water and sediment in FY2014 and FY2017.

No monitoring was conducted in FY2018 and FY2019. For reference, the monitoring results up to FY2017 are given below.

・ Monitoring results until FY2017

<Surface Water>

Stocktaking of the detection of Heptachlor, *cis*-Heptachlor epoxide and *trans*-Heptachlor epoxide in surface water during FY2002~2018

Heptachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	tr(1.2)	tr(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
	2010	nd	nd	43	nd	2.2 [0.7]	4/49	4/49
	2011	nd	nd	22	nd	1.3 [0.5]	6/49	6/49
	2014	tr(0.2)	tr(0.2)	1.5	nd	0.5 [0.2]	28/48	28/48
	2017	nd	nd	6	nd	3 [1]	2/47	2/47
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
	2010	5.9	3.9	710	0.7	0.4 [0.2]	49/49	49/49
	2011	5.8	5.8	160	0.7	0.7 [0.3]	49/49	49/49
	2014	4.9	3.4	56	0.7	0.5 [0.2]	48/48	48/48
	2017	4.7	3.5	83	nd	1.6 [0.6]	46/47	46/47

trans-Heptachlor epoxide	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency 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
	2010	nd	nd	8.0	nd	1.3 [0.5]	2/49	2/49
	2011	nd	nd	2.8	nd	0.8 [0.3]	3/49	3/49
	2014	nd	nd	nd	nd	0.8 [0.3]	0/48	0/48
	2017	nd	nd	nd	nd	2.3 [0.9]	0/47	0/47

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.
(Note 2) No monitoring was conducted in FY2012~2013 and FY2015~2016.

<Sediment>

Stocktaking of the detection of Heptachlor, *cis*-Heptachlor epoxide and *trans*-Heptachlor epoxide in sediment during FY2002~2018

Heptachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2002	4.1	3.2	120	nd	1.8 [0.6]	167/189	60/63
	2003	tr(2.7)	tr(2.2)	160	nd	3 [1.0]	138/186	53/62
	2004	tr(2.8)	tr(2.3)	170	nd	3 [0.9]	134/189	53/63
	2005	3.1	2.8	200	nd	2.5 [0.8]	120/189	48/63
	2006	5.2	3.9	230	nd	1.9 [0.6]	190/192	64/64
	2007	tr(1.8)	tr(1.5)	110	nd	3.0 [0.7]	143/192	57/64
	2008	tr(1)	nd	85	nd	4 [1]	59/192	27/64
	2009	1.6	1.3	65	nd	1.1 [0.4]	144/192	59/64
	2010	1.2	tr(0.8)	35	nd	1.1 [0.4]	51/64	51/64
	2011	tr(1.3)	tr(1.2)	48	nd	1.8 [0.7]	40/64	40/64
	2014	tr(1.0)	tr(0.9)	49	nd	1.5 [0.5]	38/63	38/63
	2017	1.2	1.1	40	nd	0.9 [0.3]	53/62	53/62

cis-Heptachlor epoxide	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2003	4	3	160	nd	3 [1]	153/186	55/62
	2004	tr(5)	tr(3)	230	nd	6 [2]	136/189	52/63
	2005	tr(4)	tr(3)	140	nd	7 [2]	119/189	49/63
	2006	4.0	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	3	2	180	nd	2 [1]	130/192	51/64
	2009	2.7	1.9	290	nd	0.7 [0.3]	176/192	63/64
	2010	3.1	2.4	300	nd	0.8 [0.3]	62/64	62/64
	2011	2.8	2.5	160	nd	0.6 [0.2]	63/64	63/64
	2014	2.1	1.7	310	nd	0.5 [0.2]	59/63	59/63
	2017	1.9	1.6	150	nd	1.2 [0.5]	51/62	51/62

trans-Heptachlor epoxide	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency 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
	2010	nd	nd	4	nd	3 [1]	1/64	1/64
	2011	nd	nd	2.4	nd	2.3 [0.9]	2/64	2/64
	2014	nd	nd	3.6	nd	0.7 [0.3]	1/63	1/63
	2017	nd	nd	nd	nd	2.0 [0.8]	0/62	0/62

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.
(Note 2) No monitoring was conducted in FY2012~2013 and FY2015~2016.

<Wildlife>

Stocktaking of the detection of Heptachlor, *cis*-Heptachlor epoxide and *trans*-Heptachlor epoxide in wildlife (bivalves, fish and birds) during FY2002~2016

Heptachlor	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	tr(3.5)	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(3.4)	5.2	16	nd	4.1 [1.4]	23/31	6/7
	2005	tr(2.9)	tr(2.9)	24	nd	6.1 [2.0]	18/31	6/7
	2006	tr(4)	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(4)	nd	120	nd	5 [2]	14/31	4/7
	2010	3	tr(2)	78	nd	3 [1]	5/6	5/6
	2011	4	4	51	nd	3 [1]	3/4	3/4
	2012	tr(3)	tr(3)	13	nd	4 [1]	4/5	4/5
	2013	3	tr(2)	19	nd	3 [1]	4/5	4/5
	2015	nd	nd	tr(1.7)	nd	3.0 [1.0]	1/3	1/3
	2016	nd	nd	tr(1.4)	nd	2.4 [0.9]	1/3	1/3
Fish (pg/g-wet)	2002	4.2	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(2.3)	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	tr(2)	nd	7	nd	6 [2]	28/80	6/16
	2008	nd	nd	9	nd	6 [2]	25/85	7/17
	2009	tr(2)	nd	8	nd	5 [2]	30/90	11/18
	2010	tr(2)	tr(2)	5	nd	3 [1]	12/18	12/18
	2011	tr(1)	tr(1)	7	nd	3 [1]	13/18	13/18
	2012	nd	tr(1)	5	nd	4 [1]	10/19	10/19
	2013	nd	nd	12	nd	3 [1]	9/19	9/19
	2015	nd	nd	9.2	nd	3.0 [1.0]	9/19	9/19
	2016	nd	nd	5.5	nd	2.4 [0.9]	8/19	8/19
Birds (pg/g-wet)	2002	tr(1.7)	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
	2010	nd	---	tr(1)	nd	3 [1]	1/2	1/2
	2011	---	---	nd	nd	3 [1]	0/1	0/1
	2012	nd	---	nd	nd	4 [1]	0/2	0/2
	2013**	nd	---	nd	nd	3 [1]	0/2	0/2
	2015**	---	---	nd	nd	3.0 [1.0]	0/1	0/1
	2016**	nd	---	nd	nd	2.4 [0.9]	0/2	0/2

cis-Heptachlor epoxide	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2003	44	29	880	9.7	6.9 [2.3]	30/30	6/6
	2004	64	34	840	tr(9.8)	9.9 [3.3]	31/31	7/7
	2005	49	20	590	7.4	3.5 [1.2]	31/31	7/7
	2006	56	23	1,100	8	4 [1]	31/31	7/7
	2007	37	20	1,100	8	4 [1]	31/31	7/7
	2008	37	19	510	8	5 [2]	31/31	7/7
	2009	59	33	380	10	3 [1]	31/31	7/7
	2010	170	260	1,800	9.0	2.4 [0.9]	6/6	6/6
	2011	55	110	320	3.9	2.0 [0.8]	4/4	4/4
	2012	48	120	180	6.2	1.5 [0.6]	5/5	5/5
	2013	28	29	110	4.4	2.1 [0.8]	5/5	5/5
	2015	21	14	91	7.2	2.1 [0.8]	3/3	3/3
	2016	23	18	75	9.4	1.9 [0.7]	3/3	3/3

cis-Heptachlor epoxide	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Fish (pg/g-wet)	2003	43	43	320	7.0	6.9 [2.3]	70/70	14/14
	2004	51	49	620	tr(3.3)	9.9 [3.3]	70/70	14/14
	2005	41	45	390	4.9	3.5 [1.2]	80/80	16/16
	2006	42	48	270	4	4 [1]	80/80	16/16
	2007	43	49	390	4	4 [1]	80/80	16/16
	2008	39	46	350	tr(3)	5 [2]	85/85	17/17
	2009	41	50	310	4	3 [1]	90/90	18/18
	2010	39	49	230	5.0	2.4 [0.9]	18/18	18/18
	2011	50	62	540	3.2	2.0 [0.8]	18/18	18/18
	2012	41	62	120	6.9	1.5 [0.6]	19/19	19/19
	2013	42	46	190	7.3	2.1 [0.8]	19/19	19/19
	2015	33	43	190	3.2	2.1 [0.8]	19/19	19/19
	2016	29	28	130	3.6	1.9 [0.7]	19/19	19/19
Birds (pg/g-wet)	2003	540	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	370	340	690	250	3.5 [1.2]	10/10	2/2
	2006	330	310	650	240	4 [1]	10/10	2/2
	2007	280	270	350	250	4 [1]	10/10	2/2
	2008	370	370	560	180	5 [2]	10/10	2/2
	2009	220	210	390	160	3 [1]	10/10	2/2
	2010	290	---	360	240	2.4 [0.9]	2/2	2/2
	2011	---	---	410	410	2.0 [0.8]	1/1	1/1
	2012	160	---	170	150	1.5 [0.6]	2/2	2/2
	2013**	300	---	560	160	2.1 [0.8]	2/2	2/2
	2015**	---	---	20	20	2.1 [0.8]	1/1	1/1
	2016**	91	---	270	31	1.9 [0.7]	2/2	2/2

trans-Heptachlor epoxide	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2003	nd	nd	48	nd	13 [4.4]	5/30	1/6
	2004	nd	nd	55	nd	12 [4.0]	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	tr(3)	nd	24	nd	8 [3]	13/31	3/7
	2010	3	tr(2)	24	nd	3 [1]	3/6	3/6
	2011	nd	nd	tr(6)	nd	7 [3]	1/4	1/4
	2012	nd	nd	tr(4)	nd	8 [3]	1/5	1/5
	2013	nd	nd	nd	nd	7 [3]	0/5	0/5
	2015	nd	nd	nd	nd	7 [3]	0/3	0/3
	2016	nd	nd	nd	nd	9 [3]	0/3	0/3
Fish (pg/g-wet)	2003	nd	nd	nd	nd	13 [4.4]	0/70	0/14
	2004	nd	nd	tr(10)	nd	12 [4.0]	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
	2010	nd	nd	nd	nd	3 [1]	0/18	0/18
	2011	nd	nd	nd	nd	7 [3]	0/18	0/18
	2012	nd	nd	nd	nd	8 [3]	0/19	0/19
	2013	nd	nd	nd	nd	7 [3]	0/19	0/19
	2015	nd	nd	10	nd	7 [3]	5/19	5/19
	2016	nd	nd	nd	nd	9 [3]	0/19	0/19

trans-Heptachlor epoxide	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Birds (pg/g-wet)	2003	nd	nd	nd	nd	13 [4.4]	0/10	0/2
	2004	nd	nd	nd	nd	12 [4.0]	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
	2010	nd	---	nd	nd	3 [1]	0/2	0/2
	2011	---	---	nd	nd	7 [3]	0/1	0/1
	2012	nd	---	nd	nd	8 [3]	0/2	0/2
	2013**	nd	---	tr(5)	nd	7 [3]	1/2	1/2
	2015**	---	---	nd	nd	7 [3]	0/1	0/1
	2016**	nd	---	nd	nd	9 [3]	0/2	0/2

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2002~2009.

(Note 2) “ ** ” : There is no consistency between the results of the ornithological survey after FY2013 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2014.

<Air>

Stocktaking of the detection of Heptachlor, *cis*-Heptachlor epoxide and *trans*-Heptachlor epoxide in air during FY2002~2016

Heptachlor	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2002	11	14	220	0.20	0.12 [0.04]	102/102	34/34
	2003Warm season	27	41	240	1.1	0.25 [0.085]	35/35	35/35
	2003Cold season	10	16	65	0.39		34/34	34/34
	2004Warm season	23	36	200	0.46	0.23 [0.078]	37/37	37/37
	2004Cold season	11	18	100	0.53		37/37	37/37
	2005Warm season	25	29	190	1.1	0.16 [0.054]	37/37	37/37
	2005Cold season	6.5	7.9	61	0.52		37/37	37/37
	2006Warm season	20	27	160	0.88	0.11 [0.04]	37/37	37/37
	2006Cold season	6.8	7.2	56	0.32		37/37	37/37
	2007Warm season	22	27	320	1.1	0.07 [0.03]	36/36	36/36
	2007Cold season	6.3	8.0	74	0.42		36/36	36/36
	2008Warm season	20	31	190	0.92	0.06 [0.02]	37/37	37/37
	2008Cold season	7.5	12	60	0.51		37/37	37/37
	2009Warm season	18	30	110	0.48	0.04 [0.01]	37/37	37/37
	2009Cold season	6.3	7.8	48	0.15		37/37	37/37
	2010Warm season	17	26	160	0.69	0.11 [0.04]	37/37	37/37
	2010Cold season	7.2	9.5	53	0.22		37/37	37/37
	2011Warm season	16	25	110	0.73	0.30 [0.099]	35/35	35/35
	2011Cold season	6.1	10	56	tr(0.13)		37/37	37/37
	2012Warm season	13	21	58	0.46	0.41 [0.14]	36/36	36/36
	2012Cold season	3.2	4.9	20	nd		35/36	35/36
	2013Warm season	11	21	43	0.46	0.16 [0.05]	36/36	36/36
	2013Cold season	3.1	4.6	22	tr(0.10)		36/36	36/36
	2015Warm season	8.7	11	49	0.43	0.19 [0.06]	35/35	35/35
	2016Warm season	12	14	120	tr(0.18)	0.22 [0.08]	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)	2003Warm season	3.5	3.5	28	0.45	0.015 [0.0048]	35/35	35/35
	2003Cold season	1.3	1.3	6.6	0.49		34/34	34/34
	2004Warm season	2.8	2.9	9.7	0.65	0.052 [0.017]	37/37	37/37
	2004Cold season	1.1	1.1	7.0	0.44		37/37	37/37
	2005Warm season	1.5	1.7	11	tr(0.10)	0.12 [0.044]	37/37	37/37
	2005Cold season	0.91	0.81	2.9	0.43		37/37	37/37
	2006Warm season	1.7	2.0	6.7	0.13	0.11 [0.04]	37/37	37/37
	2006Cold season	0.74	0.88	3.2	nd		36/37	36/37
	2007Warm season	2.9	2.8	13	0.54	0.03 [0.01]	36/36	36/36
	2007Cold season	0.93	0.82	3.0	0.41		36/36	36/36
	2008Warm season	2.4	2.2	9.9	0.53	0.022 [0.008]	37/37	37/37
	2008Cold season	0.91	0.84	3.0	0.37		37/37	37/37
	2009Warm season	2.5	2.6	16	0.37	0.03 [0.01]	37/37	37/37
	2009Cold season	1.0	0.91	3.8	0.42		37/37	37/37
	2010Warm season	2.3	2.3	10	0.38	0.02 [0.01]	37/37	37/37
	2010Cold season	0.93	0.85	4.3	0.33		37/37	37/37
	2011Warm season	2.0	2.3	6.0	0.29	0.04 [0.01]	35/35	35/35
	2011Cold season	0.90	0.90	2.8	0.35		37/37	37/37
	2012Warm season	2.0	2.1	6.3	0.37	0.05 [0.02]	36/36	36/36
	2012Cold season	0.62	0.57	1.9	0.30		36/36	36/36
	2013Warm season	2.0	2.1	7.7	0.43	0.03 [0.01]	36/36	36/36
	2013Cold season	0.66	0.63	1.4	0.32		36/36	36/36
	2015Warm season	1.4	1.4	4.7	tr(0.4)	0.5 [0.2]	35/35	35/35
	2016Warm season	1.9	1.9	9.1	0.30	0.12 [0.05]	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)	2003Warm season	tr(0.036)	tr(0.038)	0.30	nd	0.099 [0.033]	18/35	18/35
	2003Cold season	nd	nd	tr(0.094)	nd		3/34	3/34
	2004Warm season	nd	nd	tr(0.38)	nd	0.6 [0.2]	4/37	4/37
	2004Cold season	nd	nd	nd	nd		0/37	0/37
	2005Warm season	tr(0.10)	tr(0.12)	1.2	nd	0.16 [0.05]	27/37	27/37
	2005Cold season	nd	nd	0.32	nd		3/37	3/37
	2006Warm season	nd	nd	0.7	nd	0.3 [0.1]	2/37	2/37
	2006Cold season	nd	nd	tr(0.1)	nd		1/37	1/37
	2007Warm season	nd	nd	0.16	nd	0.14 [0.06]	8/36	8/36
	2007Cold season	nd	nd	tr(0.06)	nd		1/36	1/36
	2008Warm season	nd	nd	0.17	nd	0.16 [0.06]	6/37	6/37
	2008Cold season	nd	nd	nd	nd		0/37	0/37
	2009Warm season	nd	nd	0.18	nd	0.14 [0.05]	10/37	10/37
	2009Cold season	nd	nd	tr(0.06)	nd		1/37	1/37
	2010Warm season	nd	nd	0.16	nd	0.16 [0.06]	6/37	6/37
	2010Cold season	nd	nd	nd	nd		0/37	0/37
	2011Warm season	nd	nd	0.14	nd	0.13 [0.05]	5/35	5/35
	2011Cold season	nd	nd	nd	nd		0/37	0/37
	2012Warm season	nd	nd	tr(0.08)	nd	0.12 [0.05]	8/36	8/36
	2012Cold season	nd	nd	nd	nd		0/36	0/36
	2013Warm season	nd	nd	tr(0.11)	nd	0.12 [0.05]	7/36	7/36
	2013Cold season	nd	nd	nd	nd		0/36	0/36
	2015Warm season	nd	nd	nd	nd	0.03 [0.01]	0/35	0/35
	2016Warm season	nd	nd	tr(0.2)	nd	0.3 [0.1]	1/37	1/37

(Note) No monitoring was conducted in FY2014.

[9] Toxaphenes (references)

・ History and state of monitoring

Toxaphenes are a group of organochlorine insecticides used on cotton, cereal grains, fruits, nuts, and vegetables and also it has also been used to control ticks and mites in livestock. 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. Also Toxaphenes are one of the original twelve POPs covered by the Stockholm Convention.

In previous monitoring series before FY2001, total amount of Toxaphenes was measured in FY1983 (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 from FY2003 to FY2009 and in wildlife (bivalves, fish and birds) in FY2015, in surface water, sediment, wildlife (bivalves, fish and birds) and air from FY2018.

No monitoring was conducted in FY2019. For reference, the monitoring results up to FY2018 are given below.

・ Monitoring results until FY2018

<Surface Water>

Stocktaking of the detection of Parlar-26, Parlar-50 and Parlar-62 in surface water during FY2003~2018

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
	2018	nd	nd	5	nd	4 [2]	7/47	7/47
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
	2018	nd	nd	tr(2)	nd	6 [2]	1/47	1/47
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
	2018	nd	nd	nd	nd	40 [20]	0/47	0/47

(Note) No monitoring was conducted in FY2010 ~ FY2017.

<Sediment>

Stocktaking of the detection of Parlar-26, Parlar-50 and Parlar-62 in sediment during FY2003~2018

Parlar-26	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency 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
	2018	nd	nd	nd	nd	8 [3]	0/61	0/61
Parlar-50	**Monitored year**	**Geometric mean***	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency 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
	2018	nd	nd	tr(3)	nd	8 [3]	1/61	1/61
Parlar-62	**Monitored year**	**Geometric mean***	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency 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
	2018	nd	nd	tr(20)	nd	50 [20]	1/61	1/61

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2003~2009.

(Note 2) No monitoring was conducted in FY2010 ~ FY2017.

<Wildlife>

Stocktaking of the detection of Parlar-26, Parlar-50 and Parlar-62 in wildlife (bivalves, fish and birds) during FY2003~2018

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(7)	tr(8)	20	nd	10 [4]	26/31	6/7
	2008	tr(7)	tr(8)	22	nd	9 [3]	27/31	7/7
	2009	9	9	23	nd	7 [3]	27/31	7/7
	2015	tr(10)	tr(15)	tr(17)	nd	23 [9]	2/3	2/3
	2018	tr(10)	tr(15)	tr(15)	nd	21 [8]	2/3	2/3
Fish (pg/g-wet)	2003	tr(28)	tr(24)	810	nd	45 [15]	44/70	11/14
	2004	43	tr(41)	1,000	nd	42 [14]	54/70	13/14
	2005	tr(42)	53	900	nd	47 [16]	50/75	13/16
	2006	41	44	880	nd	18 [7]	70/80	15/16
	2007	24	32	690	nd	10 [4]	64/80	14/16
	2008	35	33	730	nd	9 [3]	79/85	17/17
	2009	25	20	690	nd	7 [3]	82/90	18/18
	2015	26	28	400	nd	23 [9]	13/19	13/19
	2018	tr(17)	tr(17)	280	nd	21 [8]	12/18	12/18

Parlar-26	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Birds (pg/g-wet)	2003	120	650	2,500	nd	45 [15]	5/10	1/2
	2004	70	340	810	nd	42 [14]	5/10	1/2
	2005	86	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	38	320	1,200	nd	9 [3]	6/10	2/2
	2009	26	200	500	nd	7 [3]	6/10	2/2
	2015**	---	---	tr(10)	tr(10)	23 [9]	1/1	1/1
	2018**	53	---	54	53	21 [8]	2/2	2/2

Parlar-50	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2003	tr(12)	tr(12)	58	nd	33 [11]	17/30	4/6
	2004	tr(15)	nd	tr(45)	nd	46 [15]	15/31	3/7
	2005	nd	nd	tr(38)	nd	54 [18]	9/31	4/7
	2006	tr(10)	14	32	nd	14 [5]	24/31	6/7
	2007	9	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
	2015	tr(11)	tr(15)	tr(16)	nd	30 [10]	2/3	2/3
	2018	tr(9)	16	17	nd	16 [6]	2/3	2/3
Fish (pg/g-wet)	2003	35	34	1,100	nd	33 [11]	55/70	14/14
	2004	60	61	1,300	nd	46 [15]	59/70	14/14
	2005	tr(52)	66	1,400	nd	54 [18]	55/80	13/16
	2006	56	52	1,300	nd	14 [5]	79/80	16/16
	2007	35	41	1,100	nd	9 [3]	77/80	16/16
	2008	44	45	1,000	nd	10 [4]	77/85	17/17
	2009	30	23	910	nd	8 [3]	85/90	18/18
	2015	tr(25)	tr(13)	640	nd	30 [10]	13/19	13/19
	2018	22	20	300	nd	16 [6]	16/18	16/18
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
	2015**	---	---	nd	nd	30 [10]	0/1	0/1
	2018**	tr(12)	---	tr(13)	tr(11)	16 [6]	2/2	2/2

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
	2015	nd	nd	nd	nd	150 [60]	0/3	0/3
	2018	nd	nd	nd	nd	100 [40]	0/3	0/3
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	tr(30)	nd	530	nd	70 [30]	22/80	7/16
	2008	tr(30)	nd	590	nd	80 [30]	31/85	8/17
	2009	tr(20)	nd	660	nd	70 [20]	24/90	8/18
	2015	nd	nd	320	nd	150 [60]	2/19	2/19
	2018	nd	nd	150	nd	100 [40]	3/18	3/18

Parlar-62	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
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(78)	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(40)	80	210	nd	70 [20]	5/10	1/2
	2015**	---	---	nd	nd	150 [60]	0/1	0/1
	2018**	nd	---	nd	nd	100 [40]	0/2	0/2

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2003~2009.

(Note 2) " ** " : There is no consistency between the results of the ornithological survey in FY2015 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2010 ~ 2014, FY2016 and FY2017.

<Air>

Stocktaking of the detection of Parlar-26, Parlar-50 and Parlar-62 in air during FY2003~2018

Parlar-26	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2003Warm season	0.31	0.31	0.77	tr(0.17)	0.20 [0.066]	35/35	35/35
	2003Cold season	tr(0.17)	tr(0.17)	0.27	tr(0.091)		34/34	34/34
	2004Warm season	0.27	0.26	0.46	tr(0.17)	0.20 [0.066]	37/37	37/37
	2004Cold season	tr(0.15)	tr(0.15)	0.50	tr(0.094)		37/37	37/37
	2005Warm season	nd	nd	nd	nd	0.3 [0.1]	0/37	0/37
	2005Cold season	nd	nd	nd	nd		0/37	0/37
	2006Warm season	nd	nd	nd	nd	1.8 [0.6]	0/37	0/37
	2006Cold season	nd	nd	nd	nd		0/37	0/37
	2007Warm season	nd	nd	tr(0.3)	nd	0.6 [0.2]	18/36	18/36
	2007Cold season	nd	nd	nd	nd		0/36	0/36
	2008Warm season	tr(0.21)	0.22	0.58	tr(0.12)	0.22 [0.08]	37/37	37/37
	2008Cold season	tr(0.11)	tr(0.12)	tr(0.20)	nd		36/37	36/37
	2009Warm season	tr(0.18)	tr(0.19)	0.26	tr(0.11)	0.23 [0.09]	37/37	37/37
	2009Cold season	tr(0.12)	tr(0.13)	0.27	nd		33/37	33/37
	2018Warm season	nd	nd	tr(0.3)	nd	0.4 [0.2]	12/37	12/37

Parlar-50	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2003Warm season	nd	nd	tr(0.37)	nd	0.81 [0.27]	2/35	2/35
	2003Cold season	nd	nd	nd	nd		0/34	0/34
	2004Warm season	nd	nd	nd	nd	1.2 [0.4]	0/37	0/37
	2004Cold season	nd	nd	nd	nd		0/37	0/37
	2005Warm season	nd	nd	nd	nd	0.6 [0.2]	0/37	0/37
	2005Cold season	nd	nd	nd	nd		0/37	0/37
	2006Warm season	nd	nd	nd	nd	1.6 [0.5]	0/37	0/37
	2006Cold season	nd	nd	nd	nd		0/37	0/37
	2007Warm season	nd	tr(0.1)	tr(0.2)	nd	0.3 [0.1]	29/36	29/36
	2007Cold season	nd	nd	nd	nd		0/36	0/36
	2008Warm season	nd	nd	tr(0.19)	nd	0.25 [0.09]	15/37	15/37
	2008Cold season	nd	nd	nd	nd		0/37	0/37
	2009Warm season	nd	nd	tr(0.1)	nd	0.3 [0.1]	11/37	11/37
	2009Cold season	nd	nd	tr(0.1)	nd		1/37	1/37
	2018Warm season	nd	nd	tr(0.2)	nd	0.5 [0.2]	2/37	2/37

Parlar-62	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2003Warm season	nd	nd	nd	nd	1.6 [0.52]	0/35	0/35
	2003Cold season	nd	nd	nd	nd		0/34	0/34
	2004Warm season	nd	nd	nd	nd	2.4 [0.81]	0/37	0/37
	2004Cold season	nd	nd	nd	nd		0/37	0/37
	2005Warm season	nd	nd	nd	nd	1.2 [0.4]	0/37	0/37
	2005Cold season	nd	nd	nd	nd		0/37	0/37
	2006Warm season	nd	nd	nd	nd	8 [3]	0/37	0/37
	2006Cold season	nd	nd	nd	nd		0/37	0/37
	2007Warm season	nd	nd	nd	nd	1.5 [0.6]	0/36	0/36
	2007Cold season	nd	nd	nd	nd		0/36	0/36
	2008Warm season	nd	nd	nd	nd	1.6 [0.6]	0/37	0/37
	2008Cold season	nd	nd	nd	nd		0/37	0/37
	2009Warm season	nd	nd	nd	nd	1.6 [0.6]	0/37	0/37
	2009Cold season	nd	nd	nd	nd		0/37	0/37
	2018Warm season	nd	nd	nd	nd	0.4 [0.2]	0/37	0/37

(Note) No monitoring was conducted in FY2010~FY2017.

[10] Mirex (references)

・ History and state of monitoring

Mirex was developed as an organochlorine insecticide chemical in the United States, and it was also used as a fire retardant in plastics, rubber, and electrical goods. 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. Also the substance is one of the original twelve POPs covered by the Stockholm Convention.

Before FY2001, the substance was measured in FY1983 (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 in FY2003~2009, FY2011 and FY2018.

No monitoring was conducted in FY2019. For reference, the monitoring results up to FY2018 are given below.

・ Monitoring results until FY2018

<Surface Water>

Stocktaking of the detection of Mirex in surface water during FY2003~2018

Mirex	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency 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
	2011	nd	nd	0.8	nd	0.5 [0.2]	3/49	3/49
	2018	nd	nd	1.0	nd	0.7 [0.3]	3/47	3/47

(Note) No monitoring was conducted in FY2010 and FY2012 ~ 2017.

<Sediment>

Stocktaking of the detection of Mirex in sediment during FY2003~2018

Mirex	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2003	2	tr(1.6)	1,500	nd	2 [0.4]	137/186	51/62
	2004	2	tr(1.6)	220	nd	2 [0.5]	153/189	55/63
	2005	1.8	1.2	5,300	nd	0.9 [0.3]	134/189	48/63
	2006	1.7	1.2	640	nd	0.6 [0.2]	156/192	57/64
	2007	1.5	0.9	200	nd	0.9 [0.3]	147/192	55/64
	2008	1.4	1.1	820	nd	0.7 [0.3]	117/192	48/64
	2009	1.4	1.3	620	nd	1.0 [0.4]	126/192	49/64
	2011	1.2	0.9	1,900	nd	0.9 [0.4]	42/64	42/64
	2018	1.1	0.9	240	nd	0.8 [0.3]	44/61	44/61

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2003~2009.

(Note 2) No monitoring was conducted in FY2010 and FY2012 ~ 2017.

<Wildlife>

Stocktaking of the detection of Mirex in wildlife (bivalves, fish and birds) during FY2003~2018

Mirex	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2003	4.9	4.2	19	tr(1.6)	2.4 [0.81]	30/30	6/6
	2004	4.4	4.3	12	tr(1.1)	2.5 [0.82]	31/31	7/7
	2005	5.4	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	5.9	5.2	21	tr(1.7)	2.1 [0.8]	31/31	7/7
	2011	10	7.1	44	5.2	1.9 [0.8]	4/4	4/4
	2018	4.9	3.2	20	1.8	1.4 [0.5]	3/3	3/3
Fish (pg/g-wet)	2003	8.3	9.0	25	tr(1.7)	2.4 [0.81]	70/70	14/14
	2004	13	11	180	3.8	2.5 [0.82]	70/70	14/14
	2005	13	13	78	tr(1.0)	3.0 [0.99]	80/80	16/16
	2006	11	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	8.6	9.6	37	tr(0.9)	2.1 [0.8]	90/90	18/18
	2011	12	15	41	tr(1.3)	1.9 [0.8]	18/18	18/18
	2018	8.2	8.4	70	1.9	1.4 [0.5]	18/18	18/18
Birds (pg/g-wet)	2003	120	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	77	66	180	41	3.0 [0.99]	10/10	2/2
	2006	77	70	280	39	3 [1]	10/10	2/2
	2007	57	59	100	32	3 [1]	10/10	2/2
	2008	74	68	260	27	4 [1]	10/10	2/2
	2009	49	---	79	32	2.1 [0.8]	10/10	2/2
	2011	---	---	58	58	1.9 [0.8]	1/1	1/1
	2018	110	---	260	47	1.4 [0.5]	2/2	2/2

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived during FY2003~2009.

(Note 2) No monitoring was conducted in FY2010 and FY2012~2017.

<Air>

Stocktaking of the detection of Mirex in air during FY2003~2018

Mirex	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2003Warm season	0.11	0.12	0.19	0.047	0.0084	35/35	35/35
	2003Cold season	0.044	0.043	0.099	0.024	[0.0028]	34/34	34/34
	2004Warm season	0.099	0.11	0.16	tr(0.042)	0.05 [0.017]	37/37	37/37
	2004Cold season	tr(0.046)	tr(0.047)	0.23	tr(0.019)		37/37	37/37
	2005Warm season	tr(0.09)	tr(0.09)	0.24	tr(0.05)	0.10 [0.03]	37/37	37/37
	2005Cold season	tr(0.04)	tr(0.04)	tr(0.08)	nd		29/37	29/37
	2006Warm season	tr(0.07)	tr(0.10)	0.22	nd	0.13 [0.04]	29/37	29/37
	2006Cold season	tr(0.07)	tr(0.07)	2.1	nd		27/37	27/37
	2007Warm season	0.11	0.11	0.28	0.04	0.03 [0.01]	36/36	36/36
	2007Cold season	0.04	0.04	0.09	tr(0.02)		36/36	36/36
	2008Warm season	0.09	0.09	0.25	0.03	0.03 [0.01]	37/37	37/37
	2008Cold season	0.05	0.04	0.08	0.03		37/37	37/37
	2009Warm season	0.12	0.13	0.48	0.049	0.015 [0.006]	37/37	37/37
	2009Cold season	0.058	0.054	0.18	0.030		37/37	37/37
	2011Warm season	0.14	0.13	0.25	0.08	0.04 [0.01]	35/35	35/35
	2011Cold season	0.07	0.07	0.11	tr(0.03)		37/37	37/37
	2018Warm season	0.09	0.09	0.20	0.05	0.03 [0.01]	37/37	37/37

(Note) No monitoring was conducted in FY2010 and FY2012~2017.

[11] HCHs

・ History and state of monitoring

HCHs were used as pesticides, household insecticides, and termiticides, etc. Even after their registration under the Agricultural Chemicals Regulation Law was expired in FY1971, they continue to be used as termiticides 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. The substances were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in April 2010.

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 FY2001, the substances were measured in FY1974 (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 FY1986~1998 and FY1986~2001, respectively. Under the framework of the Wildlife Monitoring, the substances were monitored in wildlife (bivalves, fish and birds) during the period of FY1978~1996 and in FY1998, FY2000 and FY2001 (*γ*-HCH (synonym:Lindane) and *δ*-HCH had not been monitored since FY1997 and FY1993, respectively.)

Under the framework of the Environmental Monitoring, *α*-HCH and *β*-HCH in surface water, sediment, and wildlife (bivalves, fish and birds) have been monitored since FY2002, except FY2018.. *α*-HCH and *β*-HCH in air and *γ*-HCH (synonym:Lindane) and *δ*-HCH in surface water, sediment, wildlife (bivalves, fish and birds) and air have also been monitored since FY2003, except FY2018.

・ Monitoring results

<Surface Water>

α-HCH: The presence of the substance in surface water was monitored at 48 sites, and it was detected at all 48 valid sites adopting the detection limit of 2pg/L, and the detection range was tr(2)~640pg/L. As results of the inter-annual trend analysis from FY2002 to FY2019, reduction tendencies in specimens from river areas, river mouth areas and sea areas were identified as statistically significant and a reduction tendency in specimens from the overall areas in surface water was also identified as statistically significant.

β-HCH: The presence of the substance in surface water was monitored at 48 sites, and it was detected at all 48 valid sites adopting the detection limit of 1pg/L, and the detection range was 17~570pg/L. As results of the inter-annual trend analysis from FY2002 to FY2019, reduction tendencies in specimens from river areas, lake areas, river mouth areas and sea areas were identified as statistically significant and a reduction tendency in specimens from the overall areas in surface water was also identified as statistically significant.

γ-HCH (synonym:Lindane): The presence of the substance in surface water was monitored at 48 sites, and it was detected at 47 of the 48 valid sites adopting the detection limit of 2pg/L, and none of the detected concentrations exceeded 480pg/L. As results of the inter-annual trend analysis from FY2003 to FY2019, reduction tendencies in specimens from river areas, lake areas, river mouth areas and sea areas were identified as statistically significant and a reduction tendency in specimens from the overall areas in surface water was also identified as statistically significant.

δ-HCH: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 46 of the 48 valid sites adopting the detection limit of 0.4pg/L, and none of the detected concentrations exceeded 85pg/L. As results of the inter-annual trend analysis from FY2003 to FY2019, a reduction tendency in specimens from river areas was identified as statistically significant. And the last 6 years period was indicated lower concentration than the period before the last 6 years in specimens from the overall areas in surface water as statistically significant.

Stocktaking of the detection of Totalα-HCH, β-HCH, γ-HCH(synonym:Lindane) and δ-HCH in surface water during FY2002~2019

α-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2002	86	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
	2010	94	75	1,400	14	4 [1]	49/49	49/49
	2011	67	60	1,000	11	7 [3]	49/49	49/49
	2012	65	56	2,200	9.5	1.4 [0.5]	48/48	48/48
	2013	57	55	1,900	9	7 [2]	48/48	48/48
	2014	47	41	700	7.3	4.5 [1.5]	48/48	48/48
	2015	48	40	610	8.7	1.2 [0.4]	48/48	48/48
	2016	38	36	640	5.1	1.1 [0.4]	48/48	48/48
	2017	47	45	680	3.7	0.9 [0.4]	47/47	47/47
	2019	35	37	640	tr(2)	4 [2]	48/48	48/48

β-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	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
	2010	180	160	2,500	33	2.0 [0.7]	49/49	49/49
	2011	130	120	840	28	2.0 [0.8]	49/49	49/49
	2012	150	130	820	17	1.4 [0.5]	48/48	48/48
	2013	130	130	1,100	20	7 [2]	48/48	48/48
	2014	100	110	1,100	11	1.0 [0.4]	48/48	48/48
	2015	130	120	1,100	21	1.2 [0.4]	48/48	48/48
	2016	100	96	1,100	12	1.2 [0.4]	48/48	48/48
	2017	100	110	830	12	1.8 [0.7]	47/47	47/47
	2019	100	92	570	17	3 [1]	48/48	48/48

γ-HCH (synonym:Lindane)	Monitored year	Geometric mean*	Median	Maximu m	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	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
	2010	26	22	190	tr(5)	6 [2]	49/49	49/49
	2011	23	20	170	3	3 [1]	49/49	49/49
	2012	22	21	440	3.0	1.3 [0.4]	48/48	48/48
	2013	21	17	560	3.2	2.7 [0.8]	48/48	48/48
	2014	18	18	350	3.5	1.2 [0.4]	48/48	48/48
	2015	17	15	110	2.6	0.9 [0.3]	48/48	48/48
	2016	14	13	130	1.8	0.8 [0.3]	48/48	48/48
	2017	17	16	190	2.1	1.4 [0.5]	47/47	47/47
	2019	14	12	480	nd	4 [2]	47/48	47/48

δ-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	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
	2010	16	17	780	0.9	0.8 [0.3]	49/49	49/49
	2011	8.6	8.9	300	0.7	0.4 [0.2]	49/49	49/49
	2012	7.9	6.7	220	tr(0.5)	1.1 [0.4]	48/48	48/48
	2013	8.2	8.9	320	tr(0.6)	1.1 [0.4]	48/48	48/48
	2014	7.1	6.5	590	0.7	0.4 [0.2]	48/48	48/48
	2015	7.2	7.4	310	0.8	0.3 [0.1]	48/48	48/48
	2016	5.5	6.0	920	tr(0.5)	0.8 [0.3]	48/48	48/48
	2017	8.2	8.2	690	tr(0.4)	1.0 [0.4]	47/47	47/47
	2019	5.1	5.3	85	nd	1.0 [0.4]	46/48	46/48

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002.
(Note 2) No monitoring was conducted in FY2018.

<Sediment>

α-HCH: The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 0.4pg/g-dry, and the detection range was 1.3~2,600pg/g-dry. As results of the inter-annual trend analysis from FY2002 to FY2019, a reduction tendency in specimens from river areas was identified as statistically significant and a reduction tendency in specimens from the overall areas in sediment was also identified as statistically significant.

β-HCH: The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 0.5pg/g-dry, and the detection range was 4.0~4,100pg/g-dry. As results of the inter-annual trend analysis from FY2002 to FY2019, a reduction tendency in specimens from river mouth areas was identified as statistically significant.

γ-HCH (synonym:Lindane): The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 0.4pg/g-dry, and the detection range was tr(0.6)~2,100pg/g-dry. As results of the inter-annual trend analysis from FY2003 to FY2019, a reduction tendency in specimens from river areas was identified as statistically significant and a reduction tendency in specimens from the overall areas in sediment was also identified as statistically significant.

δ-HCH: The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 0.2pg/g-dry, and the detection range was tr(0.2)~2,500pg/g-dry. As results of the inter-annual trend analysis from FY2002 to FY2019, a reduction tendency in specimens from river mouth areas was identified as statistically significant and a reduction tendency in specimens from the overall areas in sediment was also identified as statistically significant.

Stocktaking of the detection ofα-HCH, β-HCH, γ-HCH(synonym:Lindane) and δ-HCH in sediment during FY2002~2019

α-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	150	170	8,200	2.0	1.2 [0.4]	189/189	63/63
	2003	160	170	9,500	2	2 [0.5]	186/186	62/62
	2004	160	180	5,700	tr(1.5)	2 [0.6]	189/189	63/63
	2005	140	160	7,000	3.4	1.7 [0.6]	189/189	63/63
	2006	140	160	4,300	tr(2)	5 [2]	192/192	64/64
	2007	140	150	12,000	tr(1.3)	1.8 [0.6]	192/192	64/64
	2008	140	190	5,200	nd	1.6 [0.6]	191/192	64/64
	2009	120	120	6,300	nd	1.1 [0.4]	191/192	64/64
	2010	140	140	3,700	3.1	2.0 [0.8]	64/64	64/64
	2011	120	140	5,100	1.6	1.5 [0.6]	64/64	64/64
	2012	100	100	3,900	tr(1.1)	1.6 [0.5]	63/63	63/63
	2013	94	98	3,200	tr(0.6)	1.5 [0.5]	63/63	63/63
	2014	84	93	4,300	nd	2.4 [0.8]	62/63	62/63
	2015	97	120	9,600	1.1	0.7 [0.3]	62/62	62/62
	2016	64	77	5,000	1.1	0.9 [0.3]	62/62	62/62
	2017	77	86	1,900	1.0	0.5 [0.2]	62/62	62/62
	2019	67	83	2,600	1.3	1.1 [0.4]	61/61	61/61

β-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2002	230	230	11,000	3.9	0.9 [0.3]	189/189	63/63
	2003	250	220	39,000	5	2 [0.7]	186/186	62/62
	2004	240	230	53,000	4	3 [0.8]	189/189	63/63
	2005	200	220	13,000	3.9	2.6 [0.9]	189/189	63/63
	2006	190	210	21,000	2.3	1.3 [0.4]	192/192	64/64
	2007	200	190	59,000	1.6	0.9 [0.3]	192/192	64/64
	2008	190	200	8,900	2.8	0.8 [0.3]	192/192	64/64
	2009	180	170	10,000	2.4	1.3 [0.5]	192/192	64/64
	2010	230	210	8,200	11	2.4 [0.8]	64/64	64/64
	2011	180	210	14,000	3	3 [1]	64/64	64/64
	2012	160	170	8,300	3.7	1.5 [0.6]	63/63	63/63
	2013	160	170	6,900	4.5	0.4 [0.1]	63/63	63/63
	2014	140	140	7,200	2.9	0.9 [0.3]	63/63	63/63
	2015	160	170	5,900	2.5	0.8 [0.3]	62/62	62/62
	2016	130	160	6,000	3.7	0.9 [0.3]	62/62	62/62
	2017	140	110	3,400	5.7	1.5 [0.6]	62/62	62/62
	2019	130	110	4,100	4.0	1.2 [0.5]	61/61	61/61

γ-HCH (synonym:Lindane)	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2003	51	47	4,000	tr(1.4)	2 [0.4]	186/186	62/62
	2004	53	48	4,100	tr(0.8)	2 [0.5]	189/189	63/63
	2005	49	46	6,400	tr(1.8)	2.0 [0.7]	189/189	63/63
	2006	48	49	3,500	tr(1.4)	2.1 [0.7]	192/192	64/64
	2007	42	41	5,200	tr(0.6)	1.2 [0.4]	192/192	64/64
	2008	40	43	2,200	tr(0.7)	0.9 [0.4]	192/192	64/64
	2009	38	43	3,800	nd	0.6 [0.2]	191/192	64/64
	2010	35	30	2,300	tr(1.5)	2.0 [0.7]	64/64	64/64
	2011	35	42	3,500	nd	3 [1]	62/64	62/64
	2012	30	29	3,500	nd	1.3 [0.4]	61/63	61/63
	2013	33	35	2,100	0.9	0.6 [0.2]	63/63	63/63
	2014	27	30	2,600	nd	2.7 [0.9]	61/63	61/63
	2015	29	35	2,800	tr(0.3)	0.5 [0.2]	62/62	62/62
	2016	20	25	3,100	tr(0.7)	0.8 [0.3]	62/62	62/62
	2017	23	25	1,900	tr(0.4)	1.0 [0.4]	62/62	62/62
	2019	23	27	2,100	tr(0.6)	1.0 [0.4]	61/61	61/61

δ-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2003	42	46	5,400	nd	2 [0.7]	180/186	61/62
	2004	55	55	5,500	tr(0.5)	2 [0.5]	189/189	63/63
	2005	52	63	6,200	nd	1.0 [0.3]	188/189	63/63
	2006	45	47	6,000	nd	1.7 [0.6]	189/192	64/64
	2007	26	28	5,400	nd	5 [2]	165/192	60/64
	2008	41	53	3,300	nd	2 [1]	186/192	64/64
	2009	36	37	5,000	nd	1.2 [0.5]	190/192	64/64
	2010	39	40	3,800	1.3	1.2 [0.5]	64/64	64/64
	2011	37	47	5,000	nd	1.4 [0.5]	63/64	63/64
	2012	28	28	3,100	nd	0.8 [0.3]	62/63	62/63
	2013	31	29	2,500	0.4	0.3 [0.1]	63/63	63/63
	2014	27	26	3,900	0.4	0.4 [0.1]	63/63	63/63
	2015	27	28	2,900	tr(0.4)	0.5 [0.2]	62/62	62/62
	2016	20	24	6,100	nd	0.5 [0.2]	60/62	60/62
	2017	25	22	1,700	tr(0.2)	0.6 [0.2]	62/62	62/62
	2019	22	23	2,500	tr(0.2)	0.5 [0.2]	61/61	61/61

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002~2009.

(Note 2) No monitoring was conducted in FY2018.

<Wildlife>

α-HCH: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was 4~14pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 12 of the 16 valid areas adopting the detection limit of 2pg/g-wet, and none of the detected concentrations exceeded 130pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 2pg/g-wet, and the detected concentration was 63pg/g-wet. As results of the inter-annual trend analysis from FY2002 to FY2019, reduction tendencies in specimens from bivalves and fish were identified as statistically significant.

β-HCH: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 11~33pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 3~400pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 1pg/g-wet, and the detected concentration was 950pg/g-wet. As results of the inter-annual trend analysis from FY2002 to FY2019, a reduction tendency in specimens from fish was identified as statistically significant.

γ-HCH (synonym:Lindane): The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 2 of the 3 valid areas adopting the detection limit of 1pg/g-wet, and none of the detected concentrations exceeded 7pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 13 of the 16 valid areas adopting the detection limit of 1pg/g-wet, and none of the detected concentrations exceeded 34pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 1pg/g-wet, and the detected concentration was 7pg/g-wet. As results of the inter-annual trend analysis from FY2003 to FY2019, a reduction tendency in specimens from bivalves was identified as statistically significant, and the last 6 years period was indicated lower concentration than the period before the last 6 years in specimens from fish as statistically significant.

δ-HCH: The presence of the substance in bivalves was monitored in 3 areas, and it was not detected at all 3 valid areas adopting the detection limit of 2pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 6 of the 16 valid areas adopting the detection limit of 2pg/g-wet, and none of the detected concentrations exceeded 5pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 2pg/g-wet, and the detected concentration was 4pg/g-wet.

Stocktaking of the detection ofα-HCH, β-HCH, γ-HCH(synonym:Lindane) and δ-HCH in wildlife (bivalves, fish and birds) during FY2002~2019

α-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	67	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	56	25	1,800	tr(12)	13 [4.3]	31/31	7/7
	2005	38	25	1,100	tr(7.1)	11 [3.6]	31/31	7/7
	2006	30	21	390	6	3 [1]	31/31	7/7
	2007	31	17	1,400	8	7 [2]	31/31	7/7
	2008	26	16	380	7	6 [2]	31/31	7/7
	2009	45	21	2,200	9	5 [2]	31/31	7/7
	2010	35	20	730	13	3 [1]	6/6	6/6
	2011	64	33	1,200	13	3 [1]	4/4	4/4
	2012	23	12	340	4.0	3.7 [1.2]	5/5	5/5
	2013	30	25	690	6	3 [1]	5/5	5/5
	2014	16	16	39	7	3 [1]	3/3	3/3
	2015	11	15	25	3.5	3.0 [1.0]	3/3	3/3
	2016	13	20	22	5	3 [1]	3/3	3/3
	2017	15	16	32	6	3 [1]	3/3	3/3
	2019	9	12	14	4	4 [2]	3/3	3/3
Fish (pg/g-wet)	2002	57	56	590	tr(1.9)	4.2 [1.4]	70/70	14/14
	2003	43	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	42	43	1,000	nd	11 [3.6]	75/80	16/16
	2006	44	53	360	tr(2)	3 [1]	80/80	16/16
	2007	39	40	730	tr(2)	7 [2]	80/80	16/16
	2008	36	47	410	nd	6 [2]	84/85	17/17
	2009	39	32	830	tr(2)	5 [2]	90/90	18/18
	2010	27	39	250	tr(1)	3 [1]	18/18	18/18
	2011	37	54	690	tr(2)	3 [1]	18/18	18/18
	2012	24	32	170	nd	3.7 [1.2]	18/19	18/19
	2013	32	47	320	tr(2)	3 [1]	19/19	19/19
	2014	26	40	210	nd	3 [1]	18/19	18/19
	2015	18	26	180	tr(1.3)	3.0 [1.0]	19/19	19/19
	2016	15	17	81	nd	3 [1]	18/19	18/19
	2017	20	29	130	nd	3 [1]	18/19	18/19
	2019	8	8	130	nd	4 [2]	12/16	12/16
Birds (pg/g-wet)	2002	170	130	360	93	4.2 [1.4]	10/10	2/2
	2003	73	74	230	30	1.8 [0.61]	10/10	2/2
	2004	190	80	1,600	58	13 [4.3]	10/10	2/2
	2005	76	77	85	67	11 [3.6]	10/10	2/2
	2006	76	75	100	55	3 [1]	10/10	2/2
	2007	75	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
	2010	260	---	430	160	3 [1]	2/2	2/2
	2011	---	---	48	48	3 [1]	1/1	1/1
	2012	35	---	39	32	3.7 [1.2]	2/2	2/2
	2013**	46	---	130	16	3 [1]	2/2	2/2
	2014**	61	---	220	17	3 [1]	2/2	2/2
	2015**	---	---	13	13	3.0 [1.0]	1/1	1/1
	2016**	63	---	170	23	3 [1]	2/2	2/2
	2017**	81	---	930	7	3 [1]	2/2	2/2
	2019**	---	---	63	63	4 [2]	1/1	1/1

β-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2002	88	62	1,700	32	12 [4]	38/38	8/8
	2003	78	50	1,100	23	9.9 [3.3]	30/30	6/6
	2004	100	74	1,800	22	6.1 [2.0]	31/31	7/7
	2005	85	56	2,000	20	2.2 [0.75]	31/31	7/7
	2006	81	70	880	11	3 [1]	31/31	7/7
	2007	79	56	1,800	21	7 [3]	31/31	7/7
	2008	73	51	1,100	23	6 [2]	31/31	7/7
	2009	83	55	1,600	27	6 [2]	31/31	7/7
	2010	89	56	1,500	27	3 [1]	6/6	6/6
	2011	130	68	2,000	39	3 [1]	4/4	4/4
	2012	65	37	980	15	2.0 [0.8]	5/5	5/5
	2013	61	47	710	17	2.2 [0.8]	5/5	5/5
	2014	40	35	64	28	2.4 [0.9]	3/3	3/3
	2015	34	45	69	13	3.0 [1.0]	3/3	3/3
	2016	37	47	50	21	3 [1]	3/3	3/3
	2017	39	47	60	21	3 [1]	3/3	3/3
	2019	23	32	33	11	3 [1]	3/3	3/3
Fish (pg/g-wet)	2002	110	120	1,800	tr(5)	12 [4]	70/70	14/14
	2003	81	96	1,100	tr(3.5)	9.9 [3.3]	70/70	14/14
	2004	110	140	1,100	tr(3.9)	6.1 [2.0]	70/70	14/14
	2005	95	110	1,300	6.7	2.2 [0.75]	80/80	16/16
	2006	89	110	1,100	4	3 [1]	80/80	16/16
	2007	110	120	810	7	7 [3]	80/80	16/16
	2008	94	150	750	tr(4)	6 [2]	85/85	17/17
	2009	98	130	970	tr(5)	6 [2]	90/90	18/18
	2010	81	110	760	5	3 [1]	18/18	18/18
	2011	100	140	710	4	3 [1]	18/18	18/18
	2012	72	100	510	6.5	2.0 [0.8]	19/19	19/19
	2013	80	110	420	7.2	2.2 [0.8]	19/19	19/19
	2014	75	140	460	4.4	2.4 [0.9]	19/19	19/19
	2015	56	94	390	6.0	3.0 [1.0]	19/19	19/19
	2016	41	65	200	5	3 [1]	19/19	19/19
	2017	54	86	290	4	3 [1]	19/19	19/19
	2019	27	35	400	3	3 [1]	16/16	16/16
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	2,300	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	2,400	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
	2010	1,600	---	2,800	910	3 [1]	2/2	2/2
	2011	---	---	4,500	4,500	3 [1]	1/1	1/1
	2012	1,400	---	2,600	730	2.0 [0.8]	2/2	2/2
	2013**	1,400	---	3,000	610	2.2 [0.8]	2/2	2/2
	2014**	290	---	3,600	24	2.4 [0.9]	2/2	2/2
	2015**	---	---	57	57	3.0 [1.0]	1/1	1/1
	2016**	1,400	---	2,600	790	3 [1]	2/2	2/2
	2017**	1,000	---	3,500	300	3 [1]	2/2	2/2
	2019**	---	---	950	950	3 [1]	1/1	1/1

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(24)	tr(16)	230	nd	31 [10]	28/31	7/7
	2005	23	13	370	tr(5.7)	8.4 [2.8]	31/31	7/7
	2006	18	12	140	7	4 [2]	31/31	7/7
	2007	16	10	450	tr(4)	9 [3]	31/31	7/7
	2008	12	10	98	tr(3)	9 [3]	31/31	7/7
	2009	14	12	89	tr(3)	7 [3]	31/31	7/7
	2010	14	9	150	5	3 [1]	6/6	6/6
	2011	26	17	320	5	3 [1]	4/4	4/4
	2012	8.1	3.5	68	3.0	2.3 [0.9]	5/5	5/5
	2013	7.2	3.9	31	tr(2.1)	2.4 [0.9]	5/5	5/5
	2014	7.4	4.8	18	4.6	2.2 [0.8]	3/3	3/3
	2015	7.3	7.8	14	tr(3.6)	4.8 [1.6]	3/3	3/3
	2016	6	5	11	4	3 [1]	3/3	3/3
	2017	4	3	11	tr(2)	3 [1]	3/3	3/3
	2019	tr(2)	tr(2)	7	nd	4 [1]	2/3	2/3
Fish (pg/g-wet)	2003	16	22	130	tr(1.7)	3.3 [1.1]	70/70	14/14
	2004	tr(28)	tr(24)	660	nd	31 [10]	55/70	11/14
	2005	17	17	230	nd	8.4 [2.8]	78/80	16/16
	2006	19	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
	2010	9	13	56	tr(1)	3 [1]	18/18	18/18
	2011	12	15	160	tr(1)	3 [1]	18/18	18/18
	2012	7.8	12	43	nd	2.3 [0.9]	18/19	18/19
	2013	8.6	12	81	nd	2.4 [0.9]	17/19	17/19
	2014	8.4	14	45	nd	2.2 [0.8]	16/19	16/19
	2015	6.1	7.9	42	nd	4.8 [1.6]	14/19	14/19
	2016	5	5	43	nd	3 [1]	18/19	18/19
	2017	6	9	30	nd	3 [1]	16/19	16/19
	2019	tr(3)	tr(3)	34	nd	4 [1]	13/16	13/16
Birds (pg/g-wet)	2003	14	19	40	3.7	3.3 [1.1]	10/10	2/2
	2004	64	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	21	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
	2010	10	---	23	4	3 [1]	2/2	2/2
	2011	---	---	26	26	3 [1]	1/1	1/1
	2012	11	---	19	6.3	2.3 [0.9]	2/2	2/2
	2013**	6.0	---	24	tr(1.5)	2.4 [0.9]	2/2	2/2
	2014**	10	---	24	4.4	2.2 [0.8]	2/2	2/2
	2015**	---	---	nd	nd	4.8 [1.6]	0/1	0/1
	2016**	5	---	14	tr(2)	3 [1]	2/2	2/2
	2017**	4	---	20	tr(1)	3 [1]	2/2	2/2
	2019**	---	---	7	7	4 [1]	1/1	1/1

δ-HCH	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2003	7.4	tr(2.6)	1,300	nd	3.9 [1.3]	29/30	6/6
	2004	6.3	tr(2.1)	1,500	nd	4.6 [1.5]	25/31	6/7
	2005	5.4	tr(2.1)	1,600	nd	5.1 [1.7]	23/31	6/7
	2006	6	tr(2)	890	tr(1)	3 [1]	31/31	7/7
	2007	4	nd	750	nd	4 [2]	12/31	4/7
	2008	tr(3)	nd	610	nd	6 [2]	7/31	3/7
	2009	tr(4)	nd	700	nd	5 [2]	14/31	4/7
	2010	4	tr(2)	870	nd	3 [1]	5/6	5/6
	2011	9	tr(2)	1,400	tr(1)	3 [1]	4/4	4/4
	2012	3	tr(1)	580	nd	3 [1]	3/5	3/5
	2013	3	tr(1)	230	nd	3 [1]	3/5	3/5
	2014	tr(1)	tr(2)	3	nd	3 [1]	2/3	2/3
	2015	nd	nd	tr(1.5)	nd	2.1 [0.8]	1/3	1/3
	2016	tr(1)	tr(1)	tr(2)	tr(1)	3 [1]	3/3	3/3
	2017	tr(1.7)	tr(1.6)	3.0	tr(1.0)	2.3 [0.9]	3/3	3/3
	2019	nd	nd	nd	nd	4 [2]	0/3	0/3
Fish (pg/g-wet)	2003	tr(3.6)	4.0	16	nd	3.9 [1.3]	59/70	13/14
	2004	tr(4.2)	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
	2010	tr(2)	tr(2)	36	nd	3 [1]	13/18	13/18
	2011	3	4	19	nd	3 [1]	14/18	14/18
	2012	tr(2)	tr(2)	12	nd	3 [1]	14/19	14/19
	2013	3	tr(2)	40	nd	3 [1]	14/19	14/19
	2014	tr(2)	tr(2)	23	nd	3 [1]	14/19	14/19
	2015	tr(1.7)	tr(1.8)	17	nd	2.1 [0.8]	12/19	12/19
	2016	tr(2)	tr(2)	10	nd	3 [1]	17/19	17/19
	2017	2.4	2.4	23	nd	2.3 [0.9]	15/19	15/19
	2019	nd	nd	5	nd	4 [2]	6/16	6/16
Birds (pg/g-wet)	2003	19	18	31	12	3.9 [1.3]	10/10	2/2
	2004	30	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	12	10	22	4	4 [2]	10/10	2/2
	2008	9	8	31	tr(3)	6 [2]	10/10	2/2
	2009	5	6	9	tr(3)	5 [2]	10/10	2/2
	2010	12	---	13	11	3 [1]	2/2	2/2
	2011	---	---	5	5	3 [1]	1/1	1/1
	2012	4	---	7	tr(2)	3 [1]	2/2	2/2
	2013**	3	---	4	tr(2)	3 [1]	2/2	2/2
	2014**	tr(2)	---	3	tr(1)	3 [1]	2/2	2/2
	2015**	---	---	nd	nd	2.1 [0.8]	0/1	0/1
	2016**	tr(1)	---	tr(2)	tr(1)	3 [1]	2/2	2/2
	2017**	nd	---	tr(1.0)	nd	2.3 [0.9]	1/2	1/2
	2019**	---	---	4	4	4 [2]	1/1	1/1

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2002~2009.

(Note 2) “ ** ” indicates there is no consistency between the results of the ornithological survey after FY2013 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2018.

<Air>

α-HCH: The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.05pg/m^3, and the detection range was 6.3~230pg/m^3. As results of the inter-annual trend analysis from FY2003 to FY2019, a reduction tendency in specimens from warm season was identified as statistically significant.

β-HCH: The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was 0.38~29pg/m^3. As results of the inter-annual trend analysis from FY2003 to FY2019, a reduction tendency in specimens from warm season was identified as statistically significant.

γ-HCH (synonym:Lindane): The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.05pg/m^3, and the detection range was 0.88~49pg/m^3. As results of the inter-annual trend analysis from FY2003 to FY2019, a reduction tendency in specimens from warm season was identified as statistically significant.

δ-HCH: The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.02pg/m^3, and the detection range was tr(0.02)~19pg/m^3.

Stocktaking of the detection of*α*-HCH, *β*-HCH, *γ*-HCH (synonym: Lindane) and *δ*-HCH in air during FY2002~2019

α-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009Warm season	58	58	340	19	0.12 [0.05]	37/37	37/37
	2009Cold season	21	18	400	7.8		37/37	37/37
	2010Warm season	46	51	280	14	1.4 [0.47]	37/37	37/37
	2010Cold season	19	16	410	6.8		37/37	37/37
	2011Warm season	43	44	410	9.5	2.5 [0.83]	35/35	35/35
	2011Cold season	18	15	680	6.5		37/37	37/37
	2012Warm season	37	37	250	15	2.1 [0.7]	36/36	36/36
	2012Cold season	12	11	120	4.4		36/36	36/36
	2013Warm season	36	39	220	13	5.2 [1.7]	36/36	36/36
	2013Cold season	10	8.8	75	tr(3.9)		36/36	36/36
	2014Warm season	44	40	650	14	0.19 [0.06]	36/36	36/36
	2015Warm season	33	32	300	8.8	0.17 [0.06]	35/35	35/35
	2016Warm season	39	35	520	5.4	0.17 [0.07]	37/37	37/37
	2017Warm season	36	37	700	4.9	0.08 [0.03]	37/37	37/37
	2019Warm season	21	21	230	6.3	0.12 [0.05]	36/36	36/36

β-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2009Warm season	5.6	5.6	28	0.96	0.09 [0.03]	37/37	37/37
	2009Cold season	1.8	1.8	24	0.31		37/37	37/37
	2010Warm season	5.6	6.2	34	0.89	0.27 [0.09]	37/37	37/37
	2010Cold season	1.7	1.7	29	tr(0.26)		37/37	37/37
	2011Warm season	5.0	5.2	49	0.84	0.39 [0.13]	35/35	35/35
	2011Cold season	1.7	1.7	91	tr(0.31)		37/37	37/37
	2012Warm season	5.0	5.5	32	0.65	0.36 [0.12]	36/36	36/36
	2012Cold season	0.93	1.1	8.5	tr(0.26)		36/36	36/36
	2013Warm season	4.7	5.7	37	0.66	0.21 [0.07]	36/36	36/36
	2013Cold season	0.97	0.95	6.7	tr(0.17)		36/36	36/36
	2014Warm season	5.4	6.8	74	0.57	0.24 [0.08]	36/36	36/36
	2015Warm season	3.0	3.0	34	0.36	0.25 [0.08]	35/35	35/35
	2016Warm season	4.8	5.6	64	0.3	0.3 [0.1]	37/37	37/37
	2017Warm season	4.1	5.1	59	0.67	0.11 [0.04]	37/37	37/37
	2019Warm season	2.3	2.4	29	0.38	0.06 [0.02]	36/36	36/36

γ-HCH (synonym: Lindane)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	17	19	65	2.9	0.06 [0.02]	37/37	37/37
	2009Cold season	5.6	4.6	55	1.5		37/37	37/37
	2010Warm season	14	16	66	2.3	0.35 [0.12]	37/37	37/37
	2010Cold season	4.8	4.4	60	1.1		37/37	37/37
	2011Warm season	14	17	98	2.7	1.6 [0.52]	35/35	35/35
	2011Cold season	5.1	4.8	67	tr(1.1)		37/37	37/37
	2012Warm season	13	15	55	2.3	0.95 [0.32]	36/36	36/36
	2012Cold season	3.1	3.2	19	tr(0.63)		36/36	36/36
	2013Warm season	12	14	58	tr(2.0)	2.2 [0.7]	36/36	36/36
	2013Cold season	2.8	3.0	12	nd		34/36	34/36
	2014Warm season	14	16	100	1.7	0.17 [0.06]	36/36	36/36
	2015Warm season	8.3	10	51	1.4	0.19 [0.06]	35/35	35/35
	2016Warm season	12	13	89	0.79	0.18 [0.07]	37/37	37/37
	2017Warm season	10	11	93	0.84	0.10 [0.04]	37/37	37/37
	2019Warm season	6.4	7.0	49	0.88	0.12 [0.05]	36/36	36/36

δ-HCH	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	1.3	1.3	21	0.09	0.04 [0.02]	37/37	37/37
	2009Cold season	0.36	0.33	20	0.04		37/37	37/37
	2010Warm season	1.4	1.3	25	0.11	0.05 [0.02]	37/37	37/37
	2010Cold season	0.38	0.35	22	0.05		37/37	37/37
	2011Warm season	1.1	1.1	33	0.11	0.063 [0.021]	35/35	35/35
	2011Cold season	0.35	0.34	26	tr(0.050)		37/37	37/37
	2012Warm season	1.0	1.3	20	tr(0.06)	0.07 [0.03]	36/36	36/36
	2012Cold season	0.18	0.19	7.3	nd		35/36	35/36
	2013Warm season	1.0	1.1	20	tr(0.05)	0.08 [0.03]	36/36	36/36
	2013Cold season	0.17	0.17	5.3	nd		34/36	34/36
	2014Warm season	1.2	1.3	50	tr(0.07)	0.19 [0.06]	36/36	36/36
	2015Warm season	0.55	0.71	22	nd	0.15 [0.05]	32/35	32/35
	2016Warm season	1.0	1.2	46	nd	0.20 [0.08]	35/37	35/37
	2017Warm season	0.80	0.92	46	nd	0.08 [0.03]	36/37	36/37
	2019Warm season	0.46	0.51	19	tr(0.02)	0.04 [0.02]	36/36	36/36

(Note) No monitoring was conducted in FY2018.

[12] Chlordecone (reference)

・ History and state of monitoring (reference)

Chlordecone is a synthetic chlorinated organic compound, which was mainly used as an agricultural pesticide. No domestic record of manufacture/import of the substance was reported since it was historically never registrated under the Agricultural Chemicals Regulation Law. Chlordecone was adopted as a target chemical at the Fourth Meeting of the Conference of Parties (COP4) on 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.

As a continuous survey, the first survey was in FY2008. In the Initial Environmental Survey and the Detailed Environmental Survey etc. under the framework of the Environmental Survey and Monitoring of Chemicals after FY2002, the substance was monitored in air in FY2003.

Under the framework of the Environmental Monitoring, the substance was monitored in surface water, sediment and wildlife (bivalves, fish and birds) in FY2008, and in surface water, sediment and wildlife (bivalves, fish and birds) air in FY2010 and FY2011.

No monitoring was conducted during FY2012~FY2019. For reference, the monitoring results up to FY2011 are given below.

・ Monitoring results until FY2011

<Surface Water>

Stocktaking of the detection of Chlordecone in surface water during FY2008~2011

Chlordecone	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2008	nd	nd	0.76	nd	0.14 [0.05]	13/46	13/46
	2010	tr(0.04)	nd	1.6	nd	0.09 [0.04]	13/49	13/49
	2011	nd	nd	0.70	nd	0.20 [0.05]	15/49	15/49

(Note) No monitoring was conducted in FY2009.

<Sediment>

Stocktaking of the detection of Chlordecone sediment during FY2008~2011

Chlordecone	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2008	nd	nd	5.8	nd	0.42 [0.16]	23/129	10/49
	2010	nd	nd	2.8	nd	0.4 [0.2]	9/64	9/64
	2011	nd	nd	1.5	nd	0.40 [0.20]	9/64	9/64

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2008.

(Note 2) No monitoring was conducted in FY2009.

<Wildlife>

Stocktaking of the detection of Chlordecone in wildlife (bivalves, fish and birds) during FY2002~2014

Chlordecone	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2008	nd	nd	nd	nd	5.6 [2.2]	0/31	0/7
	2010	nd	nd	nd	nd	5.9 [2.3]	0/6	0/6
	2011	nd	nd	nd	nd	0.5 [0.2]	0/4	0/4
Fish (pg/g-wet)	2008	nd	nd	nd	nd	5.6 [2.2]	0/85	0/17
	2010	nd	nd	nd	nd	5.9 [2.3]	0/18	0/18
	2011	nd	nd	nd	nd	0.5 [0.2]	0/18	0/18
Birds (pg/g-wet)	2008	nd	nd	nd	nd	5.6 [2.2]	0/10	0/2
	2010	nd	---	nd	nd	5.9 [2.3]	0/2	0/2
	2011	---	---	nd	nd	0.5 [0.2]	0/1	0/1

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2008.

(Note 2) No monitoring was conducted in FY209.

<Air>

Stocktaking of the detection of Chlordecone in air in FY2010 and 2011

Chlordecone	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2010Warm season	nd	nd	nd	nd	0.04 [0.02]	0/37	0/37
	2010Cold season	nd	nd	nd	nd		0/37	0/37
	2011Warm season	nd	nd	nd	nd	0.04 [0.02]	0/35	0/35
	2011Cold season	nd	nd	nd	nd		0/37	0/37

[13] Hexabromobiphenyls (reference)

・ History and state of monitoring

Hexabromobiphenyls are industrial chemicals that have been used as flame retardans. 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.

As a continuous survey, the first survey was in FY2009. Under the framework of the Environmental Survey of Chemical Substances up to FY2001, the substance was monitored in surface water, sediment, wildlife (fish) and air in FY1989. Under the framework of the Initial Environmental Survey and the Detailed Environmental Survey etc. in the Environmental Survey and Monitoring of Chemicals after FY2002, the substance was monitored surface water and sediment in FY2003, in air in FY2004.

Under the framework of the Environmental Monitoring, the substances were monitored in surface water, sediment and wildlife (bivalves, fish and birds) in FY2009, in air in FY2010~2011 and in sediment, wildlife (bivalves, fish and birds) and air in FY2015.

No monitoring was conducted in FY2016 ~ FY2019. For reference, the monitoring results up to FY2015 are given below.

・ Monitoring results until FY2015

<Surface Water>

Stocktaking of the detection of Hexabromobiphenyls in surface water during FY2009~2011

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
	2010	nd	nd	nd	nd	3 [1]	0/49	0/49
	2011	nd	nd	nd	nd	2.2 [0.9]	0/49	0/49

(Note) “ ** “ indicates the sum value of the Quantification [Detection] limits of each congener in FY2009 and FY2011.

<Sediment>

Stocktaking of the detection of Hexabromobiphenyls in sediment during FY2002~2015

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
	2010	nd	nd	18	nd	1.5 [0.6]	10/64	10/64
	2011	nd	nd	6.3	nd	3.6 [1.4]	8/64	8/64
	2015	nd	nd	15	nd	0.8 [0.3]	9/62	9/62

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2009.

(Note 2) “ ** “ indicates the sum value of the Quantification [Detection] limits of each congener in FY2009 and FY2011.

(Note 3) No monitoring was conducted during FY2012~2014.

<Wildlife>

Stocktaking of the detection of Hexabromobiphenyls in wildlife (bivalves, fish and birds) during FY2009~2015

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
	2010	nd	nd	nd	nd	24 [10]	0/6	0/6
	2011	nd	nd	nd	nd	3 [1]	0/4	0/4
	2015	nd	nd	nd	nd	14 [5]	0/3	0/3
Fish (pg/g-wet)	2009	tr(0.49)	tr(0.43)	6.0	nd	1.3 [0.43]	46/90	12/18
	2010	nd	nd	nd	nd	24 [10]	0/18	0/18
	2011	nd	nd	3	nd	3 [1]	5/18	5/18
	2015	nd	nd	nd	nd	14 [5]	0/19	0/19
Birds (pg/g-wet)	2009	1.6	1.6	2.1	tr(1.2)	1.3 [0.43]	10/10	2/2
	2010	nd	---	nd	nd	24 [10]	0/2	0/2
	2011	---	---	3	3	3 [1]	1/1	1/1
	2015***	---	---	nd	nd	14 [5]	0/1	0/1

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2009.

(Note 2) “ ** “ indicates the sum value of the Quantification [Detection] limits of each congener in FY2009 and FY2010.

(Note 3) ”***” There is no consistency between the results of the ornithological survey in FY2015 and those in previous years because of the changes in the survey sites and target species.

(Note 4) No monitoring was conducted during FY2012~2014.

<Air>

Stocktaking of the detection of Hexabromobiphenyls in air during FY2010~2015

Hexabromo biphenyls	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2010Warm season	nd	nd	nd	nd	0.3 [0.1]	0/37	0/37
	2010Cold season	nd	nd	nd	nd		0/37	0/37
	2011Warm season	nd	nd	nd	nd	0.3 [0.1]	0/35	0/35
	2011Cold season	nd	nd	nd	nd		0/37	0/37
	2015Warm season	nd	nd	1.1	nd	0.06 [0.02]	2/35	2/35

(Note) No monitoring was conducted during FY2012~2014.

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

・ 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. The substances were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in April 2010. Also, Decabromodiphenyl ether was adopted as target chemicals at the COP8 of the Stockholm convention on Persistent Organic Pollutants held from late April to early May 2017.The substance was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in April 2018.

As a continuous survey, the first survey was in FY2008. Under the framework of the Environmental Survey of Chemical Substances up to FY2001, Decabromodiphenyl ether was monitored in surface water and sediment in FY1977 and FY1996, Polybromodiphenyl ethers (Br_6, Br_8 and Br_{10}) were monitored in surface water, sediment and wildlife (fish) in FY1987 and FY1988, Polybromodiphenyl ethers (Br_1~Br_7) were monitored in air in FY2001.In the Initial Environmental Survey and the Detailed Environmental Survey etc. under the framework of the Environmental Survey and Monitoring of Chemicals after FY2002, Decabromodiphenyl ether was monitored in surface water, sediment and wildlife (fish) in FY2002, Polybromodiphenyl ethers (Br_6, Br_8 and Br_{10}) were monitored in sediment and wildlife (fish) in FY2003, Pentabromodiphenyl ethers were monitored in sediment and Polybromodiphenyl ethers (Br_1~Br_7) in air in FY2004, Polybromodiphenyl ethers (Br_1~Br_7, Br_9 and Br_{10}) were monitored in surface water in FY2005.

Under the framework of the Environmental Monitoring, Polybromodiphenyl ethers (Br_4~Br_{10}) were monitored in wildlife (bivalves, fish and birds) in FY2008, in surface water, sediment and air in FY2009 and in surface water, sediment and wildlife (bivalves, fish and birds) and air in FY2010~2012, 2014~2019.

・ Monitoring results

<Surface Water>

Tetrabromodiphenyl ethers: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 39 of the 48 valid sites adopting the detection limit of 4pg/L, and none of the detected concentrations exceeded 320pg/L. As results of the inter-annual trend analysis from FY2009 to FY2019, Although the number of detections was small, the detection rates of river area, sea area and all areas in surface water were decreased, it suggested reduction tendencies of the concentrations.

Pentabromodiphenyl ethers: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 19 of the 48 valid sites adopting the detection limit of 2pg/L, and none of the detected concentrations exceeded 69pg/L. As results of the inter-annual trend analysis from FY2009 to FY2019, Although the number of detections was small, the detection rates of river area, river mouth area, sea area and all areas in surface water were decreased, it suggested reduction tendencies of the concentrations.

Hexabromodiphenyl ethers: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 5 of the 48 valid sites adopting the detection limit of 1pg/L, and none of the detected concentrations exceeded 8pg/L. As results of the inter-annual trend analysis from FY2009 to FY2019, Although the number of detections was small, the detection rates of river area, river mouth area and sea area in surface water were decreased, it suggested reduction tendencies of the concentrations.

Heptabromodiphenyl ethers: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 2 of the 48 valid sites adopting the detection limit of 2pg/L, and none of the detected concentrations exceeded 6pg/L. Although the number of detections was small, the detection rates of river area, river mouth area and sea area in surface water were decreased, it suggested reduction tendencies of the concentrations.

Octabromodiphenyl ethers: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 12 of the 48 valid sites adopting the detection limit of 1pg/L, and none of the detected concentrations exceeded 14pg/L. As results of the inter-annual trend analysis from FY2009 to FY2019, Although the number of detections was small, the detection rate of all areas in surface water was decreased, it suggested a reduction tendency of the concentrations.

Nonabromodiphenyl ethers: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 27 of the 48 valid sites adopting the detection limit of 3pg/L, and none of the detected concentrations exceeded 150pg/L.

Decabromodiphenyl ether: The presence of the substance in surface water was monitored at 48 sites, and it was detected at all 48 valid sites adopting the detection limit of 6pg/L, and the detection range was tr(10)~2,200pg/L.

Stocktaking of the detection of Polybromodiphenyl ethers (Br_4~Br_{10}) in surface water during FY2009~2019

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
	2010	nd	nd	390	nd	9 [3]	17/49	17/49
	2011	11	10	180	nd	4 [2]	48/49	48/49
	2012	tr(3)	tr(3)	22	nd	4 [1]	47/48	47/48
	2014	tr(6)	tr(6)	51	tr(4)	8 [3]	48/48	48/48
	2015	4.3	4.1	40	tr(1.2)	3.6 [1.2]	48/48	48/48
	2016	5	tr(5)	47	tr(3)	5 [2]	48/48	48/48
	2017	tr(4)	tr(4)	12	nd	9 [3]	44/47	44/47
	2018	nd	nd	72	nd	13 [5]	22/47	22/47
	2019	tr(6)	tr(6)	320	nd	11 [4]	39/48	39/48

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
	2010	tr(1)	tr(1)	130	nd	3 [1]	25/49	25/49
	2011	5	4	180	nd	3 [1]	48/49	48/49
	2012	tr(1)	tr(1)	20	nd	2 [1]	32/48	32/48
	2014	nd	nd	39	nd	4 [2]	19/48	19/48
	2015	tr(3.0)	tr(3.2)	31	nd	6.3 [2.1]	34/48	34/48
	2016	tr(1.5)	tr(1.3)	36	nd	2.4 [0.9]	39/48	39/48
	2017	nd	tr(1)	8	nd	3 [1]	24/47	24/47
	2018	nd	nd	110	nd	9 [3]	13/47	13/47
	2019	nd	nd	69	nd	6 [2]	19/48	19/48

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
	2010	nd	nd	51	nd	4 [2]	16/49	16/49
	2011	tr(1)	nd	39	nd	3 [1]	21/49	21/49
	2012	nd	nd	7	nd	3 [1]	6/48	6/48
	2014	nd	nd	8	nd	4 [1]	10/48	10/48
	2015	nd	nd	12	nd	1.5 [0.6]	5/48	5/48
	2016	nd	nd	9.1	nd	2.1 [0.8]	9/48	9/48
	2017	nd	nd	tr(6)	nd	7 [3]	1/47	1/47
	2018	nd	nd	54	nd	3 [1]	15/47	15/47
	2019	nd	nd	8	nd	2 [1]	5/48	5/48

Heptabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface Water (pg/L)	2009	nd	nd	40	nd	4 [2]	9/49	9/49
	2010	nd	nd	14	nd	3 [1]	17/49	17/49
	2011	nd	nd	14	nd	6 [2]	14/49	14/49
	2012	nd	nd	10	nd	4 [1]	9/48	9/48
	2014	nd	nd	8	nd	8 [3]	3/48	3/48
	2015	nd	nd	28	nd	2.0 [0.8]	9/48	9/48
	2016	nd	nd	11	nd	7 [3]	10/48	10/48
	2017	nd	nd	30	nd	14 [5]	1/47	1/47
	2018	nd	nd	65	nd	8 [3]	3/47	3/47
	2019	nd	nd	6	nd	4 [2]	2/48	2/48

Octabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface Water (pg/L)	2009	3.0	3.9	56	nd	1.4 [0.6]	37/49	37/49
	2010	tr(2)	tr(2)	69	nd	3 [1]	40/49	40/49
	2011	4	3	98	nd	2 [1]	44/49	44/49
	2012	tr(2)	nd	35	nd	4 [2]	16/48	16/48
	2014	2.5	3.7	38	nd	1.6 [0.6]	33/48	33/48
	2015	2.3	3.1	36	nd	1.5 [0.6]	31/48	31/48
	2016	5.8	7.5	230	nd	0.8 [0.3]	44/48	44/48
	2017	tr(2)	nd	33	nd	2 [1]	22/47	22/47
	2018	tr(2)	tr(1)	69	nd	3 [1]	35/47	35/47
	2019	nd	nd	14	nd	3 [1]	12/48	12/48

Nonabromodiphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface Water (pg/L)	2009	tr(46)	tr(38)	500	nd	91 [30]	32/49	32/49
	2010	tr(17)	tr(13)	620	nd	21 [7]	39/49	39/49
	2011	33	24	920	nd	10 [4]	47/49	47/49
	2012	tr(21)	tr(19)	320	nd	40 [13]	30/48	30/48
	2014	37	38	590	nd	6 [2]	47/48	47/48
	2015	36	33	330	nd	6 [2]	47/48	47/48
	2016	43	45	3,900	tr(2)	4 [1]	48/48	48/48
	2017	17	26	460	nd	7 [3]	37/47	37/47
	2018	12	12	170	nd	6 [2]	46/47	46/47
	2019	tr(7)	8	150	nd	8 [3]	27/48	27/48

Decabromodiphenyl ether	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface Water (pg/L)	2009	tr(310)	tr(220)	3,400	nd	600 [200]	26/49	26/49
	2010	tr(250)	tr(200)	13,000	nd	300 [100]	31/49	31/49
	2011	200	140	58,000	nd	60 [20]	45/49	45/49
	2012	tr(400)	tr(320)	12,000	nd	660 [220]	31/48	31/48
	2014	200	230	5,600	tr(14)	22 [9]	48/48	48/48
	2015	720	570	13,000	140	18 [7]	48/48	48/48
	2016	210	160	34,000	tr(12)	14 [6]	48/48	48/48
	2017	150	210	4,100	nd	24 [8]	46/47	46/47
	2018	120	110	2,700	12	11 [4]	47/47	47/47
	2019	110	99	2,200	tr(10)	14 [6]	48/48	48/48

(Note) No monitoring was conducted in FY2013.

<Sediment>

Tetrabromodiphenyl ethers: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 58 of the 61 valid sites adopting the detection limit of 2pg/g-dry, and none of the detected concentrations exceeded 710pg/g-dry. Although the number of detections was small, the detection rate of river area in sediment was decreased, it suggested a reduction tendency of the concentrations.

Pentabromodiphenyl ethers: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 52 of the 61 valid sites adopting the detection limit of 1pg/g-dry, and none of the detected concentrations exceeded 740pg/g-dry. Although the number of detections was small, the detection rate of river area in sediment was decreased, it suggested a reduction tendency of the concentrations.

Hexabromodiphenyl ethers: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 41 of the 61 valid sites adopting the detection limit of 2pg/g-dry, and none of the detected concentrations exceeded 690pg/g-dry. Although the number of detections was small, the detection rate of river area in sediment was decreased, it suggested a reduction tendency of the concentrations.

Heptabromodiphenyl ethers: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 39 of the 61 valid sites adopting the detection limit of 3pg/g-dry, and none of the detected concentrations exceeded 1,400pg/g-dry. Although the number of detections was small, the detection rate of river area in sediment was decreased, it suggested a reduction tendency of the concentrations.

Octabromodiphenyl ethers: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 50 of the 61 valid sites adopting the detection limit of 1pg/g-dry, and none of the detected concentrations exceeded 2,000pg/g-dry. Although the number of detections was small, the detection rate of river area in sediment was decreased, it suggested a reduction tendency of the concentrations.

Nonabromodiphenyl ethers: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 59 of the 61 valid sites adopting the detection limit of 2pg/g-dry, and none of the detected concentrations exceeded 40,000pg/g-dry.

Decabromodiphenyl ether: The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 2pg/g-dry, and the detection range was 14~560,000pg/g-dry.

Stocktaking of the detection of Polybromodiphenyl ethers (Br_4~Br_{10}) in sediment during FY2009~2019

Tetrabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	tr(60)	tr(44)	1,400	nd	69 [23]	131/192	51/64
	2010	35	38	910	nd	6 [2]	57/64	57/64
	2011	32	30	2,600	nd	30 [10]	47/64	47/64
	2012	27	37	4,500	nd	2 [1]	60/63	60/63
	2014	tr(24)	tr(19)	550	nd	27 [9]	44/63	44/63
	2015	30	28	1,400	nd	21 [7]	44/62	44/62
	2016	tr(21)	tr(16)	390	nd	33 [11]	35/62	35/62
	2017	13	10	570	nd	9 [4]	44/62	44/62
	2018	21	tr(16)	3,100	nd	18 [6]	43/61	43/61
	2019	15	14	710	nd	5 [2]	58/61	58/61
Pentabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	36	24	1,700	nd	24 [8]	146/192	57/64
	2010	26	23	740	nd	5 [2]	58/64	58/64
	2011	24	18	4,700	nd	5 [2]	62/64	62/64
	2012	21	21	2,900	nd	2.4 [0.9]	62/63	62/63
	2014	16	14	570	nd	6 [2]	53/63	53/63
	2015	23	20	1,300	nd	18 [6]	44/62	44/62
	2016	13	tr(10)	400	nd	12 [4]	46/62	46/62
	2017	10	tr(5.5)	560	nd	9 [4]	37/62	37/62
	2018	19	24	2,800	nd	4 [2]	53/61	53/61
	2019	9	9	740	nd	3 [1]	52/61	52/61

Hexabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	21	21	2,600	nd	5 [2]	139/192	53/64
	2010	23	23	770	nd	4 [2]	57/64	57/64
	2011	31	42	2,000	nd	9 [3]	52/64	52/64
	2012	15	19	1,700	nd	3 [1]	48/63	48/63
	2014	21	27	730	nd	5 [2]	50/63	50/63
	2015	11	15	820	nd	3 [1]	42/62	42/62
	2016	17	19	600	nd	8 [3]	40/62	40/62
	2017	16	24	570	nd	6 [2]	44/62	44/62
	2018	29	37	1,300	nd	3 [1]	52/61	52/61
	2019	14	17	690	nd	4 [2]	41/61	41/61

Heptabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	30	25	16,000	nd	9 [4]	125/192	51/64
	2010	28	18	930	nd	4 [2]	58/64	58/64
	2011	29	32	2,400	nd	7 [3]	55/64	55/64
	2012	34	32	4,400	nd	4 [2]	48/63	48/63
	2014	19	tr(14)	680	nd	16 [6]	41/63	41/63
	2015	16	21	1,800	nd	3 [1]	44/62	44/62
	2016	16	17	1,100	nd	6 [2]	44/62	44/62
	2017	18	16	580	nd	15 [6]	36/62	36/62
	2018	44	48	1,900	nd	14 [5]	46/61	46/61
	2019	15	11	1,400	nd	6 [3]	39/61	39/61

Octabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	210	96	110,000	nd	1.2 [0.5]	182/192	63/64
	2010	71	76	1,800	nd	10 [4]	60/64	60/64
	2011	57	64	36,000	nd	10 [4]	55/64	55/64
	2012	78	74	15,000	nd	19 [6]	47/63	47/63
	2014	52	58	2,000	nd	12 [4]	55/63	55/63
	2015	58	tr(44)	1,400	nd	48 [16]	41/62	41/62
	2016	51	49	1,400	nd	6 [2]	55/62	55/62
	2017	38	58	1,900	nd	5 [2]	48/62	48/62
	2018	100	140	5,500	nd	1.2 [0.5]	57/61	57/61
	2019	33	47	2,000	nd	3 [1]	50/61	50/61

Nonabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	1,100	710	230,000	nd	9 [4]	181/192	64/64
	2010	360	430	26,000	nd	24 [9]	60/64	60/64
	2011	710	630	70,000	nd	23 [9]	62/64	62/64
	2012	360	380	84,000	nd	34 [11]	52/63	52/63
	2014	470	470	42,000	nd	60 [20]	60/63	60/63
	2015	300	420	11,000	nd	24 [8]	55/62	55/62
	2016	430	390	26,000	nd	27 [9]	60/62	60/62
	2017	400	490	29,000	nd	15 [5]	61/62	61/62
	2018	690	770	56,000	nd	5 [2]	60/61	60/61
	2019	310	420	40,000	nd	5 [2]	59/61	59/61

Decabromodiphenyl ether	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	6,000	4,800	880,000	tr(30)	60 [20]	192/192	64/64
	2010	5,100	4,200	700,000	nd	220 [80]	60/64	60/64
	2011	4,200	4,700	700,000	nd	40 [20]	62/64	62/64
	2012	5,700	6,300	760,000	nd	270 [89]	60/63	60/63
	2014	5,600	5,000	980,000	nd	240 [80]	61/63	61/63
	2015	6,600	7,200	490,000	40	40 [20]	62/62	62/62
	2016	4,700	5,100	940,000	nd	120 [41]	61/62	61/62
	2017	4,600	5,700	580,000	tr(27)	30 [10]	62/62	62/62
	2018	5,100	6,300	520,000	tr(14)	42 [14]	61/61	61/61
	2019	4,400	6,300	560,000	14	4 [2]	61/61	61/61

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2009.

(Note 2) No monitoring was conducted in FY2013.

<Wildlife>

Tetrabromodiphenyl ethers: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 7pg/g-wet, and the detection range was tr(15)~68pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 7pg/g-wet, and the detection range was tr(10)~210pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 7pg/g-wet, and the detected concentration was 210pg/g-wet. As results of the inter-annual trend analysis from FY2008 to FY2019, a reduction tendency in specimens of bivalves was identified as statistically significant.

Pentabromodiphenyl ethers: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 4pg/g-wet, and the detection range was tr(5)~28pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 4pg/g-wet, and the detection range was tr(4)~58pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 4pg/g-wet, and the detected concentration was 150pg/g-wet. As results of the inter-annual trend analysis from FY2008 to FY2019, a reduction tendency in specimens of fish was identified as statistically significant.

Hexabromodiphenyl ethers: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 1 of the 3 valid areas adopting the detection limit of 8pg/g-wet, and the detected concentration was 24pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 8pg/g-wet, and the detection range was tr(12)~290pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 8pg/g-wet, and the detected concentration was 480pg/g-wet.

Heptabromodiphenyl ethers: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 1 of the 3 valid areas adopting the detection limit of 9pg/g-wet, and the detected concentration was tr(18)pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 9 of the 16 valid areas adopting the detection limit of 9pg/g-wet, and none of the detected concentrations exceeded 82pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 9pg/g-wet, and the detected concentration was 260pg/g-wet.

Octabromodiphenyl ethers: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 1 of the 3 valid areas adopting the detection limit of 7pg/g-wet, and the detected concentration was 39pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 8 of the 16 valid areas adopting the detection limit of 7pg/g-wet, and none of the detected concentrations exceeded 120pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 7pg/g-wet, and the detected concentration was 330pg/g-wet.

Nonabromodiphenyl ethers: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 1 of the 3 valid areas adopting the detection limit of 20pg/g-wet, and the detected concentration was 81pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was not detected at all 16 valid areas adopting the detection limit of 20pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and not detected in the area adopting the detection limit of 20pg/g-wet. Although the number of detections was small, the detection rate of specimens from fish was decreased, it suggested a reduction tendency of the concentrations.

Decabromodiphenyl ether: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 1 of the 3 valid areas adopting the detection limit of 70pg/g-wet, and the detected concentration was tr(180)pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was not detected at all 16 valid areas adopting the detection limit of 70pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and not detected in the area adopting the detection limit of 70pg/g-wet. Although the number of detections was small, the detection rate of specimens from fish was decreased, it suggested a reduction tendency of the concentrations.

Stocktaking of the detection of Polybromodiphenyl ethers (Br_4~Br_{10}) in wildlife (bivalves, fish and birds) during FY2008~2019

Tetrabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2008	73	61	380	20	5.9 [2.2]	31/31	7/7
	2010	59	73	310	nd	43 [16]	5/6	5/6
	2011	96	120	490	26	16 [6]	4/4	4/4
	2012	59	44	190	24	19 [7]	5/5	5/5
	2014	56	38	140	33	15 [6]	3/3	3/3
	2015	48	38	89	32	15 [6]	3/3	3/3
	2016	42	32	98	23	13 [5]	3/3	3/3
	2017	47	23	200	23	16 [6]	3/3	3/3
	2018	36	26	68	26	14 [5]	3/3	3/3
	2019	26	tr(17)	68	tr(15)	18 [7]	3/3	3/3
Fish (pg/g-wet)	2008	120	110	1,300	9.8	5.9 [2.2]	85/85	17/17
	2010	160	170	740	tr(16)	43 [16]	18/18	18/18
	2011	110	110	860	tr(9)	16 [6]	18/18	18/18
	2012	120	140	650	tr(10)	19 [7]	19/19	19/19
	2014	150	160	1,300	18	15 [6]	19/19	19/19
	2015	90	82	580	tr(14)	15 [6]	19/19	19/19
	2016	76	53	390	tr(10)	13 [5]	19/19	19/19
	2017	80	73	360	tr(7)	16 [6]	19/19	19/19
	2018	79	61	440	tr(13)	14 [5]	18/18	18/18
	2019	57	62	210	tr(10)	18 [7]	16/16	16/16
Birds (pg/g-wet)	2008	170	190	1,200	32	5.9 [2.2]	10/10	2/2
	2010	140	---	270	72	43 [16]	2/2	2/2
	2011	---	---	67	67	16 [6]	1/1	1/1
	2012	73	---	110	49	19 [7]	2/2	2/2
	2014**	190	---	480	78	15 [6]	2/2	2/2
	2015**	---	---	36	36	15 [6]	1/1	1/1
	2016**	170	---	470	62	13 [5]	2/2	2/2
	2017**	130	---	660	26	16 [6]	2/2	2/2
	2018**	290	---	310	280	14 [5]	2/2	2/2
	2019**	---	---	210	210	18 [7]	1/1	1/1

Pentabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2008	32	27	94	tr(11)	16 [5.9]	31/31	7/7
	2010	32	37	98	tr(9)	14 [6]	6/6	6/6
	2011	51	60	160	tr(12)	15 [6]	4/4	4/4
	2012	28	24	67	tr(8)	18 [6]	5/5	5/5
	2014	30	37	41	18	12 [5]	3/3	3/3
	2015	18	19	20	16	13 [5]	3/3	3/3
	2016	11	9	20	tr(8)	9 [4]	3/3	3/3
	2017	18	16	62	tr(6)	12 [5]	3/3	3/3
	2018	13	21	23	tr(5)	11 [4]	3/3	3/3
	2019	12	12	28	tr(5)	10 [4]	3/3	3/3
Fish (pg/g-wet)	2008	30	37	280	nd	16 [5.9]	72/85	16/17
	2010	51	54	200	nd	14 [6]	16/18	16/18
	2011	39	39	300	nd	15 [6]	17/18	17/18
	2012	37	54	180	nd	18 [6]	17/19	17/19
	2014	41	47	570	nd	12 [5]	18/19	18/19
	2015	22	17	140	nd	13 [5]	18/19	18/19
	2016	18	14	87	tr(4)	9 [4]	19/19	19/19
	2017	23	28	87	nd	12 [5]	18/19	18/19
	2018	21	21	100	nd	11 [4]	17/18	17/18
	2019	17	18	58	tr(4)	10 [4]	16/16	16/16

Pentabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Birds (pg/g-wet)	2008	150	130	440	52	16 [5.9]	10/10	2/2
	2010	150	---	200	120	14 [6]	2/2	2/2
	2011	---	---	110	110	15 [6]	1/1	1/1
	2012	85	---	110	66	18 [6]	2/2	2/2
	2014**	100	---	320	31	12 [5]	2/2	2/2
	2015**	---	---	22	22	13 [5]	1/1	1/1
	2016**	88	---	300	26	9 [4]	2/2	2/2
	2017**	77	---	500	12	12 [5]	2/2	2/2
	2018**	180	---	240	140	11 [4]	2/2	2/2
	2019**	---	---	150	150	10 [4]	1/1	1/1

Hexabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2008	19	16	82	tr(5.3)	14 [5.0]	31/31	7/7
	2010	8	16	26	nd	8 [3]	4/6	4/6
	2011	38	41	81	20	10 [4]	4/4	4/4
	2012	21	23	130	tr(6)	10 [4]	5/5	5/5
	2014	23	21	52	11	10 [4]	3/3	3/3
	2015	tr(9)	tr(6)	41	nd	12 [5]	2/3	2/3
	2016	tr(13)	tr(13)	40	nd	21 [8]	2/3	2/3
	2017	tr(14)	20	36	nd	17 [7]	2/3	2/3
	2018	tr(12)	tr(12)	34	nd	21 [8]	2/3	2/3
	2019	nd	nd	24	nd	21 [8]	1/3	1/3
Fish (pg/g-wet)	2008	46	51	310	nd	14 [5.0]	83/85	17/17
	2010	39	47	400	nd	8 [3]	16/18	16/18
	2011	53	50	430	nd	10 [4]	17/18	17/18
	2012	55	71	320	nd	10 [4]	18/19	18/19
	2014	60	61	1,100	nd	10 [4]	18/19	18/19
	2015	44	45	250	nd	12 [5]	18/19	18/19
	2016	42	36	190	nd	21 [8]	18/19	18/19
	2017	49	49	210	nd	17 [7]	18/19	18/19
	2018	44	48	190	nd	21 [8]	17/18	17/18
	2019	42	40	290	tr(12)	21 [8]	16/16	16/16
Birds (pg/g-wet)	2008	140	120	380	62	14 [5.0]	10/10	2/2
	2010	110	---	140	86	8 [3]	2/2	2/2
	2011	---	---	96	96	10 [4]	1/1	1/1
	2012	150	---	320	72	10 [4]	2/2	2/2
	2014**	170	---	680	42	10 [4]	2/2	2/2
	2015**	---	---	30	30	12 [5]	1/1	1/1
	2016**	220	---	740	68	21 [8]	2/2	2/2
	2017**	230	---	1,000	51	17 [7]	2/2	2/2
	2018**	650	---	1,300	330	21 [8]	2/2	2/2
	2019**	---	---	480	480	21 [8]	1/1	1/1

Heptabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2008	tr(8.5)	tr(7.6)	35	nd	18 [6.7]	20/31	7/7
	2010	nd	nd	tr(10)	nd	30 [10]	1/6	1/6
	2011	14	26	44	nd	11 [4]	3/4	3/4
	2012	tr(8)	tr(6)	59	nd	12 [5]	3/5	3/5
	2014	nd	nd	13	nd	12 [5]	1/3	1/3
	2015	nd	nd	tr(11)	nd	12 [5]	1/3	1/3
	2016	nd	nd	tr(8)	nd	13 [5]	1/3	1/3
	2017	nd	nd	tr(9)	nd	22 [8]	1/3	1/3
	2018	nd	nd	tr(10)	nd	15 [6]	1/3	1/3
	2019	nd	nd	tr(18)	nd	24 [9]	1/3	1/3

Heptabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Fish (pg/g-wet)	2008	tr(11)	tr(8.1)	77	nd	18 [6.7]	44/85	10/17
	2010	nd	nd	40	nd	30 [10]	4/18	4/18
	2011	13	21	130	nd	11 [4]	13/18	13/18
	2012	tr(11)	18	120	nd	12 [5]	11/19	11/19
	2014	tr(10)	13	280	nd	12 [5]	10/19	10/19
	2015	nd	nd	44	nd	12 [5]	4/19	4/19
	2016	tr(9)	tr(7)	85	nd	13 [5]	11/19	11/19
	2017	tr(11)	tr(12)	55	nd	22 [8]	10/19	10/19
	2018	tr(9)	tr(8)	58	nd	15 [6]	11/18	11/18
	2019	tr(10)	tr(10)	82	nd	24 [9]	9/16	9/16
Birds (pg/g-wet)	2008	35	35	53	19	18 [6.7]	10/10	2/2
	2010	tr(19)	---	70	nd	30 [10]	1/2	1/2
	2011	---	---	44	44	11 [4]	1/1	1/1
	2012	63	---	280	14	12 [5]	2/2	2/2
	2014**	19	---	150	nd	12 [5]	1/2	1/2
	2015**	---	---	tr(11)	tr(11)	12 [5]	1/1	1/1
	2016**	65	---	220	19	13 [5]	2/2	2/2
	2017**	89	---	440	tr(18)	22 [8]	2/2	2/2
	2018**	230	---	480	110	15 [6]	2/2	2/2
	2019**	---	---	260	260	24 [9]	1/1	1/1

Octabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2008	nd	nd	10	nd	9.6 [3.6]	15/31	6/7
	2010	nd	nd	tr(10)	nd	11 [4]	2/6	2/6
	2011	7	9	29	nd	7 [3]	3/4	3/4
	2012	8	tr(7)	25	nd	8 [3]	4/5	4/5
	2014	tr(9.2)	11	14	tr(5)	11 [4]	3/3	3/3
	2015	nd	nd	nd	nd	14 [5]	0/3	0/3
	2016	nd	nd	nd	nd	16 [6]	0/3	0/3
	2017	nd	nd	tr(9)	nd	20 [8]	1/3	1/3
	2018	nd	nd	nd	nd	16 [6]	0/3	0/3
	2019	tr(8)	nd	39	nd	17 [7]	1/3	1/3
Fish (pg/g-wet)	2008	tr(5.7)	nd	73	nd	9.6 [3.6]	35/85	7/17
	2010	tr(6)	nd	100	nd	11 [4]	8/18	8/18
	2011	tr(6)	tr(7)	150	nd	7 [3]	10/18	10/18
	2012	tr(7)	8	160	nd	8 [3]	12/19	12/19
	2014	14	13	540	nd	11 [4]	15/19	15/19
	2015	tr(7)	nd	60	nd	14 [5]	9/19	9/19
	2016	tr(8)	nd	86	nd	16 [6]	9/19	9/19
	2017	tr(9.7)	nd	88	nd	20 [8]	9/19	9/19
	2018	tr(7)	nd	74	nd	16 [6]	8/18	8/18
	2019	tr(8)	nd	120	nd	17 [7]	8/16	8/16
Birds (pg/g-wet)	2008	42	41	64	30	9.6 [3.6]	10/10	2/2
	2010	41	---	65	26	11 [4]	2/2	2/2
	2011	---	---	66	66	7 [3]	1/1	1/1
	2012	130	---	420	40	8 [3]	2/2	2/2
	2014**	17	---	140	nd	11 [4]	1/2	1/2
	2015**	---	---	tr(5)	tr(5)	14 [5]	1/1	1/1
	2016**	65	---	220	19	16 [6]	2/2	2/2
	2017**	130	---	720	25	20 [8]	2/2	2/2
	2018**	190	---	580	61	16 [6]	2/2	2/2
	2019**	---	---	330	330	17 [7]	1/1	1/1

Nonabromodiphenyl ethers	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2008	nd	nd	tr(23)	nd	35 [13]	5/31	1/7
	2010	tr(16)	tr(15)	60	nd	30 [10]	5/6	5/6
	2011	tr(12)	tr(11)	40	nd	22 [9]	3/4	3/4
	2012	tr(15)	25	45	nd	24 [9]	3/5	3/5
	2014	40	tr(20)	110	tr(20)	30 [10]	3/3	3/3
	2015	nd	nd	tr(11)	nd	23 [9]	1/3	1/3
	2016	nd	nd	nd	nd	36 [14]	0/3	0/3
	2017	nd	nd	nd	nd	50 [20]	0/3	0/3
	2018	nd	nd	nd	nd	40 [20]	0/3	0/3
	2019	tr(20)	nd	81	nd	50 [20]	1/3	1/3
Fish (pg/g-wet)	2008	nd	nd	tr(15)	nd	35 [13]	2/85	2/17
	2010	nd	nd	40	nd	30 [10]	3/18	3/18
	2011	nd	nd	tr(15)	nd	22 [9]	5/18	5/18
	2012	nd	nd	54	nd	24 [9]	9/19	9/19
	2014	tr(10)	tr(20)	40	nd	30 [10]	16/19	16/19
	2015	nd	nd	35	nd	23 [9]	6/19	6/19
	2016	nd	nd	tr(22)	nd	36 [14]	3/19	3/19
	2017	nd	nd	68	nd	50 [20]	1/19	1/19
	2018	nd	nd	nd	nd	40 [20]	0/18	0/18
	2019	nd	nd	nd	nd	50 [20]	0/16	0/16
Birds (pg/g-wet)	2008	tr(21)	tr(20)	tr(33)	nd	35 [13]	9/10	2/2
	2010	32	---	50	tr(20)	30 [10]	2/2	2/2
	2011	---	---	62	62	22 [9]	1/1	1/1
	2012	100	---	150	67	24 [9]	2/2	2/2
	2014**	tr(10)	---	tr(20)	tr(10)	30 [10]	2/2	2/2
	2015**	---	---	tr(12)	tr(12)	23 [9]	1/1	1/1
	2016**	nd	---	tr(21)	nd	36 [14]	1/2	1/2
	2017**	nd	---	nd	nd	50 [20]	0/2	0/2
	2018**	49	---	53	46	40 [20]	2/2	2/2
	2019**	---	---	nd	nd	50 [20]	0/1	0/1

Decabromodiphenyl ether	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2008	nd	nd	tr(170)	nd	220 [74]	8/31	3/7
	2010	nd	nd	tr(190)	nd	270 [97]	2/6	2/6
	2011	nd	nd	240	nd	230 [80]	1/4	1/4
	2012	120	170	480	nd	120 [50]	4/5	4/5
	2014	220	tr(150)	570	tr(120)	170 [60]	3/3	3/3
	2015	nd	nd	tr(70)	nd	170 [70]	1/3	1/3
	2016	nd	nd	tr(110)	nd	300 [100]	1/3	1/3
	2017	nd	nd	tr(180)	nd	210 [80]	1/3	1/3
	2018	nd	nd	nd	nd	240 [80]	0/3	0/3
	2019	nd	nd	tr(180)	nd	190 [70]	1/3	1/3
Fish (pg/g-wet)	2008	nd	nd	230	nd	220 [74]	5/76	4/16
	2010	nd	nd	tr(150)	nd	270 [97]	2/18	2/18
	2011	nd	nd	tr(90)	nd	230 [80]	2/18	2/18
	2012	tr(59)	tr(60)	380	nd	120 [50]	11/19	11/19
	2014	tr(75)	tr(70)	300	nd	170 [60]	13/19	13/19
	2015	nd	nd	380	nd	170 [70]	5/19	5/19
	2016	nd	nd	tr(190)	nd	300 [100]	7/19	7/19
	2017	nd	nd	2,100	nd	210 [80]	1/19	1/19
	2018	nd	nd	tr(110)	nd	240 [80]	2/18	2/18
	2019	nd	nd	nd	nd	190 [70]	0/16	0/16
Birds (pg/g-wet)	2008	nd	nd	tr(110)	nd	220 [74]	4/10	1/2
	2010	nd	---	nd	nd	270 [97]	0/2	0/2
	2011	---	---	tr(170)	tr(170)	230 [80]	1/1	1/1
	2012	250	---	260	240	120 [50]	2/2	2/2
	2014**	tr(65)	---	tr(140)	nd	170 [60]	1/2	1/2
	2015**	---	---	tr(90)	tr(90)	170 [70]	1/1	1/1
	2016**	nd	---	nd	nd	300 [100]	0/2	0/2
	2017**	nd	---	nd	nd	210 [80]	0/2	0/2
	2018**	tr(210)	---	500	tr(90)	240 [80]	2/2	2/2
	2019**	---	---	nd	nd	190 [70]	0/1	0/1

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2008.
(Note 2) "**" There is no consistency between the results of the ornithological survey after FY2014 and those in previous years because of the changes in the survey sites and target species.
(Note 3) No monitoring was conducted in FY2009 and FY2013.

<Air>

Tetrabromodiphenyl ethers: The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.01pg/m^3, and the detection range was tr(0.03)~5.5pg/m^3. As results of the inter-annual trend analysis from FY2008 to FY2019, a reduction tendency in specimens from warm season was identified as statistically significant.

Pentabromodiphenyl ethers: The presence of the substance in air was monitored at 36 sites, and it was detected at 27 of the 36 valid sites adopting the detection limit of 0.05pg/m^3, and none of the detected concentrations exceeded 6.1pg/m^3. Although the number of detections was small, the detection rate of specimens from warm season was decreased, it suggested a reduction tendency of the concentrations.

Hexabromodiphenyl ethers: The presence of the substance in air was monitored at 36 sites, and it was detected at 15 of the 36 valid sites adopting the detection limit of 0.05pg/m^3, and none of the detected concentrations exceeded 0.79pg/m^3. Although the number of detections was small, the detection rate of specimens from warm season was decreased, it suggested a reduction tendency of the concentrations.

Heptabromodiphenyl ethers: The presence of the substance in air was monitored at 36 sites, and it was detected at 24 of the 36 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded 2.7pg/m^3. Although the number of detections was small, the detection rate of specimens from warm season was decreased, it suggested a reduction tendency of the concentrations.

Octabromodiphenyl ethers: The presence of the substance in air was monitored at 36 sites, and it was detected at 32 of the 36 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded 2.6pg/m^3. Although the number of detections was small, the detection rate of specimens from warm season was decreased, it suggested a reduction tendency of the concentrations.

Nonabromodiphenyl ethers: The presence of the substance in air was monitored at 36 sites, and it was detected at 34 of the 36 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded 3.1pg/m^3. Although the number of detections was small, the detection rate of specimens from warm season was decreased, it suggested a reduction tendency of the concentrations.

Decabromodiphenyl ether: The presence of the substance in air was monitored at 36 sites, and it was detected at 32 of the 36 valid sites adopting the detection limit of 0.1pg/m3, and none of the detected concentrations exceeded 14pg/m^3. Although the number of detections was small, the detection rate of specimens from warm season was decreased, it suggested a reduction tendency of the concentrations.

Stocktaking of the detection of Polybromodiphenyl ethers (Br_4~Br_{10}) in air during FY2008~2019

Tetrabromo diphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	0.89	0.80	18	0.11	0.11 [0.04]	37/37	37/37
	2009Cold season	0.40	0.37	7.1	tr(0.04)		37/37	37/37
	2010Warm season	0.79	0.57	50	0.15	0.12 [0.05]	37/37	37/37
	2010Cold season	0.40	0.35	25	tr(0.09)		37/37	37/37
	2011Warm season	0.80	0.72	9.3	tr(0.11)	0.18 [0.07]	35/35	35/35
	2011Cold season	0.36	0.34	7.0	nd		35/37	35/37
	2012Warm season	0.7	0.7	5.7	nd	0.3 [0.1]	35/36	35/36
	2012Cold season	tr(0.2)	tr(0.2)	1.7	nd		25/36	25/36
	2014Warm season	0.53	0.47	2.3	tr(0.09)	0.28 [0.09]	36/36	36/36
	2015Warm season	tr(0.3)	tr(0.3)	2.7	nd	0.4 [0.1]	30/35	30/35
	2016Warm season	0.5	0.4	28	nd	0.4 [0.2]	30/37	30/37
	2017Warm season	0.39	0.34	4.1	tr(0.06)	0.15 [0.05]	37/37	37/37
	2018Warm season	0.28	0.26	3.9	0.05	0.05 [0.02]	37/37	37/37
	2019Warm season	0.25	0.23	5.5	tr(0.03)	0.04 [0.01]	36/36	36/36

Pentabromo diphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	0.20	0.19	18	nd	0.16 [0.06]	33/37	33/37
	2009Cold season	0.19	0.16	10	nd		29/37	29/37
	2010Warm season	0.20	0.17	45	nd	0.12 [0.05]	35/37	35/37
	2010Cold season	0.20	0.22	28	nd		34/37	34/37
	2011Warm season	0.19	0.17	8.8	nd	0.16 [0.06]	31/35	31/35
	2011Cold season	0.16	tr(0.14)	2.6	nd		31/37	31/37
	2012Warm season	tr(0.13)	tr(0.12)	2.4	nd	0.14 [0.06]	30/36	30/36
	2012Cold season	tr(0.09)	tr(0.09)	0.77	nd		26/36	26/36
	2014Warm season	tr(0.13)	tr(0.14)	0.80	nd	0.28 [0.09]	25/36	25/36
	2015Warm season	nd	nd	0.9	nd	0.6 [0.2]	6/35	6/35
	2016Warm season	nd	nd	28	nd	0.4 [0.2]	6/37	6/37
	2017Warm season	0.11	0.10	3.4	nd	0.10 [0.04]	33/37	33/37
	2018Warm season	tr(0.08)	nd	4.1	nd	0.20 [0.08]	18/37	18/37
	2019Warm season	tr(0.10)	tr(0.06)	6.1	nd	0.12 [0.05]	27/36	27/36

Hexabromo diphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	tr(0.11)	tr(0.11)	2.0	nd	0.22 [0.09]	19/37	19/37
	2009Cold season	tr(0.20)	0.22	27	nd		24/37	24/37
	2010Warm season	tr(0.14)	tr(0.13)	4.9	nd	0.16 [0.06]	29/37	29/37
	2010Cold season	0.24	0.27	5.4	nd		31/37	31/37
	2011Warm season	tr(0.11)	tr(0.10)	1.2	nd	0.14 [0.05]	28/35	28/35
	2011Cold season	0.16	0.18	1.7	nd		30/37	30/37
	2012Warm season	nd	nd	3.1	nd	0.3 [0.1]	9/36	9/36
	2012Cold season	tr(0.1)	tr(0.1)	0.5	nd		22/36	22/36
	2014Warm season	nd	nd	0.4	nd	0.4 [0.1]	5/36	5/36
	2015Warm season	nd	nd	2.0	nd	1.1 [0.4]	3/35	3/35
	2016Warm season	nd	nd	2.7	nd	0.6 [0.2]	3/37	3/37
	2017Warm season	nd	nd	2.1	nd	0.3 [0.1]	11/37	11/37
	2018Warm season	nd	nd	1.5	nd	0.17 [0.06]	9/37	9/37
	2019Warm season	tr(0.05)	nd	0.79	nd	0.13 [0.05]	15/36	15/36

Heptabromo diphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	tr(0.1)	nd	1.7	nd	0.3 [0.1]	17/37	17/37
	2009Cold season	tr(0.2)	0.3	20	nd		25/37	25/37
	2010Warm season	tr(0.2)	tr(0.1)	1.4	nd	0.3 [0.1]	24/37	24/37
	2010Cold season	0.3	0.4	11	nd		28/37	28/37
	2011Warm season	tr(0.1)	tr(0.1)	1.1	nd	0.3 [0.1]	20/35	20/35
	2011Cold season	tr(0.2)	tr(0.2)	2.3	nd		25/37	25/37
	2012Warm season	nd	nd	1.8	nd	0.5 [0.2]	6/36	6/36
	2012Cold season	nd	nd	0.7	nd		8/36	8/36
	2014Warm season	nd	nd	tr(0.4)	nd	0.7 [0.2]	2/36	2/36
	2015Warm season	nd	nd	tr(0.6)	nd	1.3 [0.4]	2/35	2/35
	2016Warm season	nd	nd	1.3	nd	1.1 [0.4]	1/37	1/37
	2017Warm season	nd	nd	3.2	nd	0.4 [0.2]	10/37	10/37
	2018Warm season	tr(0.09)	nd	1.3	nd	0.20 [0.08]	16/37	16/37
	2019Warm season	tr(0.1)	tr(0.1)	2.7	nd	0.3 [0.1]	24/36	24/36

Octabromo diphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	tr(0.2)	0.3	1.6	nd	0.3 [0.1]	23/37	23/37
	2009Cold season	0.3	0.4	7.1	nd		26/37	26/37
	2010Warm season	0.25	0.30	2.3	nd	0.15 [0.06]	30/37	30/37
	2010Cold season	0.40	0.52	6.9	nd		32/37	32/37
	2011Warm season	0.24	0.31	1.9	nd	0.20 [0.08]	27/35	27/35
	2011Cold season	0.35	0.44	7.0	nd		30/37	30/37
	2012Warm season	tr(0.2)	tr(0.2)	1.2	nd	0.3 [0.1]	29/36	29/36
	2012Cold season	0.3	0.4	1.2	nd		30/36	30/36
	2014Warm season	tr(0.1)	tr(0.1)	0.7	nd	0.4 [0.1]	22/36	22/36
	2015Warm season	nd	nd	3.8	nd	1.1 [0.4]	9/35	9/35
	2016Warm season	nd	nd	1.6	nd	0.6 [0.2]	18/37	18/37
	2017Warm season	tr(0.19)	0.23	5.7	nd	0.21 [0.07]	28/37	28/37
	2018Warm season	0.15	0.14	1.3	nd	0.11 [0.04]	34/37	34/37
	2019Warm season	tr(0.2)	tr(0.2)	2.6	nd	0.3 [0.1]	32/36	32/36

Nonabromo diphenyl ethers	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	tr(0.7)	tr(0.7)	3.0	nd	1.8 [0.6]	22/37	22/37
	2009Cold season	tr(1.0)	tr(0.8)	3.9	nd		27/37	27/37
	2010Warm season	nd	nd	24	nd	3.7 [1.2]	12/37	12/37
	2010Cold season	tr(1.2)	tr(1.3)	7.1	nd		22/37	22/37
	2011Warm season	tr(0.8)	0.9	3.9	nd	0.9 [0.4]	29/35	29/35
	2011Cold season	1.1	1.1	14	nd		30/37	30/37
	2012Warm season	tr(0.5)	tr(0.5)	5.1	nd	1.2 [0.4]	24/36	24/36
	2012Cold season	tr(0.9)	tr(1.1)	4.7	nd		30/36	30/36
	2014Warm season	nd	nd	tr(3)	nd	4 [1]	7/36	7/36
	2015Warm season	nd	nd	12	nd	3.2 [1.1]	14/35	14/35
	2016Warm season	tr(0.9)	tr(0.9)	11	nd	1.4 [0.5]	28/37	28/37
	2017Warm season	0.8	0.8	40	nd	0.6 [0.2]	31/37	31/37
	2018Warm season	0.51	0.7	3	nd	0.4 [0.2]	31/37	31/37
	2019Warm season	0.5	0.7	3.1	nd	0.3 [0.1]	34/36	34/36

Decabromo diphenyl ether	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Air (pg/m^3)	2009Warm season	tr(7)	tr(9)	31	nd	16 [5]	28/37	28/37
	2009Cold season	tr(10)	tr(11)	45	nd		29/37	29/37
	2010Warm season	nd	nd	290	nd	27 [9.1]	10/37	10/37
	2010Cold season	tr(11)	tr(12)	88	nd		21/37	21/37
	2011Warm season	tr(8.2)	tr(9.0)	30	nd	12 [4.0]	31/35	31/35
	2011Cold season	tr(8.4)	tr(9.0)	44	nd		29/37	29/37
	2012Warm season	nd	nd	31	nd	16 [5]	17/36	17/36
	2012Cold season	tr(10)	tr(12)	73	nd		28/36	28/36
	2014Warm season	tr(4.7)	tr(5.0)	64	nd	9 [3]	24/36	24/36
	2015Warm season	4.2	4.3	61	nd	2.2 [0.7]	30/35	30/35
	2016Warm season	5	5	86	nd	3 [1]	35/37	35/37
	2017Warm season	4.2	4.4	140	nd	2.4 [0.8]	34/37	34/37
	2018Warm season	2.6	3.4	19	nd	2.0 [0.8]	31/37	31/37
	2019Warm season	1.8	2.6	14	nd	0.3 [0.1]	32/36	32/36

(Note) No monitoring was conducted in FY2013.

[15] Perfluorooctane sulfonic acid (PFOS)

・ History and state of monitoring

Perfluorooctane sulfonic acid (PFOS) has been used as electric and electronic parts, fire fighting foam, photo imaging, hydraulic fluids and textiles. Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride 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.

As a continuous survey, the first survey was in FY2008. Under the framework the Initial Environmental Survey and the Detailed Environmental Survey etc. in the Environmental Survey and Monitoring of Chemicals after FY2002, the substance was monitored in surface water in FY2002, sediment and wildlife (fish) in FY2003, air in FY2004, surface water, sediment and wildlife (bivalves and fish) in FY2005.

Under the framework of the Environmental Monitoring, the substance was monitored in surface water, sediment and wildlife (bivalves, fish and birds) in FY2009, in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY2010~2012, FY2014~2016 and FY2019, in air in FY2013, in wildlife (bivalves, fish and birds) and air in FY2017, and in surface water and sediment in FY2018.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 48 sites, and it was detected at 47 of the 48 valid sites adopting the detection limit of 30pg/L, and none of the detected concentrations exceeded 2,500pg/L.

As results of the inter-annual trend analysis from FY2009 to FY2019, a reduction tendency in specimens from lake areas was identified as statistically significant.

Stocktaking of the detection of Perfluorooctane sulfonic acid (PFOS) in surface water during FY2009~2019

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
	2010	490	380	230,000	tr(37)	50 [20]	49/49	49/49
	2011	480	360	10,000	tr(20)	50 [20]	49/49	49/49
	2012	550	510	14,000	39	31 [12]	48/48	48/48
	2014	460	410	7,500	nd	50 [20]	47/48	47/48
	2015	630	490	4,700	120	29 [11]	48/48	48/48
	2016	330	300	14,000	tr(23)	50 [20]	48/48	48/48
	2018	310	300	4,100	nd	70 [30]	42/47	42/47
	2019	290	260	2,500	nd	80 [30]	47/48	47/48

(Note) No monitoring was conducted in FY2013 and FY2017.

<Sediment>

The presence of the substance in sediment was monitored at 61 sites, and it was detected at 60 of the 61 valid sites adopting the detection limit of 4pg/g-dry, and none of the detected concentrations exceeded 460pg/g-dry.

As results of the inter-annual trend analysis from FY2009 to FY2019, reduction tendencies in specimens from river mouth areas and sea areas were identified as statistically significant and a reduction tendency in specimens from the overall areas in sediment was also identified as statistically significant.

Stocktaking of the detection of Perfluorooctane sulfonic acid (PFOS) in sediment during FY2009~2019

Perfluorooctane sulfonic acid (PFOS)	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	78	97	1,900	nd	9.6 [3.7]	180/190	64/64
	2010	82	100	1,700	tr(3)	5 [2]	64/64	64/64
	2011	92	110	1,100	nd	5 [2]	63/64	63/64
	2012	68	84	1,200	tr(7)	9 [4]	63/63	63/63
	2014	59	79	980	nd	5 [2]	62/63	62/63
	2015	91	88	2,200	7	3 [1]	62/62	62/62
	2016	54	61	690	5	5 [2]	62/62	62/62
	2018	43	57	700	nd	7 [3]	55/61	55/61
	2019	44	46	460	nd	9 [4]	60/61	60/61

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2009.

(Note 2) No monitoring was conducted in FY2013.

<Wildlife>

The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was tr(2)~140pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was tr(3)~3,600pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 2pg/g-wet, and the detected concentration was 360pg/g-wet.

Stocktaking of the detection of Perfluorooctane sulfonic acid (PFOS) in wildlife (bivalves, fish and birds) during FY2009~2017

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
	2010	72	85	680	nd	25 [9.6]	5/6	5/6
	2011	38	44	100	16	10 [4]	4/4	4/4
	2012	27	21	160	tr(4)	7 [3]	5/5	5/5
	2014	8	6	93	nd	5 [2]	2/3	2/3
	2015	7	tr(2)	210	nd	4 [2]	2/3	2/3
	2016	11	tr(6)	160	nd	9 [3]	2/3	2/3
	2017	22	34	160	nd	12 [4]	2/3	2/3
	2019	10	tr(4)	140	tr(2)	6 [2]	3/3	3/3
Fish (pg/g-wet)	2009	220	230	15,000	nd	19 [7.4]	83/90	17/18
	2010	390	480	15,000	nd	25 [9.6]	17/18	17/18
	2011	82	95	3,200	nd	10 [4]	16/18	16/18
	2012	110	130	7,300	tr(5)	7 [3]	19/19	19/19
	2014	82	83	4,600	nd	5 [2]	18/19	18/19
	2015	91	90	2,500	nd	4 [2]	18/19	18/19
	2016	79	80	5,200	nd	9 [3]	18/19	18/19
	2017	150	150	11,000	tr(4)	12 [4]	19/19	19/19
	2019	67	80	3,600	tr(3)	6 [2]	16/16	16/16
Birds (pg/g-wet)	2009	300	360	890	37	19 [7.4]	10/10	2/2
	2010	1,300	---	3,000	580	25 [9.6]	2/2	2/2
	2011	---	---	110	110	10 [4]	1/1	1/1
	2012	160	---	410	63	7 [3]	2/2	2/2
	2014**	4,600	---	110,000	190	5 [2]	2/2	2/2
	2015**	---	---	790	790	4 [2]	1/1	1/1
	2016**	3,600	---	9,100	1,400	9 [3]	2/2	2/2
	2017**	9,800	---	32,000	3,000	12 [4]	2/2	2/2
	2019**	---	---	360	360	6 [2]	1/1	1/1

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2009.

(Note 2) “ ** ” indicates there is no consistency between the results of the ornithological survey after FY2014 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2013 and FY2018.

<Air>

The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.3pg/m^3, and the detection range was 1.3~7.8pg/m^3.

As results of the inter-annual trend analysis from FY2010 to FY2019, a reduction tendency in specimens from warm season was identified as statistically significant.

Stocktaking of the detection of Perfluorooctane sulfonic acid (PFOS) in air during FY2010~2019

Perfluorooctane sulfonic acid (PFOS)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2010Warm season	5.2	5.9	14	1.6	0.4 [0.1]	37/37	37/37
	2010Cold season	4.7	4.4	15	1.4		37/37	37/37
	2011Warm season	4.4	4.2	10	0.9	0.5 [0.2]	35/35	35/35
	2011Cold season	3.7	3.8	9.5	1.3		37/37	37/37
	2012Warm season	3.6	3.8	8.9	1.3	0.5 [0.2]	36/36	36/36
	2012Cold season	2.7	3.0	5.9	1.0		36/36	36/36
	2013Warm season	4.6	5.2	9.6	1.2	0.3 [0.1]	36/36	36/36
	2013Cold season	3.7	3.9	7.4	1.6		36/36	36/36
	2014Warm season	3.1	3.2	8.6	0.52	0.17 [0.06]	36/36	36/36
	2015Warm season	2.8	2.6	8.8	0.59	0.19 [0.06]	35/35	35/35
	2016Warm season	3.1	2.4	9.3	0.7	0.6 [0.2]	37/37	37/37
	2017Warm season	2.9	2.7	8.9	1.1	0.3 [0.1]	37/37	37/37
	2019Warm season	3.8	4.1	7.8	1.3	0.8 [0.3]	36/36	36/36

(Note) No monitoring was conducted in FY2018.

[16] 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. PFOA, its salts and PFOA-related compounds were adopted as target chemicals at the COP9 of the Stockholm convention on Persistent Organic Pollutants held from late April to early May 2019. The substances were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in December 2020.

As a continuous survey, the first survey was in FY2009. Under the framework of the Environmental Survey and Monitoring of Chemicals after FY2002, the Initial Environmental Survey and the Detailed Environmental Survey etc., the substance was monitored in surface water in FY2002, sediment and wildlife (fish) in FY2003, air in FY2004, surface water, sediment and wildlife (bivalves and fish) in FY2005.

Under the framework of the Environmental Monitoring, PFOA was monitored in surface water, sediment and wildlife (bivalves, fish and birds) in FY2009, in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY2010~2012, FY2014~FY2016 and FY2019, in air in FY2013, in wildlife (bivalves, fish and birds) and air in FY2017, and in surface water and sediment in FY2018.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 48 sites, and it was detected at all 48 valid sites adopting the detection limit of 40pg/L, and the detection range was 160~11,000pg/L.

As results of the inter-annual trend analysis from FY2009 to FY2019, a reduction tendency in specimens from river mouth areas was identified as statistically significant and a reduction tendency in specimens from the overall areas in surface water was also identified as statistically significant.

Stocktaking of the detection of Perfluorooctanoic acid (PFOA) in surface water during FY2009~2019

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
	2010	2,700	2,400	23,000	190	60 [20]	49/49	49/49
	2011	2,000	1,700	50,000	380	50 [20]	49/49	49/49
	2012	1,400	1,100	26,000	240	170 [55]	48/48	48/48
	2014	1,400	1,400	26,000	140	50 [20]	48/48	48/48
	2015	1,400	1,200	17,000	310	56 [22]	48/48	48/48
	2016	1,300	1,200	21,000	260	50 [20]	48/48	48/48
	2018	1,100	1,100	28,000	160	70 [30]	47/47	47/47
	2019	1,000	900	11,000	160	90 [40]	48/48	48/48

(Note) No monitoring was conducted in FY2013 and FY2017.

<Sediment>

The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 2pg/g-dry, and the detection range was tr(3)~190pg/g-dry.

As results of the inter-annual trend analysis from FY2009 to FY2019, a reduction tendencies in specimens from river areas and river mouth areas were identified as statistically significant.

Stocktaking of the detection of Perfluorooctanoic acid (PFOA) in sediment during FY2009~2019

Perfluorooctanoic acid (PFOA)	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2009	27	24	500	nd	8.3 [3.3]	182/190	64/64
	2010	28	33	180	nd	12 [5]	62/64	62/64
	2011	100	93	1,100	22	5 [2]	64/64	64/64
	2012	51	48	280	12	4 [2]	63/63	63/63
	2014	44	50	190	tr(6)	11 [5]	63/63	63/63
	2015	48	48	270	8	3 [1]	62/62	62/62
	2016	27	27	190	nd	9 [4]	61/62	61/62
	2018	23	25	190	nd	9 [4]	58/61	58/61
	2019	21	22	190	tr(3)	5 [2]	61/61	61/61

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2009.
(Note 2) No monitoring was conducted in FY2013 and FY2017.

<Wildlife>

The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 2pg/g-wet, and the detection range was tr(2)~tr(5)pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 12 of the 16 valid areas adopting the detection limit of 2pg/g-wet, and none of the detected concentrations exceeded 18pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 2pg/g-wet, and the detected concentration was 27pg/g-wet.

Although the number of detections was small, the detection rate of specimens from fish was decreased, it suggested a reduction tendency of the concentrations.

Stocktaking of the detection of Perfluorooctanoic acid (PFOA) in wildlife (bivalves, fish and birds) during FY2009~2017

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
	2010	28	33	76	nd	26 [9.9]	5/6	5/6
	2011	100	93	1,100	22	5 [2]	64/64	64/64
	2012	tr(21)	tr(23)	46	nd	38 [13]	4/5	4/5
	2014	tr(4)	tr(6)	10	nd	10 [3]	2/3	2/3
	2015	tr(6.5)	tr(6.3)	26	nd	10 [3.4]	2/3	2/3
	2016	4	7	9	nd	4 [2]	2/3	2/3
	2017	tr(6)	tr(7)	18	nd	12 [4]	2/3	2/3
	2019	tr(3)	tr(4)	tr(5)	tr(2)	6 [2]	3/3	3/3
Fish (pg/g-wet)	2009	tr(23)	tr(19)	490	nd	25 [9.9]	74/90	17/18
	2010	tr(13)	tr(11)	95	nd	26 [9.9]	13/18	13/18
	2011	nd	nd	51	nd	41 [14]	7/18	7/18
	2012	tr(35)	tr(32)	86	nd	38 [13]	18/19	18/19
	2014	tr(6)	tr(4)	85	nd	10 [3]	11/19	11/19
	2015	tr(5.7)	tr(5.3)	99	nd	10 [3.4]	11/19	11/19
	2016	4	tr(3)	20	tr(2)	4 [2]	19/19	19/19
	2017	tr(6)	tr(4)	79	nd	12 [4]	12/19	12/19
	2019	tr(3)	tr(3)	18	nd	6 [2]	12/16	12/16
Birds (pg/g-wet)	2009	32	29	58	tr(16)	25 [9.9]	10/10	2/2
	2010	38	---	48	30	26 [9.9]	2/2	2/2
	2011	---	---	nd	nd	41 [14]	0/1	0/1
	2012	tr(27)	---	tr(28)	tr(26)	38 [13]	2/2	2/2
	2014**	62	---	2,600	nd	10 [3]	1/2	1/2
	2015**	---	---	31	31	10 [3.4]	1/1	1/1
	2016**	130	---	320	52	4 [2]	2/2	2/2
	2017**	240	---	680	85	12 [4]	2/2	2/2
	2019**	---	---	27	27	6 [2]	1/1	1/1

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2009.
(Note 2) " ** " indicates there is no consistency between the results of the ornithological survey after FY2014 and those in previous years because of the changes in the survey sites and target species.
(Note 3) No monitoring was conducted in FY2013 and FY2018.

<Air>

The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.3pg/m^3, and the detection range was 5.5~46pg/m^3.

Stocktaking of the detection of Perfluorooctanoic acid (PFOA) in air during FY2010~2017

Perfluorooctanoic acid (PFOA)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2010Warm season	25	26	210	4.0	0.5 [0.2]	37/37	37/37
	2010Cold season	14	14	130	2.4		37/37	37/37
	2011Warm season	20	18	240	tr(3.5)	5.4 [1.8]	35/35	35/35
	2011Cold season	12	11	97	nd		36/37	36/37
	2012Warm season	11	12	120	1.9	0.7 [0.2]	36/36	36/36
	2012Cold season	6.9	6.0	48	1.6		36/36	36/36
	2013Warm season	23	23	190	3.2	1.8 [0.6]	36/36	36/36
	2013Cold season	14	14	53	3.0		36/36	36/36
	2014Warm season	28	29	210	5.4	0.4 [0.1]	36/36	36/36
	2015Warm season	19	17	260	tr(3.7)	4.2 [1.4]	35/35	35/35
	2016Warm season	17	15	140	3.2	1.3 [0.4]	37/37	37/37
	2017Warm season	14	13	150	tr(2.0)	3.3 [1.1]	37/37	37/37
	2019 Warm season	14	14	46	5.5	0.8 [0.3]	36/36	36/36

(Note) No monitoring was conducted in FY2018.

[17] Pentachlorobenzene

・ History and state of monitoring

Pentachlorobenzene have been used as used in PCB products, in dyestuff carriers, as a fungicide, a flame retardant and as a chemical intermediate e.g. previously for the production of quintozene. PeCB might still be used as an intermediate. PeCB is also produced unintentionally during combustion, thermal and industrial processes. It also present as impurities in products such as solvents or pesticides.It was historically never registered under the Agricultural Chemicals Regulation Law. The substance is produced as a by-product when agricultural chemicals are produced. In addition, it is generated unintentionally at the time of combustion. The substance 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.

As a continuous survey to FY2001, undert the framework “the Wildlife Monitoring of Chemicals,” the substance was monitored in wildlife (bivalves and fish) in FY1980, wildlife (bivalves, fish and birds) from FY1979 to FY1986, in FY1988, FY1990, FY1992, FY1996 and FY1999.

Under the framework of the Environmental Monitoring, the substance was monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY2007, FY2010~2015 and FY2017~2019, in air in FY2009, and in sediment, wildlife (bivalves, fish and birds) and air in FY2016.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 48 sites, and it was detected at all 48 valid sites adopting the detection limit of 2pg/L, and the detection range was tr(2)~360pg/L.

Stocktaking of the detection of Pentachlorobenzene in surface water during FY2007~2019

Pentachlorobenzene	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2007	nd	nd	nd	nd	3,300 [1,300]	0/48	0/48
	2010	8	5	100	tr(1)	4 [1]	49/49	49/49
	2011	11	11	170	2.6	2.4 [0.9]	49/49	49/49
	2012	14	11	170	3	3 [1]	48/48	48/48
	2013	12	10	170	tr(3)	4 [1]	48/48	48/48
	2014	10	7.0	180	2.8	0.8 [0.3]	48/48	48/48
	2015	13	11	180	3.0	1.5 [0.5]	48/48	48/48
	2017	8.8	5.9	140	2.0	1.4 [0.6]	47/47	47/47
	2018	12	9.7	320	2.7	1.3 [0.5]	47/47	47/47
	2019	9	7	360	tr(2)	6 [2]	48/48	48/48

(Note) No monitoring was conducted in FY2008, FY2009 and FY2016.

<Sediment>

The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 0.4pg/g-dry, and the detection range was 1.2~3,300pg/g-dry.

Stocktaking of the detection of Pentachlorobenzene in sediment during FY2007~2018

Pentachlorobenzene	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2007	tr(46)	nd	2,400	nd	86 [33]	79/192	35/64
	2010	90	95	4,200	1.0	0.9 [0.3]	64/64	64/64
	2011	95	76	4,500	3	5 [2]	64/64	64/64
	2012	33	33	1,100	nd	2.5 [0.8]	62/63	62/63
	2013	84	98	3,800	2.2	2.1 [0.7]	63/63	63/63
	2014	70	78	3,600	tr(1.2)	2.4 [0.8]	63/63	63/63
	2015	65	69	2,600	2.4	1.5 [0.5]	62/62	62/62
	2016	62	71	3,700	tr(1.1)	1.8 [0.6]	62/62	62/62
	2017	61	61	2,800	1.3	1.2 [0.5]	62/62	62/62
	2018	72	77	3,400	1.2	0.9 [0.3]	61/61	61/61
	2019	29	27	3,300	1.2	0.9 [0.4]	61/61	61/61

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2007.

(Note 2) No monitoring was conducted in FY2008 and FY2009.

<Wildlife>

The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 7~14pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was 3~280pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 1pg/g-wet, and the detected concentration was 470pg/g-wet.

Stocktaking of the detection of Pentachlorobenzene in wildlife (bivalves, fish and birds) during FY2007~2019

Pentachlorobenzene	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2007	nd	nd	tr(150)	nd	180 [61]	1/31	1/7
	2010	18	16	110	5.9	1.9 [0.7]	6/6	6/6
	2011	28	16	260	10	4 [1]	4/4	4/4
	2012	16	9.7	110	tr(5.8)	8.1 [2.7]	5/5	5/5
	2013	nd	nd	87	nd	78 [26]	1/5	1/5
	2014	14	11	23	10	9.3 [3.1]	3/3	3/3
	2015	tr(11)	tr(9.7)	18	tr(7.4)	12 [4.0]	3/3	3/3
	2016	tr(13)	tr(12)	15	tr(11)	15 [5.1]	3/3	3/3
	2017	18	19	22	14	4 [1]	3/3	3/3
	2018	tr(8)	tr(7)	tr(13)	tr(5)	15 [5]	3/3	3/3
	2019	10	11	14	7	3 [1]	3/3	3/3
Fish (pg/g-wet)	2007	nd	nd	480	nd	180 [61]	36/80	10/16
	2010	42	37	230	5.6	1.9 [0.7]	18/18	18/18
	2011	36	37	220	5	4 [1]	18/18	18/18
	2012	29	37	190	tr(5.0)	8.1 [2.7]	19/19	19/19
	2013	tr(35)	tr(40)	160	nd	78 [26]	11/19	11/19
	2014	38	51	280	nd	9.3 [3.1]	18/19	18/19
	2015	26	40	230	nd	12 [4.0]	18/19	18/19
	2016	19	22	150	nd	15 [5.1]	16/19	16/19
	2017	29	32	170	4	4 [1]	19/19	19/19
	2018	19	29	70	nd	15 [5]	15/18	15/18
	2019	20	19	280	3	3 [1]	16/16	16/16

Pentachlorobenzene	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Birds (pg/g-wet)	2007	tr(140)	tr(140)	210	tr(89)	180 [61]	10/10	2/2
	2010	91	---	170	49	1.9 [0.7]	2/2	2/2
	2011	---	---	52	52	4 [1]	1/1	1/1
	2012	77	---	130	46	8.1 [2.7]	2/2	2/2
	2013**	300	---	390	230	78 [26]	2/2	2/2
	2014**	56	---	560	tr(5.6)	9.3 [3.1]	2/2	2/2
	2015**	---	---	53	53	12 [4.0]	1/1	1/1
	2016**	240	---	570	100	15 [5.1]	2/2	2/2
	2017**	130	---	470	35	4 [1]	2/2	2/2
	2018**	370	---	480	280	15 [5]	2/2	2/2
	2019**	---	---	470	470	3 [1]	1/1	1/1

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2007.

(Note 2) " ** " indicates there is no consistency between the results of the ornithological survey after FY2013 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2008 and FY2009.

<Air>

The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.04pg/m^3, and the detection range was 36~110pg/m^3.

Stocktaking of the detection of Pentachlorobenzene in air during FY2007~2019

Pentachloro benzene	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2007Warm season	85	83	310	18	12 [4.8]	78/78	26/26
	2007Cold season	60	55	220	27		75/75	25/25
	2009Warm season	63	64	210	20	6.4 [2.5]	111/111	37/37
	2009Cold season	25	22	120	tr(5.0)		111/111	37/37
	2010Warm season	68	73	140	36	1.2 [0.5]	37/37	37/37
	2010Cold season	70	69	180	37		37/37	37/37
	2011Warm season	61	60	140	30	2.1 [0.70]	35/35	35/35
	2011Cold season	59	57	180	26		37/37	37/37
	2012Warm season	58	57	150	31	1.8 [0.6]	36/36	36/36
	2012Cold season	55	55	120	27		36/36	36/36
	2013Warm season	55	58	160	27	1.7 [0.6]	36/36	36/36
	2013Cold season	55	52	110	34		36/36	36/36
	2014Warm season	83	86	210	39	0.9 [0.3]	36/36	36/36
	2015Warm season	67	68	170	34	0.6 [0.2]	35/35	35/35
	2016Warm season	75	75	220	33	0.5 [0.2]	37/37	37/37
	2017Warm season	71	69	200	32	0.3 [0.1]	37/37	37/37
	2018Warm season	59	61	100	30	0.22 [0.08]	37/37	37/37
	2019 Warm season	64	64	110	36	0.09 [0.04]	36/36	36/36

(Note) No monitoring was conducted in FY2008.

[18] Endosulfans (reference)

・ History and state of monitoring

Endosulfans had been used an insecticide that has been used since the 1950s to control crop pests, tsetse flies and ectoparasites of cattle and as a wood preservative. Endosulfans were adopted as target chemicals at the COP5 of the Stockholm convention on Persistent Organic Pollutants in Apri 2011. The substances were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in May 2014.

As a continuous survey, the first survey was in FY2011, under the framework of the Environmental Survey of Chemical Substances up to FY2001, the substance was monitored in surface water and sediment in FY1982 and air in FY1996.

Under the framework of the Environmental Monitoring, the substances were monitored in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY2011 and FY2012, in wildlife (bivalves, fish and birds) and air in FY2014 and FY2015 and in air in FY2016 and in surface water, sediment in FY2018.

No monitoring was conducted in FY2019. For reference, the monitoring results up to FY2018 are given below.

・ Monitoring results until FY2018

<Surface Water>

Stocktaking of the detection of α-Endosulfan and β-Endosulfan in surface water during FY2011~2018

α-Endosulfan	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2011	nd	nd	180	nd	120 [50]	2/49	2/49
	2012	nd	nd	30	nd	27 [10]	3/48	3/48
	2018	nd	nd	tr(50)	nd	120 [40]	1/47	1/47
β-Endosulfan	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2011	nd	nd	270	nd	22 [9]	8/49	8/49
	2012	nd	nd	tr(12)	nd	24 [9]	1/48	1/48
	2018	nd	nd	tr(20)	nd	30 [10]	3/47	3/47

(Note) No monitoring was conducted during FY2013~FY2017.

<Sediment>

Stocktaking of the detection of α-Endosulfan and β-Endosulfan in sediment during FY2011~2018

α-Endosulfan	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2011	tr(13)	tr(11)	480	nd	30 [10]	35/64	35/64
	2012	nd	nd	480	nd	13 [5]	19/63	19/63
	2018	nd	nd	30	nd	5 [2]	21/61	21/61
β-Endosulfan	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2011	tr(5)	tr(4)	240	nd	9 [4]	38/64	38/64
	2012	nd	nd	250	nd	13 [5]	8/63	8/63
	2018	nd	nd	41	nd	5 [2]	11/61	11/61

(Note) No monitoring was conducted during FY2013~FY2017.

<Wildlife>

Stocktaking of the detection of *α*-Endosulfan and *β*-Endosulfan in wildlife (bivalves, fish and birds) during FY2011~2015

α-Endosulfan	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2011	62	120	330	nd	50 [20]	3/4	3/4
	2012	tr(54)	tr(61)	200	nd	71 [24]	4/5	4/5
	2014	tr(20)	nd	130	nd	60 [20]	1/3	1/3
	2015	nd	nd	130	nd	120 [38]	1/3	1/3
Fish (pg/g-wet)	2011	tr(20)	tr(20)	140	nd	50 [20]	10/18	10/18
	2012	nd	nd	tr(54)	nd	71 [24]	6/19	6/19
	2014	nd	nd	tr(30)	nd	60 [20]	1/19	1/19
	2015*	nd	nd	tr(49)	nd	120 [38]	1/19	1/19
Birds (pg/g-wet)	2011	---	---	nd	nd	50 [20]	0/1	0/1
	2012	nd	---	nd	nd	71 [24]	0/2	0/2
	2014*	nd	---	nd	nd	60 [20]	0/2	0/2
	2015*	---	---	nd	nd	120 [38]	0/1	0/1

β-Endosulfan	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2011	16	26	52	4	11 [4]	4/4	4/4
	2012	15	16	43	nd	14 [5]	4/5	4/5
	2014	nd	nd	23	nd	19 [6]	1/3	1/3
	2015	nd	nd	tr(22)	nd	32 [11]	1/3	1/3
Fish (pg/g-wet)	2011	nd	nd	37	nd	11 [4]	9/18	9/18
	2012	nd	nd	15	nd	14 [5]	6/19	6/19
	2014	nd	nd	tr(8)	nd	19 [6]	3/19	3/19
	2015	nd	nd	tr(11)	nd	32 [11]	1/19	1/19
Birds (pg/g-wet)	2011	---	---	nd	nd	11 [4]	0/1	0/1
	2012	nd	---	tr(7)	nd	14 [5]	1/2	1/2
	2014*	nd	---	tr(8)	nd	19 [6]	1/2	1/2
	2015*	---	---	nd	nd	32 [11]	0/1	0/1

(Note 1) “ * ” indicates there is no consistency between the results of the ornithological survey after FY2014 and those in previous years because of the changes in the survey sites and target species.

(Note 2) No monitoring was conducted in FY2013.

<Air>

Stocktaking of the detection of *α*-Endosulfan and *β*-Endosulfan in air during FY2011~2016

α-Endosulfan	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
大気 (pg/m^3)	2011Warm season	26	24	190	tr(7.8)	12 [4.0]	35/35	35/35
	2011Cold season	tr(9.6)	tr(9.8)	45	nd		35/37	35/37
	2012Warm season	23	22	98	tr(6.0)	16 [5.3]	36/36	36/36
	2012Cold season	nd	nd	19	nd		15/36	15/36
	2014Warm season	20	23	90	2.6	0.8 [0.3]	36/36	36/36
	2015Warm season	10	11	140	1.6	1.0 [0.3]	35/35	35/35
	2016Warm season	8.9	9.3	46	1.0	0.8 [0.3]	37/37	37/37

β-Endosulfan	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
大気 (pg/m^3)	2011Warm season	2.1	1.8	11	nd	1.2 [0.39]	34/35	34/35
	2011Cold season	tr(0.80)	tr(0.90)	8.3	nd		31/37	31/37
	2012Warm season	1.3	1.3	18	nd	1.2 [0.4]	33/36	33/36
	2012Cold season	nd	nd	1.7	nd		17/36	17/36
	2014Warm season	1.3	1.4	6.1	nd	1.2 [0.4]	33/36	33/36
	2015Warm season	0.7	0.6	38	nd	0.5 [0.2]	33/35	33/35
	2016Warm season	0.8	tr(0.7)	3.3	nd	0.8 [0.3]	34/37	34/37

(Note) No monitoring was conducted in FY2013.

[19] 1,2,5,6,9,10-Hexabromocyclododecanes

・ History and state of monitoring

1,2,5,6,9,10-Hexabromocyclododecanes have been used a flame retardant additive, providing fire protection during the service life of vehicles, buildings or articles, as well as protection while stored. *α*-1,2,5,6,9,10-Hexabromocyclododecane, *β*-1,2,5,6,9,10-Hexabromocyclododecane and *γ*-1,2,5,6,9,10-Hexabromocyclododecane were adopted as target chemicals at the COP6 of the Stockholm convention on Persistent Organic Pollutants held from late April to early May 2013, and designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in May 2014.

As a continuous survey, the first survey was in FY2011, under the framework of the Environmental Survey of Chemical Substances up to FY2001, the substances were monitored in surface water, sediment and wildlife (fish) in FY1987. In the framework of the Environmental Survey and Monitoring of Chemicals after FY2002 under the Initial Environmental Survey and the Detailed Environmental Survey etc., the substance was monitored in surface water and sediment in FY2003, in wildlife (fish) in FY2004.

Under the framework of the Environmental Monitoring, *α*-1,2,5,6,9,10-Hexabromocyclododecane, *β*-1,2,5,6,9,10-Hexabromocyclododecane, *γ*-1,2,5,6,9,10-Hexabromocyclododecane, *δ*-1,2,5,6,9,10-Hexabromo cyclododecane and *ε*-1,2,5,6,9,10-Hexabromocyclododecan have been monitored in surface water, sediment and wildlife (bivalves, fish and birds) in FY2011, in sediment, wildlife (bivalves, fish and birds) and air in FY2012, surface water, wildlife (bivalves, fish and birds) and air in FY2014 and in sediment, wildlife (bivalves, fish and birds) and air in FY2015. And *α*-1,2,5,6,9,10-Hexabromocyclododecane, *β*-1,2,5,6,9,10-Hexabromocyclododecane and *γ*-1,2,5,6,9,10-Hexabromocyclododecane have been monitored in sediment, wildlife (bivalves, fish and birds) and air in FY2016 in wildlife (bivalves, fish and birds) and air in FY2017 in wildlife (bivalves, fish and birds) in FY2018 in wildlife (bivalves, fish and birds) and air in FY2019.

・ Monitoring results

<Wildlife>

α-1,2,5,6,9,10-Hexabromocyclododecane: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 9pg/g-wet, and the detection range was 68~260pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 15 of the 16 valid areas adopting the detection limit of 9pg/g-wet, and none of the detected concentrations exceeded 980pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 9pg/g-wet, and the detected concentration was 1,100pg/g-wet. As results of the inter-annual trend analysis from FY2011 to FY2019, reduction tendencies in specimens of bivalves and fish were identified as statistically significant.

β-1,2,5,6,9,10-Hexabromocyclododecane: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 1 of the 3 valid areas adopting the detection limit of 9pg/g-wet, and the detected concentration was tr(22)pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was not detected at all 16 valid areas adopting the detection limit of 9pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and not detected in the area adopting the detection limit of 9pg/g-wet. Although the number of detections was small, the detection rates of specimens from bivalves and fish were decreased, it suggested reduction tendencies of the concentrations.

γ-1,2,5,6,9,10-Hexabromocyclododecane: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 9pg/g-wet, and the detection range was tr(13)~140pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 9 of the 16 valid areas adopting the detection limit of 9pg/g-wet, and none of the detected concentrations exceeded 62pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and not detected in the area adopting the detection limit of 9pg/g-wet. As results of the inter-annual trend analysis from FY2011 to FY2019, a reduction tendency in specimens of bivalves was identified as statistically significant.

Stocktaking of the detection of *α*-1,2,5,6,9,10-Hexabromocyclododecane, *β*-1,2,5,6,9,10-Hexabromocyclododecane and *γ*-1,2,5,6,9,10-Hexabromocyclododecane in wildlife (bivalves, fish and birds) during FY2011~2019

α-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2011	1,100	1,200	13,000	tr(86)	170 [70]	10/10	4/4
	2012	530	480	2,500	190	50 [20]	5/5	5/5
	2014	270	270	380	200	30 [10]	3/3	3/3
	2015	260	200	560	150	30 [10]	3/3	3/3
	2016	140	140	180	110	22 [9]	3/3	3/3
	2017	190	200	430	86	24 [9]	3/3	3/3
	2018	120	88	270	76	23 [9]	3/3	3/3
	2019	140	150	260	68	24 [9]	3/3	3/3
Fish (pg/g-wet)	2011	770	850	69,000	nd	170 [70]	41/51	16/17
	2012	510	560	8,700	nd	50 [20]	18/19	18/19
	2014	240	290	15,000	nd	30 [10]	18/19	18/19
	2015	160	180	3,000	nd	30 [10]	18/19	18/19
	2016	110	140	1,100	tr(12)	22 [9]	19/19	19/19
	2017	140	140	7,800	tr(9)	24 [9]	19/19	19/19
	2018	89	140	530	nd	23 [9]	17/18	17/18
	2019	79	92	980	nd	24 [9]	15/16	15/16
Birds (pg/g-wet)	2011	200	nd	530	nd	170 [70]	1/3	1/1
	2012	120	---	1,400	nd	50 [20]	1/2	1/2
	2014**	480	---	1,800	130	30 [10]	2/2	2/2
	2015**	---	---	80	80	30 [10]	1/1	1/1
	2016**	400	---	1,600	100	22 [9]	2/2	2/2
	2017**	330	---	2,200	50	24 [9]	2/2	2/2
	2018**	600	---	610	590	23 [9]	2/2	2/2
	2019**	---	---	1,100	1,100	24 [9]	1/1	1/1

β-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2011	tr(70)	tr(85)	240	nd	98 [40]	7/10	3/4
	2012	tr(25)	40	90	nd	40 [10]	4/5	4/5
	2014	tr(10)	tr(10)	tr(20)	tr(10)	30 [10]	3/3	3/3
	2015	tr(10)	tr(10)	30	nd	30 [10]	2/3	2/3
	2016	nd	tr(8)	tr(9)	nd	21 [8]	2/3	2/3
	2017	tr(9)	nd	36	nd	23 [9]	1/3	1/3
	2018	nd	nd	nd	nd	22 [8]	0/3	0/3
	2019	nd	nd	tr(22)	nd	24 [9]	1/3	1/3
Fish (pg/g-wet)	2011	nd	nd	760	nd	98 [40]	11/51	5/17
	2012	nd	nd	40	nd	40 [10]	8/19	8/19
	2014	nd	nd	30	nd	30 [10]	5/19	5/19
	2015	nd	nd	tr(20)	nd	30 [10]	2/19	2/19
	2016	nd	nd	tr(12)	nd	21 [8]	3/19	3/19
	2017	nd	nd	tr(12)	nd	23 [9]	2/19	2/19
	2018	nd	nd	nd	nd	22 [8]	0/18	0/18
	2019	nd	nd	nd	nd	24 [9]	0/16	0/16
Birds (pg/g-wet)	2011	nd	nd	nd	nd	98 [40]	0/3	0/1
	2012	nd	---	nd	nd	40 [10]	0/2	0/2
	2014**	nd	---	nd	nd	30 [10]	0/2	0/2
	2015**	---	---	nd	nd	30 [10]	0/1	0/1
	2016**	nd	---	nd	nd	21 [8]	0/2	0/2
	2017**	nd	---	nd	nd	23 [9]	0/2	0/2
	2018**	nd	---	nd	nd	22 [8]	0/2	0/2
	2019**	---	---	nd	nd	24 [9]	0/1	0/1

γ-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Bivalves (pg/g-wet)	2011	440	470	3,300	nd	210 [80]	8/10	4/4
	2012	170	180	910	30	30 [10]	5/5	5/5
	2014	60	60	110	30	30 [10]	3/3	3/3
	2015	70	90	200	tr(20)	30 [10]	3/3	3/3
	2016	37	39	61	tr(21)	24 [9]	3/3	3/3
	2017	49	30	200	tr(20)	24 [9]	3/3	3/3
	2018	tr(19)	39	46	nd	21 [8]	2/3	2/3
	2019	34	22	140	tr(13)	22 [9]	3/3	3/3
Fish (pg/g-wet)	2011	210	tr(90)	50,000	nd	210 [80]	26/51	10/17
	2012	75	80	1,600	nd	30 [10]	16/19	16/19
	2014	30	tr(20)	2,800	nd	30 [10]	12/19	12/19
	2015	tr(20)	tr(10)	230	nd	30 [10]	10/19	10/19
	2016	tr(16)	tr(13)	160	nd	24 [9]	11/19	11/19
	2017	tr(16)	tr(18)	120	nd	24 [9]	12/19	12/19
	2018	tr(11)	tr(11)	130	nd	21 [8]	10/18	10/18
	2019	tr(12)	tr(13)	62	nd	22 [9]	9/16	9/16
Birds (pg/g-wet)	2011	tr(180)	nd	460	nd	210 [80]	1/3	1/1
	2012	31	---	190	nd	30 [10]	1/2	1/2
	2014**	tr(10)	---	tr(10)	tr(10)	30 [10]	2/2	2/2
	2015**	---	---	tr(10)	tr(10)	30 [10]	1/1	1/1
	2016**	tr(10)	---	tr(20)	nd	24 [9]	1/2	1/2
	2017**	tr(9)	---	tr(18)	nd	24 [9]	1/2	1/2
	2018**	nd	---	nd	nd	21 [8]	0/2	0/2
	2019**	---	---	nd	nd	22 [9]	0/1	0/1

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2011.

(Note 2) " ** " : There is no consistency between the results of the ornithological survey after FY2014 and those in previous years because of the changes in the survey sites and target species.

(Note 3) No monitoring was conducted in FY2013.

<Air

α-1,2,5,6,9,10-Hexabromocyclododecane: The presence of the substance in air was monitored at 36 sites, and it was detected at 35 of the 36 valid sites adopting the detection limit of 0.1pg/m^3, and none of the detected concentrations exceeded 4.1pg/m^3.

β-1,2,5,6,9,10-Hexabromocyclododecane: The presence of the substance in air was monitored at 36 sites, and it was detected at 26 of the 36 valid sites adopting the detection limit of 0.08pg/m^3, and none of the detected concentrations exceeded 1.2pg/m^3.

γ-1,2,5,6,9,10-Hexabromocyclododecane: The presence of the substance in air was monitored at 36 sites, and it was detected at 15 of the 36 valid sites adopting the detection limit of 0.2pg/m^3, and none of the detected concentrations exceeded 1.5pg/m^3.

Stocktaking of the detection of *α*-1,2,5,6,9,10-Hexabromocyclododecane, *β*-1,2,5,6,9,10-Hexabromocyclododecane and *γ*-1,2,5,6,9,10-Hexabromocyclododecane in air during FY2012~2019

α-1,2,5,6,9,10-Hexabromo cyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Site
Air (pg/m^3)	2012Warm season	1.7	2.2	130	nd	0.6 [0.2]	31/36	31/36
	2012Cold season	2.9	3.0	63	nd		35/36	35/36
	2014Warm season	tr(0.6)	tr(0.7)	3.1	nd	1.2 [0.4]	25/36	25/36
	2015Warm season	tr(0.6)	tr(0.7)	30	nd	0.9 [0.3]	26/35	26/35
	2016Warm season	0.5	0.5	2.4	tr(0.1)	0.3 [0.1]	37/37	37/37
	2017Warm season	0.5	0.5	3.3	nd	0.3 [0.1]	36/37	36/37
	2019Warm season	0.5	0.5	4.1	nd	0.3 [0.1]	35/36	35/36

β-1,2,5,6,9,10-Hexabromo cyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2012Warm season	0.5	0.5	29	nd	0.3 [0.1]	30/36	30/36
	2012Cold season	0.8	0.8	18	nd		35/36	35/36
	2014Warm season	nd	nd	tr(0.8)	nd	1.0 [0.3]	8/36	8/36
	2015Warm season	nd	nd	3.9	nd	0.8 [0.3]	7/35	7/35
	2016Warm season	tr(0.1)	tr(0.1)	0.7	nd	0.3 [0.1]	21/37	21/37
	2017Warm season	tr(0.2)	tr(0.1)	0.8	nd	0.3 [0.1]	33/37	33/37
	2019Warm season	tr(0.13)	tr(0.15)	1.2	nd	0.21 [0.08]	26/36	26/36

γ-1,2,5,6,9,10-Hexabromo cyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2012Warm season	1.6	1.7	280	nd	0.3 [0.1]	31/36	31/36
	2012Cold season	2.1	1.8	84	nd		35/36	35/36
	2014Warm season	nd	nd	tr(1.2)	nd	1.3 [0.4]	4/36	4/36
	2015Warm season	nd	nd	4.4	nd	0.8 [0.3]	11/35	11/35
	2016Warm season	tr(0.1)	nd	1.4	nd	0.3 [0.1]	16/37	16/37
	2017Warm season	tr(0.1)	tr(0.1)	0.8	nd	0.3 [0.1]	20/37	20/37
	2019Warm season	nd	nd	1.5	nd	0.4 [0.2]	15/36	15/36

(Note) No monitoring was conducted in FY2013 and FY2018.

・ Monitoring results until FY2016

<Surface Water>

Stocktaking of the detection of 1,2,5,6,9,10-Hexabromocyclododecanes in surface water in FY2011 and FY2014

α-1,2,5,6,9,10-Hexabromocyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2011	nd	nd	6,300	nd	1,500 [600]	4/47	4/47
	2014	nd	nd	1,600	nd	1,500 [600]	1/48	1/48

β-1,2,5,6,9,10-Hexabromocyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2011	nd	nd	1,300	nd	1,300 [500]	4/47	4/47
	2014	nd	nd	tr(300)	nd	500 [200]	1/48	1/48

γ-1,2,5,6,9,10-Hexabromocyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2011	nd	nd	65,000	nd	1,200 [500]	5/47	5/47
	2014	nd	nd	nd	nd	700 [300]	0/48	0/48

δ-1,2,5,6,9,10-Hexabromocyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2011	nd	nd	nd	nd	790 [300]	0/47	0/47
	2014	nd	nd	nd	nd	600 [200]	0/48	0/48

ε-1,2,5,6,9,10-Hexabromocyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2011	nd	nd	nd	nd	740 [300]	0/47	0/47
	2014	nd	nd	nd	nd	400 [200]	0/48	0/48

<Sediment>

Stocktaking of the detection of 1,2,5,6,9,10-Hexabromocyclododecanes in sediment during FY2011~2016

α-1,2,5,6,9,10-Hexabromocyclododecane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2011	430	nd	24,000	nd	420 [280]	78/186	35/62
	2012	310	280	22,000	nd	180 [70]	47/63	47/63
	2015	390	410	27,000	nd	150 [60]	47/62	47/62
	2016	260	210	27,000	nd	130 [60]	43/62	43/62

β-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2011	nd	nd	14,000	nd	250 [170]	48/186	21/62
	2012	tr(93)	nd	8,900	nd	150 [60]	29/63	29/63
	2015	120	92	7,600	nd	150 [60]	33/62	33/62
	2016	tr(87)	nd	7,400	nd	130 [50]	31/62	31/62

γ-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2011	670	nd	570,000	nd	400 [260]	89/186	36/62
	2012	420	330	55,000	nd	160 [60]	52/63	52/63
	2015	330	450	60,000	nd	110 [42]	48/62	48/62
	2016	250	190	50,000	nd	150 [60]	42/62	42/62

δ-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2011	nd	nd	800	nd	350 [250]	11/186	6/62
	2012	nd	nd	680	nd	300 [100]	5/63	5/63
	2015	nd	nd	nd	nd	180 [70]	0/62	0/62

ε-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2011	nd	nd	tr(260)	nd	280 [210]	2/186	1/62
	2012	nd	nd	310	nd	150 [60]	7/63	7/63
	2015	nd	nd	nd	nd	130 [51]	0/62	0/62

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2011.

(Note 2) No monitoring was conducted in FY2013 and FY2014. No monitoring of *δ*-1,2,5,6,9,10-Hexabromocyclododecane and *ε*-1,2,5,6,9,10-Hexabromocyclododecane was conducted in FY2016.

<Wildlife>

Stocktaking of the detection of *δ*-1,2,5,6,9,10-Hexabromocyclododecane and *ε*-1,2,5,6,9,10-Hexabromocyclo dodecane in wildlife (bivalves, fish and birds) during FY2011~2015

δ-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2011	nd	nd	nd	nd	140 [60]	0/10	0/4
	2012	nd	nd	nd	nd	50 [20]	0/5	0/5
	2014	nd	nd	nd	nd	30 [10]	0/3	0/3
	2015	nd	nd	nd	nd	30 [10]	0/3	0/3
Fish (pg/g-wet)	2011	nd	nd	nd	nd	140 [60]	0/51	0/17
	2012	nd	nd	nd	nd	50 [20]	0/19	0/19
	2014	nd	nd	nd	nd	30 [10]	0/19	0/19
	2015	nd	nd	tr(20)	nd	30 [10]	1/19	1/19
Birds (pg/g-wet)	2011	nd	nd	nd	nd	140 [60]	0/3	0/1
	2012	nd	---	nd	nd	50 [20]	0/2	0/2
	2014**	nd	---	nd	nd	30 [10]	0/2	0/2
	2015**	---	---	nd	nd	30 [10]	0/1	0/1

ε-1,2,5,6,9,10-Hexa bromocyclododecane	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2011	nd	nd	nd	nd	140 [60]	0/10	0/4
	2012	nd	nd	tr(30)	nd	40 [20]	1/5	1/5
	2014	nd	nd	tr(20)	nd	30 [10]	1/3	1/3
	2015	nd	nd	tr(10)	nd	30 [10]	1/3	1/3
Fish (pg/g-wet)	2011	nd	nd	nd	nd	140 [60]	0/51	0/17
	2012	nd	nd	tr(30)	nd	40 [20]	3/19	3/19
	2014	nd	nd	80	nd	30 [10]	3/19	3/19
	2015	nd	nd	tr(10)	nd	30 [10]	1/19	1/19
Birds (pg/g-wet)	2011	nd	nd	nd	nd	140 [60]	0/3	0/1
	2012	nd	---	nd	nd	40 [20]	0/2	0/2
	2014**	nd	---	nd	nd	30 [10]	0/2	0/2
	2015**	---	---	nd	nd	30 [10]	0/1	0/1

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2011.
(Note 2) " ** " : There is no consistency between the results of the ornithological survey after FY2014 and those in previous years because of the changes in the survey sites and target species.
(Note 3) No monitoring was conducted in FY2013

<Air>

Stocktaking of the detection of δ-1,2,5,6,9,10-Hexabromocyclododecane and ε-1,2,5,6,9,10-Hexabromocyclo dodecane in air during FY2012~2017

δ-1,2,5,6,9,10-Hexabromo cyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2012Warm season	nd	nd	0.8	nd	0.4 [0.2]	1/36	1/36
	2012Cold season	nd	nd	1.1	nd		1/36	1/36
	2014Warm season	nd	nd	nd	nd	1.8 [0.6]	0/36	0/36
	2015Warm season	nd	nd	1.9	nd	1.9 [0.6]	1/35	1/35

ε-1,2,5,6,9,10-Hexabromo cyclododecane	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2012Warm season	nd	nd	nd	nd	0.6 [0.2]	0/36	0/36
	2012Cold season	nd	nd	tr(0.5)	nd		1/36	1/36
	2014Warm season	nd	nd	nd	nd	0.9 [0.3]	0/36	0/36
	2015Warm season	nd	nd	nd	nd	0.9 [0.3]	0/35	0/35

(Note) No monitoring was conducted in FY2013.

[20] Total Polychlorinated Naphthalenes (Total PCNs)

・ History and results of the monitoring

Polychlorinated Naphthalenes (PCNs) make effective insulating coatings for electrical wires and have been used as wood preservatives, as rubber and plastic additives, for capacitor dielectrics and in lubricants. The substances with over 3 chloric ions were designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in August 1979. And PCNs (Cl_2~Cl_8) was adopted as target chemicals at the COP7 of the Stockholm convention on Persistent Organic Pollutants in May 2015 and Dichloronaphthalene designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in April 2016.

In previous monitoring series, Polychlorinated Naphthalenes were monitored in wildlife (bivalves, fish and birds) during the period of FY1980~1985 FY1987 FY 1989 FY 1991 and FY 1993 under the framework of "the Wildlife Monitoring."

Under the framework of "the Environmental Monitoring", Polychlorinated Naphthalenes with over a chloric ions have been monitored in wildlife (bivalves, fish and birds) in FY 2006, in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY2008, in air in FY2014, in wildlife (bivalves, fish and birds) in FY2015 and in sediment, wildlife (bivalves, fish and birds) and air in FY2016~2017, in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY2018 and FY2019.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 48 sites, and it was detected at 32 of the 48 valid sites adopting the detection limit of 7.5pg/L, and none of the detected concentrations exceeded 260pg/L.

Stocktaking of the detection of Total Polychlorinated Naphthalenes in surface water during FY2008~2019

Total Polychlorinated Naphthalenes	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit*	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2008	nd	nd	180	nd	85[30]	9/48	9/48
	2018	tr(32)	tr(34)	260	nd	35 [12]	39/47	39/47
	2019	tr(14)	tr(12)	260	nd	24 [7.5]	32/48	32/48

(Note 1) " * " indicates the sum value of the Quantification [Detection] limits of each congener.
(Note 2) No monitoring was conducted during FY2009~2017.

<Sediment>

The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 2.7pg/g-dry, and the detection range was 13~58,000pg/g-dry.

Stocktaking of the detection of Total Polychlorinated Naphthalenes in sediment during FY2008~2019

Total Polychlorinated Naphthalenes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit**	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2008	410	400	28,000	nd	84 [30]	166/189	58/63
	2016	760	870	160,000	nd	59 [20]	59/62	59/62
	2017	630	800	32,000	tr(16)	27 [9.1]	62/62	62/62
	2018	680	810	34,000	9.9	8.5 [3.2]	61/61	61/61
	2019	600	720	58,000	13	7.3 [2.7]	61/61	61/61

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2008.
(Note 2) " ** " indicates the sum value of the Quantification [Detection] limits of each congener.
(Note 3) No monitoring was conducted during FY2009~2015.

<Wildlife>

The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 2 of the 3 valid areas adopting the detection limit of 15pg/g-wet, and none of the detected concentrations exceeded 820pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 12 of the 16 valid areas adopting the detection limit of 15pg/g-wet, and none of the detected concentrations exceeded 270pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 15pg/g-wet, and the detected concentration was 170pg/g-wet.

Stocktaking of the detection of Total Polychlorinated Naphthalenes in wildlife (bivalves, fish and birds) during FY2006~2019

Total Polychlorinated Naphthalenes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit**	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2006	85	73	1.2	tr(19)	27 [11]	31/31	7/7
	2008	77	73	1,300	tr(11)	26 [10]	31/31	7/7
	2015	70	67	580	nd	54 [18]	2/3	2/3
	2016	72	tr(49)	790	nd	57 [19]	2/3	2/3
	2017	46	68	1,400	nd	33 [12]	2/3	2/3
	2018	58	tr(22)	700	tr(13)	36 [12]	3/3	3/3
	2019	84	96	820	nd	40 [15]	2/3	2/3
Fish (pg/g-wet)	2006	72	49	2,700	nd	27 [11]	78/80	16/16
	2008	59	40	2,200	nd	26 [10]	79/85	17/17
	2015	tr(50)	85	390	nd	54 [18]	13/19	13/19
	2016	tr(44)	tr(48)	340	nd	57 [19]	13/19	13/19
	2017	32	51	360	nd	33 [12]	17/19	17/19
	2018	41	36	520	nd	36 [12]	16/18	16/18
	2019	46	78	270	nd	40 [15]	12/16	12/16
Birds (pg/g-wet)	2006	tr(17)	tr(18)	27	tr(11)	27 [11]	10/10	2/2
	2008	tr(10)	nd	tr(22)	nd	26 [10]	5/10	1/2
	2015***	---	---	tr(20)	tr(20)	54 [18]	1/1	1/1
	2016***	130	---	320	tr(49)	57 [19]	2/2	2/2
	2017***	91	---	460	tr(18)	33 [12]	2/2	2/2
	2018***	230	---	250	220	36 [12]	2/2	2/2
	2019***	---	---	170	170	40 [15]	1/1	1/1

(Note 1) “ * ” :Arithmetic mean values were calculated for each point, from which the geometric mean value for all points were derived in FY2006 and FY2008.

(Note 2) “ * ” indicates the sum value of the Quantification [Detection] limits of each congener.

(Note 3) “ *** ” indicates there is no consistency between the results of the ornithological survey after FY2015 and those in previous years because of the changes in the survey sites and target species.

(Note 4) No monitoring was conducted in FY2007 and FY2009~2014.

<Air>

The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.2pg/m^3, and the detection range was 6.5~1,100pg/m^3.

Stocktaking of the detection of Total Polychlorinated Naphthalenes in sediment during FY2008~2019

Total Polychlorinated Naphthalenes	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit*	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2008Warm season	200	230	660	35	4.0[1.3]	22/22	22/22
	2008Cold season	tr(9.6)	tr(9.8)	45	nd		36/36	36/36
	2014Warm season	110	130	1,600	5.4	2.8 [1.0]	36/36	36/36
	2016Warm season	110	130	660	9.0	0.79 [0.28]	37/37	37/37
	2017Warm season	110	120	920	7	0.67 [0.24]	37/37	37/37
	2018Warm season	86	110	590	5.3	0.5 [0.2]	37/37	37/37
	2019Warm season	100	130	1,100	6.5	0.6 [0.2]	36/36	36/36

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

(Note 2) No monitoring was conducted in FY2009~2013 and FY2015.

[21] Hexachlorobuta-1,3-diene

・ History and results of the monitoring

Hexachlorobuta-1,3-diene had been used as a solvent for other chlorine-containing compounds. The substance was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law on April 2005. The substance was adopted as target chemicals at the COP7 of the Stockholm convention on Persistent Organic Pollutants in May 2015.

As a continuous survey, the first survey was in FY2007, under the framework of the Environmental Survey of Chemical Substances up to FY2002, the substance was monitored in surface wate and sediment in FY1981, under the framework of the Environmental Survey and Monitoring of Chemicals after FY2002, in the Initial Environmental Survey and the Detailed Environmental Survey etc., the substance was monitored in surface water and sediment in FY2007.

Under the framework of the Environmental Monitoring, the substances have been monitored in surface water sediment and wildlife (bivalves, fish and birds) in FY2013, and in air in FY2015~2019.

・ Monitoring results

<Air>

The presence of the substance in air was monitored at 36 sites, and it was detected at 35 of the 36 valid sites adopting the detection limit of 20pg/m^3, and none of the detected concentrations exceeded 5,800pg/m^3.

Stocktaking of the detection of Hexachlorobuta-1,3-diene in air in FY2015~2019

Hexachloro buta 1,3-diene	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2015Warm season	1,100	1,200	3,500	45	29 [11]	102/102	34/34
	2016Warm season	850	800	4,300	510	60 [20]	111/111	37/37
	2017Warm season	4,200	4,000	23,000	1,100	60 [20]	37/37	37/37
	2018Warm season	3,600	3,500	8,500	150	30 [10]	110/110	37/37
	2019Warm season	1,500	2,600	5,800	nd	50 [20]	104/108	35/36

・ Monitoring results until FY2013

<Surface Water>

Stocktaking of the detection of Hexachlorobuta-1,3-diene in surface water in FY2007 and FY2013

Hexachlorobuta 1,3-diene	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water	2007	nd	nd	nd	nd	870 [340]	0/48	0/48
(pg/L)	2013	nd	nd	tr(43)	nd	94 [37]	1/48	1/48

<Sediment>

Stocktaking of the detection of Hexachlorobuta-1,3-diene in sediment in FY2007 and FY2013

Hexachlorobuta 1,3-diene	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment	2007	nd	nd	1,300	nd	22 [8.5]	22/192	10/64
(pg/g-dry)	2013	nd	nd	1,600	nd	9.9 [3.8]	40/189	20/63

(Note 1) “ * ” :Arithmetic mean values were calculated for each point, from which the geometric mean value for all points were derived in FY2007 and FY2013.

(Note 2) No monitoring was conducted during FY2008~2012.

<Wildlife>

Stocktaking of the detection of Hexachlorobuta-1,3-diene in wildlife (bivalves, fish and birds) in FY2007 and FY2013

Hexachlorobuta 1,3-diene	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves	2007	nd	nd	nd	nd	36 [12]	0/31	0/7
(pg/g-wet)	2013	nd	nd	tr(7.1)	nd	9.4 [3.7]	3/13	1/5
Fish	2007	nd	nd	nd	nd	36 [12]	0/80	0/16
(pg/g-wet)	2013	nd	nd	59	nd	9.4 [3.7]	7/57	4/19
Birds	2007	nd	nd	nd	nd	36 [12]	0/10	0/2
(pg/g-wet)	2013**	nd	nd	nd	nd	9.4 [3.7]	0/6	0/2

(Note 1) “ * ” :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2007.

(Note 2) “ ** ” indicates there is no consistency between the results of the ornithological survey in FY2015 and those in previous years because of the changes in the survey sites and target species.

[22] Pentachlorophenol and its salts and esters

・ History and state of monitoring

Pentachlorophenol was used as a herbicide, insecticide, fungicide, algaecide, disinfectant and as an ingredient in antifouling paint. Pentachlorophenol and its salts and esters were adopted as target chemicals at the COP7 of the Stockholm convention on Persistent Organic Pollutants in May 2015, and designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in Octorber 2016.

As a continuous survey, the first survey of Pentachlorophenol was in FY2015, under the framework of the Environmental Survey of Chemical Substances up to FY2007, the substance was monitored in surface water and sediment in FY1974 and FY1996, and under the framework of the Environmental Survey and Monitoring of Chemicals after FY2002, in the Initial Environmental Survey and the Detailed Environmental Survey etc., the substance was monitored in surface water in FY2005.

Under the framework of the Environmental Monitoring, Pentachlorophenol was monitored in surface water in FY2015. And Pentachlorophenol and Pentachloroanisole were monitored in wildlife (bivalves, fish and birds) and air in FY2016, in surfacewater, sediment, wildlife (bivalves, fish and birds) and air in FY2017~FY2019.

・ Monitoring results

<Surface Water>

Pentachlorophenol: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 32 of the 48 valid sites adopting the detection limit of 20pg/L, and none of the detected concentrations exceeded 3,500pg/L.

Pentachloroanisole: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 20 of the 48 valid sites adopting the detection limit of 10pg/L, and none of the detected concentrations exceeded 210pg/L.

Stocktaking of the detection of Pentachlorophenol and Pentachloroanisole in surface water during FY2015~FY2019

Pentachlorophenol	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface Water (pg/L)	2015	tr(130)	tr(90)	26,000	nd	260 [85]	25/48	25/48
	2017	86	110	3,500	nd	30 [10]	43/47	43/47
	2018	50	47	4,400	nd	24 [9]	44/47	44/47
	2019	tr(60)	tr(50)	3,500	nd	60 [20]	32/48	32/48
Pentachloroanisole	**Monitored year**	**Geometric mean**	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Surface Water (pg/L)	2017	tr(10)	tr(8)	1,000	nd	14 [5]	32/47	32/47
	2018	tr(10)	tr(7)	230	nd	16 [6]	30/47	30/47
	2019	tr(10)	nd	210	nd	30 [10]	20/48	20/48

(Note) No monitoring was conducted in FY2016. No monitoring of Pentachloroanisole was conducted in FY2015.

<Sediment>

Pentachlorophenol: The presence of the substance in sediment was monitored at 61 sites, and it was detected at all 61 valid sites adopting the detection limit of 2pg/g-dry, and the detection range was 7~6,200pg/g-dry.

Pentachloroanisole: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 60 of the 61 valid sites adopting the detection limit of 0.8pg/g-dry, and none of the detected concentrations exceeded 140pg/g-dry.

Stocktaking of the detection of Pentachlorophenol and Pentachloroanisole in sediment during FY2017~FY2019

Pentachlorophenol	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2017	350	390	7,400	8	4 [2]	62/62	62/62
	2018	220	300	3,900	nd	18 [6]	59/61	59/61
	2019	260	380	6,200	7	6 [2]	61/61	61/61
Pentachloroanisole	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2017	34	32	190	nd	5 [2]	61/62	61/62
	2018	tr(23)	tr(25)	160	nd	27 [9]	53/61	53/61
	2019	14	15	140	nd	2.1 [0.8]	60/61	60/61

<Wildlife>

Pentachlorophenol: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 4pg/g-wet, and the detection range was 13~54pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 14 of the 16 valid areas adopting the detection limit of 4pg/g-wet, and none of the detected concentrations exceeded 57pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 4pg/g-wet, and the detected concentration was 430pg/g-wet.

Pentachloroanisole: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was tr(2)~15pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at all 16 valid areas adopting the detection limit of 1pg/g-wet, and the detection range was tr(1)~59pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 1pg/g-wet, and the detected concentration was 91pg/g-wet.

Stocktaking of the detection of Pentachlorophenol and Pentachloroanisole in wildlife (bivalves, fish and birds) during FY2016~FY2019

Pentachlorophenol	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2016	tr(45)	tr(46)	65	tr(30)	63 [21]	3/3	3/3
	2017	nd	nd	tr(35)	nd	36 [12]	1/3	1/3
	2018	tr(20)	tr(20)	30	tr(10)	30 [10]	3/3	3/3
	2019	26	26	54	13	10 [4]	3/3	3/3
Fish (pg/g-wet)	2016	100	130	990	nd	63 [21]	18/19	18/19
	2017	tr(15)	tr(15)	110	nd	36 [12]	14/19	14/19
	2018	tr(10)	tr(10)	80	nd	30 [10]	13/18	13/18
	2019	17	22	57	nd	10 [4]	14/16	14/16
Birds (pg/g-wet)	2016	1,200	---	3,100	440	63 [21]	2/2	2/2
	2017	1,800	---	11,000	300	36 [12]	2/2	2/2
	2018	460	---	1,200	180	30 [10]	2/2	2/2
	2019	---	---	430	430	10 [4]	1/1	1/1
Pentachloroanisole	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2016	7	3	35	3	3 [1]	3/3	3/3
	2017	6	tr(3)	36	tr(2)	4 [1]	3/3	3/3
	2018	6	tr(4)	21	tr(2)	6 [2]	3/3	3/3
	2019	4	tr(2)	15	tr(2)	3 [1]	3/3	3/3
Fish (pg/g-wet)	2016	8	6	100	tr(1)	3 [1]	19/19	19/19
	2017	7	5	120	tr(1)	4 [1]	19/19	19/19
	2018	8	7	73	nd	6 [2]	16/18	16/18
	2019	5	6	59	tr(1)	3 [1]	16/16	16/16
Birds (pg/g-wet)	2016	12	---	14	10	3 [1]	2/2	2/2
	2017	23	---	47	11	4 [1]	2/2	2/2
	2018	15	---	20	11	6 [2]	2/2	2/2
	2019	---	---	91	91	3 [1]	1/1	1/1

<Air>

Pentachlorophenol: The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.2pg/m^3, and the detection range was 0.6~22pg/m^3.

Pentachloroanisole: The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 0.1pg/m^3, and the detection range was 4.3~180pg/m^3.

Stocktaking of the detection of Pentachlorophenol and Pentachloroanisole in air during FY2016~FY2019

Pentachloro phenol	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2016Warm season	6.3	6.0	25	0.6	0.5 [0.2]	37/37	37/37
	2017Warm season	4.6	4.8	33	0.7	0.6 [0.2]	37/37	37/37
	2018Warm season	5.1	5.8	30	0.9	0.5 [0.2]	37/37	37/37
	2019Warm season	4.1	4.2	22	0.6	0.6 [0.2]	36/36	36/36

Pentachloro phenol	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2016Warm season	39	42	220	3.4	1.0 [0.4]	37/37	37/37
	2017Warm season	34	36	210	6.0	1.2 [0.5]	37/37	37/37
	2018Warm season	34	40	110	4.6	1.1 [0.4]	37/37	37/37
	2019Warm season	30	32	180	4.3	0.3 [0.1]	36/36	36/36

[23] Short-chain chlorinated paraffins

・ History and state of monitoring

Short-chain chlorinated paraffinsare are used primarily in metalworking applications and in polyvinyl chloride (PVC) plastics. Other uses are adhesives and sealants, leather fat liquors, plastics, and as flame retardants in rubber, textiles and polymeric materials. The substances were adopted as target chemicals at the COP8 of the Stockholm convention on Persistent Organic Pollutants in April-May 2017.

Under the framework of the Initial Environmental Survey and the Detailed Environmental Survey etc., the substances were surveied in surface water, sediment and wildlife (fish) in FY2004 and in surface water, sediment and wildlife (bivalves and fish) in FY2005.

Under the framework of the Environmental Monitoring, the substances have been monitored in wildlife (bivalves, fish and birds) and air in FY2016, and in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY2017~2019.

The results of short-chain chlorinated paraffins are tentative values obtained in trials among various problems in the measurement method.

・ Monitoring results

<Surface water>

Chlorinated decanes: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 17 of the 48 valid sites adopting the detection limit of 200pg/L, and none of the detected concentrations exceeded 2,300pg/L.

Chlorinated undecanes: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 19 of the 48 valid sites adopting the detection limit of 500pg/L, and none of the detected concentrations exceeded 5,000pg/L.

Chlorinated dodecanes: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 20 of the 48 valid sites adopting the detection limit of 400pg/L, and none of the detected concentrations exceeded 34,000pg/L.

Chlorinated tridecanes: The presence of the substance in surface water was monitored at 48 sites, and it was detected at 17 of the 48 valid sites adopting the detection limit of 500pg/L, and none of the detected concentrations exceeded 38,000pg/L.

Stocktaking of the detection of Chlorinated decanes, Chlorinated undecanes, Chlorinated dodecanes and Chlorinated tridecanes in surface water during FY2017~FY2019

Chlorinated decanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2017	nd	nd	tr(1,600)	nd	3,300 [1,100]	1/47	1/47
	2018	nd	nd	1,600	nd	1,000 [400]	8/47	8/47
	2019	nd	nd	2,300	nd	600 [200]	17/48	17/48

Chlorinated undecanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2017	nd	nd	3,100	nd	1,500 [500]	13/47	13/47
	2018	nd	nd	3,500	nd	2,000 [800]	6/47	6/47
	2019	nd	nd	5,000	nd	1,400 [500]	19/48	19/48

Chlorinated dodecanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Surface Water (pg/L)	2017	nd	nd	10,000	nd	3,300 [1,100]	4/47	4/47
	2018	nd	nd	3,000	nd	3,000 [1,000]	16/47	16/47
	2019	nd	nd	34,000	nd	1,000 [400]	20/48	20/48
Chlorinated tridecanes	**Monitored year**	**Geometric mean***	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Surface Water (pg/L)	2017	nd	nd	10,000	nd	3,600 [1,200]	7/47	7/47
	2018	nd	nd	11,000	nd	4,500 [1,500]	18/47	18/47
	2019	nd	nd	38,000	nd	1,300 [500]	17/48	17/48

(Note) Chlorinated paraffins with 5~9 chlorines are target chemicals.

<Sediment>

Chlorinated decanes: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 8 of the 61 valid sites adopting the detection limit of 1,000pg/g-dry, and none of the detected concentrations exceeded 2,600pg/g-dry.

Chlorinated undecanes: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 22 of the 61 valid sites adopting the detection limit of 1,000pg/g-dry, and none of the detected concentrations exceeded 5,900pg/g-dry.

Chlorinated dodecanes: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 27 of the 61 valid sites adopting the detection limit of 1,000pg/g-dry, and none of the detected concentrations exceeded 83,000pg/g-dry.

Chlorinated tridecanes: The presence of the substance in sediment was monitored at 61 sites, and it was detected at 39 of the 61 valid sites adopting the detection limit of 1,000pg/g-dry, and none of the detected concentrations exceeded 60,000pg/g-dry.

Stocktaking of the detection of Chlorinated decanes, Chlorinated undecanes, Chlorinated dodecanes and Chlorinated tridecanes in sediment during FY2017~FY2019

Chlorinated decanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Sediment (pg/g-dry)	2017	nd	nd	17,000	nd	10,000 [4,000]	12/62	12/62
	2018	nd	nd	7,000	nd	6,000 [2,000]	7/61	7/61
	2019	nd	nd	2,600	nd	2,000 [1,000]	8/61	8/61
Chlorinated undecanes	**Monitored year**	**Geometric mean***	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2017	nd	nd	37,000	nd	10,000 [4,000]	19/62	19/62
	2018	nd	nd	tr(13,000)	nd	15,000 [5,000]	7/61	7/61
	2019	nd	nd	5,900	nd	2,000 [1,000]	22/61	22/61
Chlorinated dodecanes	**Monitored year**	**Geometric mean***	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2017	nd	nd	44,000	nd	11,000 [4,000]	19/62	19/62
	2018	tr(2,000)	nd	38,000	nd	6,000 [2,000]	28/61	28/61
	2019	tr(1,100)	nd	83,000	nd	2,000 [1,000]	27/61	27/61
Chlorinated tridecanes	**Monitored year**	**Geometric mean***	**Median**	**Maximum**	**Minimum**	**Quantification [Detection] limit**	**Detection Frequency Sample**	**Detection Frequency Site**
Sediment (pg/g-dry)	2017	nd	nd	94,000	nd	12,000 [5,000]	18/62	18/62
	2018	nd	nd	36,000	nd	9,000 [3,000]	24/61	24/61
	2019	tr(1,700)	tr(1,700)	60,000	nd	2,000 [1,000]	39/61	39/61

(Note) Chlorinated paraffins with 5~9 chlorines are target chemicals.

<Wildlife>

Chlorinated decanes: The presence of the substance in bivalves was monitored in 3 areas, and it was not detected at all 3 valid areas adopting the detection limit of 300pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 5 of the 16 valid areas adopting the detection limit of 300pg/g-wet, and none of the detected concentrations exceeded tr(700)pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 300pg/g-wet, and the detected concentration was tr(600)pg/g-wet.

Chlorinated undecanes: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 1 of the 3 valid areas adopting the detection limit of 200pg/g-wet, and the detected concentration was 600pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 11 of the 16 valid areas adopting the detection limit of 200pg/g-wet, and none of the detected concentrations exceeded 1,100pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 200pg/g-wet, and the detected concentration was 1,400pg/g-wet.

Chlorinated dodecanes: The presence of the substance in bivalves was monitored in 3 areas, and it was not detected at all 3 valid areas adopting the detection limit of 500pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 2 of the 16 valid areas adopting the detection limit of 500pg/g-wet, and none of the detected concentrations exceeded tr(900)pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 500pg/g-wet, and the detected concentration was tr(500)pg/g-wet.

Chlorinated tridecanes: The presence of the substance in bivalves was monitored in 3 areas, and it was detected at all 3 valid areas adopting the detection limit of 200pg/g-wet, and the detection range was tr(300)~1,100pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 11 of the 16 valid areas adopting the detection limit of 200pg/g-wet, and none of the detected concentrations exceeded 1,300pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and detected in the area adopting the detection limit of 200pg/g-wet, and the detected concentration was 1,300pg/g-wet.

Stocktaking of the detection of Chlorinated decanes, Chlorinated undecanes, Chlorinated dodecanes and Chlorinated tridecanes in wildlife (bivalves, fish and birds) during FY2016~FY2019

Chlorinated decanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2016	tr(700)	tr(700)	2,200	nd	1,300 [500]	2/3	2/3
	2017	670	1,700	1,800	nd	500 [200]	2/3	2/3
	2018	nd	tr(400)	tr(400)	nd	1,200 [400]	2/3	2/3
	2019	nd	nd	nd	nd	900 [300]	0/3	0/3
Fish (pg/g-wet)	2016	tr(600)	tr(700)	2,800	nd	1,300 [500]	13/19	13/19
	2017	tr(410)	tr(400)	2,100	nd	500 [200]	16/19	16/19
	2018	nd	nd	tr(800)	nd	1,200 [400]	1/18	1/18
	2019	nd	nd	tr(700)	nd	900 [300]	5/16	5/16
Birds (pg/g-wet)	2016	tr(1,000)	---	1,300	tr(800)	1,300 [500]	2/2	2/2
	2017	tr(400)	---	1,600	nd	500 [200]	1/2	1/2
	2018	nd	---	tr(600)	nd	1,200 [400]	1/2	1/2
	2019	---	---	tr(600)	tr(600)	900 [300]	1/1	1/1

Chlorinated undecanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2016	tr(2,900)	tr(2,000)	6,000	tr(2,000)	3,000 [1,000]	3/3	3/3
	2017	2,200	3,400	11,000	tr(300)	800 [300]	3/3	3/3
	2018	nd	nd	nd	nd	1,800 [700]	0/3	0/3
	2019	nd	nd	600	nd	500 [200]	1/3	1/3
Fish (pg/g-wet)	2016	tr(2,900)	tr(2,000)	15,000	nd	3,000 [1,000]	18/19	18/19
	2017	1,900	1,100	24,000	nd	800 [300]	16/19	16/19
	2018	nd	nd	tr(700)	nd	1,800 [700]	1/18	1/18
	2019	tr(300)	tr(400)	1,100	nd	500 [200]	11/16	11/16
Birds (pg/g-wet)	2016	4,900	---	8,000	3,000	3,000 [1,000]	2/2	2/2
	2017	5,000	---	31,000	800	800 [300]	2/2	2/2
	2018	nd	---	nd	nd	1,800 [700]	0/2	0/2
	2019	---	---	1,400	1,400	500 [200]	1/1	1/1
Chlorinated dodecanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2016	tr(1,400)	tr(1,500)	tr(1,800)	tr(1,100)	2,100 [700]	3/3	3/3
	2017	2,000	1,400	4,700	1,300	900 [300]	3/3	3/3
	2018	nd	nd	nd	nd	1,500 [600]	0/3	0/3
	2019	nd	nd	nd	nd	1,200 [500]	0/3	0/3
Fish (pg/g-wet)	2016	tr(1,800)	tr(1,800)	8,700	nd	2,100 [700]	17/19	17/19
	2017	2,100	2,100	19,000	nd	900 [300]	18/19	18/19
	2018	nd	nd	nd	nd	1,500 [600]	0/18	0/18
	2019	nd	nd	tr(900)	nd	1,200 [500]	2/16	2/16
Birds (pg/g-wet)	2016	3,800	---	6,600	2,200	2,100 [700]	2/2	2/2
	2017	5,500	---	25,000	1,200	900 [300]	2/2	2/2
	2018	nd	---	nd	nd	1,500 [600]	0/2	0/2
	2019	---	---	tr(500)	tr(500)	1,200 [500]	1/1	1/1
Chlorinated tridecanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] Limit	Detection Frequency Sample	Detection Frequency Site
Bivalves (pg/g-wet)	2016	tr(700)	tr(700)	tr(900)	tr(500)	1,100 [400]	3/3	3/3
	2017	870	700	3,100	tr(300)	500 [200]	3/3	3/3
	2018	nd	nd	nd	nd	1,400 [500]	0/3	0/3
	2019	500	400	1,100	tr(300)	400 [200]	3/3	3/3
Fish (pg/g-wet)	2016	tr(800)	tr(800)	4,900	nd	1,100 [400]	17/19	17/19
	2017	tr(290)	nd	4,100	nd	500 [200]	8/19	8/19
	2018	nd	nd	nd	nd	1,400 [500]	0/18	0/18
	2019	tr(200)	tr(200)	1,300	nd	400 [200]	11/16	11/16
Birds (pg/g-wet)	2016	1,400	---	1,500	1,400	1,100 [400]	2/2	2/2
	2017	900	---	8,100	nd	500 [200]	1/2	1/2
	2018	nd	---	nd	nd	1,400 [500]	0/2	0/2
	2019	---	---	1,300	1,300	400 [200]	1/1	1/1

(Note) Chlorinated paraffins with 5~9 chlorines are target chemicals.

<Air>

Chlorinated decanes: The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 100pg/m^3, and the detection range was tr(100)~1,500pg/m^3.

Chlorinated undecanes: The presence of the substance in air was monitored at 36 sites, and it was detected at all 36 valid sites adopting the detection limit of 100pg/m^3, and the detection range was tr(100)~2,300pg/m^3.

Chlorinated dodecanes: The presence of the substance in air was monitored at 36 sites, and it was detected at 23 of the 36 valid sites adopting the detection limit of 90pg/m^3, and none of the detected concentrations exceeded 1,600pg/m^3.

Chlorinated tridecanes: The presence of the substance in air was monitored at 36 sites, and it was detected at 19 of the 36 valid sites adopting the detection limit of 80pg/m^3, and none of the detected concentrations exceeded 1,600pg/m^3.

Stocktaking of the detection of Chlorinated decanes, Chlorinated undecanes, Chlorinated dodecanes and Chlorinated tridecanes in air during FY2016~FY2019

Chlorinated decanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2016 Warm season	tr(170)	tr(200)	940	nd	290 [110]	24/37	24/37
	2017 Warm season	370	380	1,500	tr(70)	140 [50]	37/37	37/37
	2018 Warm season	370	390	1,700	tr(130)	150 [60]	37/37	37/37
	2019 Warm season	400	400	1,500	tr(100)	400 [100]	36/36	36/36
Chlorinated undecanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2016 Warm season	tr(350)	tr(320)	3,200	nd	610 [240]	20/37	20/37
	2017 Warm season	500	510	2,300	tr(90)	190 [60]	37/37	37/37
	2018 Warm season	450	430	2,600	tr(100)	110 [40]	37/37	37/37
	2019 Warm season	400	400	2,300	tr(100)	300 [100]	36/36	36/36
Chlorinated dodecanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2016 Warm season	nd	nd	740	nd	430 [170]	7/37	7/37
	2017 Warm season	190	190	730	tr(30)	100 [30]	37/37	37/37
	2018 Warm season	190	190	880	tr(60)	110 [40]	37/37	37/37
	2019 Warm season	tr(140)	tr(170)	1,600	nd	260 [90]	23/36	23/36
Chlorinated tridecanes	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2016 Warm season	nd	nd	510	nd	320 [120]	13/37	13/37
	2017 Warm season	150	160	1,600	nd	120 [40]	35/37	35/37
	2018 Warm season	tr(100)	tr(110)	470	nd	180 [70]	26/37	26/37
	2019 Warm season	tr(90)	tr(90)	1,600	nd	250 [80]	19/36	19/36

(Note) In FY2016, Chlorinated decanes with 4~6 chlorines and Chlorinated undecanes, Chlorinated dodecanes and Chlorinated tridecanes with 4~7 chlorines are target chemicals. After FY2017, Chlorinated paraffins with 4~7 chlorines are target chemicals.

[24] Dicofol

・ History and state of monitoring

Dicofol was used as insecticides and mites etc., but the registration of Chlordanes under the Agricultural Chemicals Regulation Law was expired in FY2004. The substance was designated as a Class I Specified Chemical Substance under the Chemical Substances Control Law in April 2005. The substance was adopted as a target chemical at the COP9 of the Stockholm convention on Persistent Organic Pollutants held from late April to early May 2019.

Under the framework of the Initial Environmental Survey and the Detailed Environmental Survey etc., the substance was surveied in sediment in FY2004.

Under the framework of the Environmental Monitoring, the substance has been monitored in wildlife (bivalves, fish and birds) in FY2006, in surface water, sediment and wildlife (bivalves, fish and birds) in FY2008, in air in FY2016, in wildlife (bivalves, fish and birds) in FY2018, and in surface water, sediment, wildlife (bivalves, fish and birds) and air in FY2019.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 48 sites, and it was detected at 3 of the 48 valid sites adopting the detection limit of 8pg/L, and none of the detected concentrations exceeded 40pg/L.

Stocktaking of the detection of Dicofol in surface water in FY2008 and FY2019

Dicofol	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Surface Water (pg/L)	2008	nd	nd	76	nd	25 [10]	13/48	13/48
	2019	nd	nd	40	nd	13 [8]	3/48	3/48

<Sediment>

The presence of the substance in sediment was monitored at 61 sites, and it was detected at 40 of the 61 valid sites adopting the detection limit of 2pg/g-dry, and none of the detected concentrations exceeded 84pg/g-dry.

Stocktaking of the detection of Dicofol in sediment in FY2008 and FY2019

Dicofol	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2008	nd	nd	460	nd	160 [63]	13/63	30/186
	2019	4	4	84	nd	4 [2]	40/61	40/61

(Note) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2008.

<Wildlife>

The presence of the substance in bivalves was monitored in 3 areas, and it was detected at 1 of the 3 valid areas adopting the detection limit of 10pg/g-wet, and the detected concentration was tr(10)pg/g-wet. For fish, the presence of the substance was monitored in 16 areas, and it was detected at 12 of the 16 valid areas adopting the detection limit of 10pg/g-wet, and none of the detected concentrations exceeded 120pg/g-wet. For birds, the presence of the substance was monitored in 1 area, and not detected in the area adopting the detection limit of 10pg/g-wet.

Stocktaking of the detection of Dicofol in wildlife (bivalves, fish and birds) in during FY2006~2019

Dicofol	Monitored year	Geometric mean*	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Bivalves (pg/g-wet)	2006	tr(58)	tr(70)	240	nd	92 [36]	22/31	5/7
	2008	tr(110)	120	210	nd	120 [48]	28/31	7/7
	2018	nd	nd	30	nd	30 [10]	1/3	1/3
	2019	nd	nd	tr(10)	nd	30 [10]	1/3	1/3
Fish (pg/g-wet)	2006	nd	nd	290	nd	92 [36]	5/80	1/16
	2008	tr(62)	tr(77)	270	nd	120 [48]	55/85	14/17
	2018	tr(10)	nd	280	nd	30 [10]	9/18	9/18
	2019	tr(10)	tr(10)	120	nd	30 [10]	12/16	12/16
Birds (pg/g-wet)	2006	nd	nd	nd	nd	92 [36]	0/10	0/2
	2008	nd	nd	300	nd	120 [48]	1/10	1/2
	2018	nd	---	nd	nd	30 [10]	0/2	0/2
	2019	---	---	nd	nd	30 [10]	0/1	0/1

(Note 1) " * " :Arithmetic mean value was calculated for each point, from which the geometric mean value for all points was derived in FY2006 and FY2008.

(Note 2) No monitoring was conducted in FY2007 and FY2009~2017.

<Air>

The presence of the substance in air was monitored at 36 sites, and it was detected at 5 of the 36 valid sites adopting the detection limit of 0.2pg/m^3, and none of the detected concentrations exceeded 0.4pg/m^3.

Stocktaking of the detection of Dicofol in air in FY2016 and FY2019

Dicofol	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] limit	Detection Frequency	
							Sample	Site
Air (pg/m^3)	2016 Warm season	nd	nd	1.0	nd	0.5 [0.2]	10/37	10/37
	2019 Warm season	nd	nd	0.4	nd	0.4 [0.2]	5/36	5/36

[25] Perfluorohexane sulfonic acid (PFHxS)

・ History and state of monitoring

Perfluorohexane sulfonic acid (PFHxS) is used as Fluoropolymer processing aid and Surfactant etc. At the fifteenth meeting held from 1 to 4 October 2019, the Committee adopted the risk management evaluation on perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS-related compounds and recommended to the Conference of the Parties that it consider listing the chemicals in Annex A to the Convention without specific exemptions.

Under the framework of the Environmental Monitoring, the substance has been monitored in surface water, and sediment in FY2018 and FY2019.

・ Monitoring results

<Surface Water>

The presence of the substance in surface water was monitored at 48 sites, and it was detected at 45 of the 48 valid sites adopting the detection limit of 30pg/L, and none of the detected concentrations exceeded 1,800pg/L.

Stocktaking of the detection of Perfluorohexane sulfonic acid (PFHxS) in surface water in FY2018 and FY2019

Perfluorohexane sulfonic acid (PFHxS)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] Limit	Detection Frequency	
							Sample	Site
Surface water (pg/L)	2018	190	130	2,600	nd	120 [50]	44/47	44/47
	2019	150	120	1,800	nd	60 [30]	45/48	45/48

<Sediment>

The presence of the substance in sediment was monitored at 61 sites, and it was detected at 10 of the 61 valid sites adopting the detection limit of 5pg/g-dry, and none of the detected concentrations exceeded 15pg/g-dry.

Stocktaking of the detection of Perfluorohexane sulfonic acid (PFHxS) in sediment in FY2018 and FY2019

Perfluorohexane sulfonic acid (PFHxS)	Monitored year	Geometric mean	Median	Maximum	Minimum	Quantification [Detection] Limit	Detection Frequency	
							Sample	Site
Sediment (pg/g-dry)	2018	nd	nd	27	nd	11 [5]	15/61	15/61
	2019	nd	nd	15	nd	13 [5]	10/61	10/61

●References

i) Environmental Health and Safety Division, Environmental Health Department, Ministry of the Environment, “Chemicals in the Environment,” the Surface Water/Sediment Monitoring (http://www.env.go.jp/chemi/kurohon/)

ii) Environmental Health and Safety Division, Environmental Health Department, Ministry of the Environment, “Chemicals in the Environment,” the Wildlife Monitoring (http://www.env.go.jp/chemi/kurohon/)

iii) Environmental Health and Safety Division, Environmental Health Department, Ministry of the Environment, “Chemicals in the Environment,” the Follow-up Survey of the Status of Pollution by Unintentionally Formed Chemicals (http://www.env.go.jp/chemi/kurohon/)

iv) Environmental Health and Safety Division, Environmental Health Department, Ministry of the Environment, “Chemicals in the Environment,” the Environmental Survey of Chemical Substances (http://www.env.go.jp/chemi/kurohon/)

〇Egg of Great Cormorants (egg yolk and white) (References)

In the FY2018 monitoring survey, eggs of great cormorants were analyzed to check for the presence of 12 chemicals (groups): Total PCBs, Hexachlorobenzene, DDTs, Toxaphenes, Mirex, Polybromodiphenyl ethers, Pentachlorobenzene, 1,2,5,6,9,10-Hexabromocyclododecanes, Total Polychlorinated Naphthalenes, Pentachlorophenol and its salts and esters, Short-chain chlorinated paraffins and Dicofol.

The eggs were taken under Shimosone-bashi Bridge Riv. Fuefuki* and around Koyaike pond**. The results of the analysis in Table 1.

(Note 1) " * " : The eggs were taken by Yamanashi Institute for Public Health and Environment and Yamanashi Prefectural Fisheries Technology Center.

(Note 2) " ** " :The eggs were taken by Water and Air Quality Control Division, Environmental Management Bureau, Agricultural and Environmental Affairs Department, Hyogo Prefectural Government and Green Nature Division, Environmental Policy Office, Department of Citizen Autonomy, Itami City.

Table 1 List of the detection values of egg of Great Cormorant

No.	Target chemicals	Quantification [Detection] Limits	Egg of Great Cormorant				(Reposted) Adult of Great Cormorant**	
			Shimosone-bashi Bridge, Riv.Fuefuki (Kofu City)		Koyaike pond (Itami City)		Lake Biwa (offshore of Tikubu Island)	Riv.Tenjin (Kurayoshi City)
			Egg white	Egg white	Egg white	Egg white		
[1]	Total PCBs	63 [21]	3,200	2,600,000	27,000	12,000,000	85,000	130,000
[2]	HCB	3.3 [1.1]	96	41,000	110	34,000	2,600	3,100
[6]	DDTs							
	[6-1] *p,p′*-DDT	3 [1]	3	3,600	14	5,900	63	29
	[6-2] *p,p′*-DDE	3 [1]	1,600	1,600,000	1,700	670,000	22,000	290,000
	[6-3] *p,p′*-DDD	1.4 [0.6]	tr(1.1)	270	8.7	1,300	260	210
	[6-4] *o,p′*-DDT	2.7 [0.9]	nd	82	nd	78	tr(2.5)	nd
	[6-5] *o,p′*-DDE	3 [1]	nd	11	nd	31	tr(1)	tr(1)
	[6-6] *o,p′*-DDD	2.4 [0.9]	nd	17	tr(1.2)	110	9.9	3.7
[9]	Toxaphenes							
	[9-1]Parlar-26	21 [8]	nd	990	nd	300	54	53
	[9-2]Parlar-50	16 [6]	nd	300	nd	490	tr(13)	tr(11)
	[9-3]Parlar-62	100 [40]	nd	nd	nd	nd	nd	nd
[10]	Mirex	1.4 [0.5]	3.6	2,500	1.6	920	47	260
[14]	Polybromodiphenyl ethers(Br_4~Br_{10})							
	[14-1] Tetrabromodiphenyl ethers	14 [5]	150	45,000	50	10,000	310	280
	[14-2] Pentabromodiphenyl ethers	11 [4]	32	23,000	tr(10)	5,800	140	240
	[14-3] Hexabromodiphenyl ethers	21 [8]	28	31,000	tr(14)	10,000	330	1,300
	[14-4] Heptabromodiphenyl ethers	15 [6]	nd	12,000	tr(6)	6,800	110	480
	[14-5] Octabromodiphenyl ethers	16 [6]	nd	12,000	nd	6,600	61	580
	[14-6] Nonabromodiphenyl ethers	40 [20]	nd	480	nd	430	53	46
	[14-7] Decabromodiphenyl ether	240 [80]	nd	390	nd	950	500	tr(90)
[17]	Pentachlorobenzene	15 [5]	20	6,200	32	8,100	280	480
[19]	1,2,5,6,9,10-Hexabromocyclododecanes							
	[19-1] *α*-1,2,5,6,9,10-Hexabromocyclododecane	23 [9]	160	39,000	170	30,000	590	610
	[19-2] *β*-1,2,5,6,9,10-Hexabromocyclododecane	22 [8]	nd	nd	nd	nd	nd	nd
	[19-3] *γ*-1,2,5,6,9,10-Hexabromocyclododecane	21 [8]	nd	260	nd	260	nd	nd
[20]	Total Polychlorinated Naphthalenes	36 [12]	tr(16)	15,000	50	30,000	250	220
[22]	Pentachlorophenol and its salts and esters							
	[22-1] Pentachlorophenol	30 [10]	110	13,000	tr(10)	910	180	1,200
	[22-2] Pentachloroanisole	6 [2]	tr(3)	530	nd	230	20	11
[23]	Short-chain chlorinated paraffins							
	[23-1] Chlorinated decanes	1,200 [400]	nd	nd	nd	nd	tr(600)	nd
	[23-2] Chlorinated undecanes	1,800 [700]	nd	nd	nd	nd	nd	nd
	[23-3] Chlorinated dodecanes	1,500 [600]	nd	nd	nd	nd	nd	nd
	[23-4] Chlorinated tridecanes	1,400 [500]	nd	nd	nd	tr(2600)	nd	nd
[24]	Dicofol	30 [10]	nd	nd	nd	nd	nd	nd

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

(Note 2) ”**” indicates these values are previously mentioned in the main part but are mentioned here again to indicate the stage of life cycle of great cormorants from egg to adult.