

Chapter 2 Results of the Detailed Environmental Survey in FY2021

1. Purpose of the survey

The Detailed Environmental Survey is implemented to provide as required under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances (Law 117, 1973) (hereafter, the Chemical Substances Control Law), the data and details required for risk assessments et al. of chemical substances prioritized for evaluations. This compiled material is intended to allow for nationwide assessments of exposure in the general environment.

2. Target chemicals

In the FY2021 Detailed Environmental Survey, 6 chemicals (groups) that were selected and designated as target chemicals. The combinations of target chemicals and the surveyed media are given below.

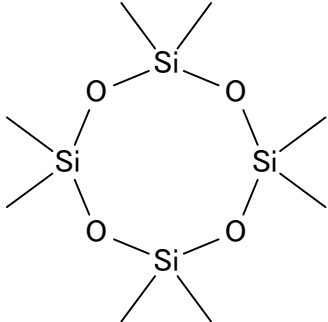
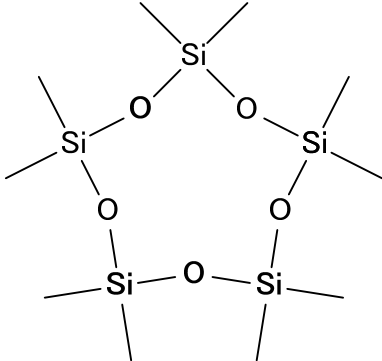
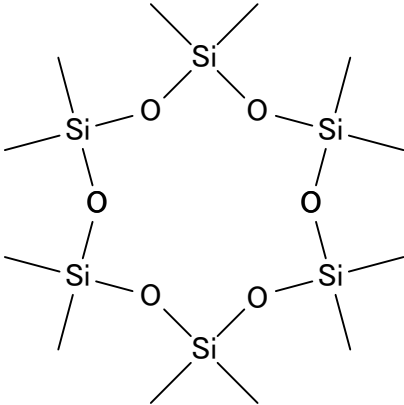
No.	Name	The Chemical Substances Control Law *1		The PRTR Law *2,3			Surveyed media			
		Before the revision	After the revision	2000-	2008-	2021-	Surface water	Sedi-ment	Wild-life	Air
[1]	Cyclopolydimethylsiloxanes									
	[1-1] Octamethylcyclotetrasiloxane		Monitored			I 96	○		○	
	[1-2] Decamethylcyclopentasiloxane						○		○	
	[1-3] Dodecamethylcyclohexasiloxane		Monitored				○		○	
[2]	Tetraalkylammonium salts									
	[2-1] Hexadecyl(trimethyl)ammonium salt	III Monitored (Chloride)	Priority Assessment Chemical Substances	II 69	I 389 (Chloride) II 85 (Bromide)	I 431 (Chloride)	○			
	[2-2] Trimethyl(octadecyl)ammonium salt		Priority Assessment Chemical Substances			I 339	○			
	[2-3] Didecyl(dimethyl)ammonium salt		Priority Assessment Chemical Substances			I 224	○			
[3]	Tetramethylammonium hydroxide	II Monitored	Priority Assessment Chemical Substances			I 307	○			
[4]	Trioctylamine	III Monitored	Priority Assessment Chemical Substances			I 322	○			
[5]	2-Benzylideneoctanal		Priority Assessment Chemical Substances			I 449	○	○		
[6]	Methanamine	II Monitored	Priority Assessment Chemical Substances		I 423					○

(Note 1) "Before the revision" in "The Chemical Substances Control Law" means designation before the May 20, 2009 revision of the law (enforced April 1, 2011), and "After the revision" means designation after the law revision.

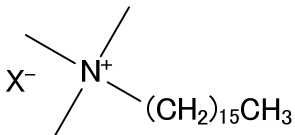
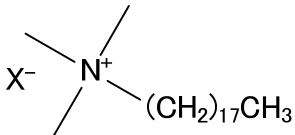
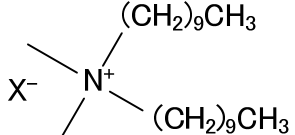
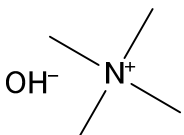
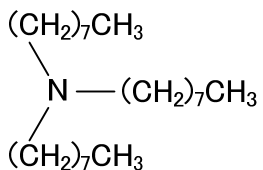
(Note 2) "The PRTR Law" hereafter means "Act on Confirmation, etc. of Release Amounts of Specific Chemical Substances in the Environment and Promotion of Improvements to the Management Thereof (Law No. 86 of 1999)."

(Note 3) "2000-" in the "The PRTR Law" means designation at the time of enactment of government ordinance of the law on June 7, 2000, "2008-" means the designation after the revision of the government ordinance on November 21, 2008, and "2021-" means the designation after the revision of the government ordinance on October 20, 2021.

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

[3] Cyclopolydimethylsiloxanes	
[3-1] Octamethylcyclotetrasiloxane	
	<p>Molecular formula: C₈H₂₄O₄Si₄ CAS: 556-67-2 ENCS: 7-475 (Cyclic polyalkyl (C₁ ~ C₂₀) siloxane) MW: 296.62 mp: 17.7 °C²⁾ bp: 175 °C (1013 hPa)²⁾ sw: 0.036 mg/L (20±0.5 °C)²⁾ Specific gravities: 0.9561 g/cm³ logPow: 6.74³⁾</p>
[3-2] Decamethylcyclopentasiloxane	
	<p>Molecular formula: C₁₀H₃₀O₅Si₅ CAS: 541-02-6 ENCS: 7-475 (Cyclic polyalkyl (C₁ - C₂₀) siloxane) MW: 370.77 mp: -38 °C²⁾ bp: 211 °C (1013 hPa)²⁾ sw: 0.0301 mg/L (20±0.5 °C)²⁾ Specific gravities: 0.9593 g/cm³ (20 °C)³⁾ logPow: 8.06⁴⁾</p>
[3-3] Dodecamethylcyclohexasiloxane	
	<p>Molecular formula: C₁₂H₃₆O₆Si₆ CAS: 540-97-6 ENCS: 7-475 (Cyclic polyalkyl (C₁ ~C₂₀) siloxane) MW: 444.92 mp: -3 °C²⁾ bp: 245 °C²⁾ sw: 0.0106 mg/L (20±0.5 °C)²⁾ Specific gravities: 0.9672 g/cm³³⁾ logPow: 8.87⁴⁾</p>

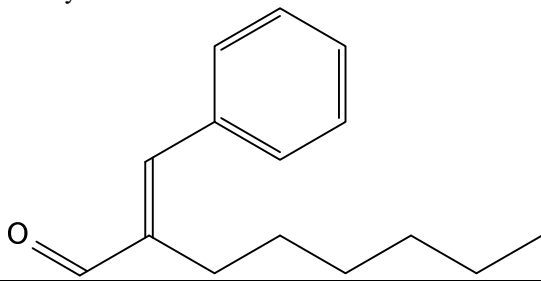
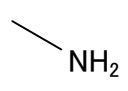
(Abbreviations) CAS CAS registry number, ENCS registry number in the Existing and New Chemical Substances List, MW molecular weight, mp melting point, bp boiling point, SW solubility in water, Specific gravities Specific gravity(no unit) or density, logPow *n*-octanol-water partition coefficient, kPa kilopascal (1 atom approximately equal to 101.3kPa).

[2] Tetraalkylammonium salts	
[2-1] Hexadecyl(trimethyl)ammonium salt	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  <p>X: Halogen</p> </div> <div> <p>Molecular formula: C₁₉H₄₂XN CAS: 112-02-7 (Chloride), 57-09-0 (Bromide) ENCS: 2-184*¹, 9-795*², 9-1971*³ MW: 320.00 (Chloride), 364.46 (Bromide) mp: 240°C (Bromide)³⁾ bp: Uncertain sw: 440mg/L (Chloride, 30°C)³⁾ Specific gravities: 0.9 approximately (Chloride)³⁾ logPow: 3.23 (Chloride)³⁾</p> </div> </div>
[2-2] Trimethyl(octadecyl)ammonium salt	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  <p>X: Halogen</p> </div> <div> <p>Molecular formula: C₂₁H₄₆XN CAS: 112-03-8 (Chloride), 1120-02-1 (Bromide) ENCS: 2-184*¹, 9-1971*³ MW: 348.05 (Chloride), 392.28 (Bromide) mp: 95~104°C (Chloride)⁴⁾ bp: 235~249°C (Chloride)⁴⁾ sw: 1.76mg/L (Chloride, 25°C)⁴⁾ Specific gravities: Uncertain logPow: 4.17 (Chloride)⁴⁾</p> </div> </div>
[2-3] Didecyl(dimethyl)ammonium salt	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  <p>X: Halogen</p> </div> <div> <p>Molecular formula: C₂₂H₄₈XN CAS: 7173-51-5 (Chloride), 2390-68-3 (Bromide) ENCS: 2-184*¹, 9-1971*³ MW: 362.09 (Chloride), 406.53 (Bromide) mp: 94~100°C (Chloride)³⁾ bp: > 180°C (Chloride)³⁾ sw: 0.65g/L (Chloride, 25°C)³⁾ Specific gravities: 0.87 (Chloride, 20°C)³⁾ logPow: 2.59 (Chloride, 20°C, pH 7)³⁾</p> </div> </div>
[3] Tetramethylammonium hydroxide	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  </div> <div> <p>Molecular formula: C₄H₁₃NO CAS: 75-59-2 ENCS: 2-186 MW: 91.15 mp: 63°C⁵⁾ bp: Decomposition at 135~140°C⁵⁾ sw: Uncertain Specific gravities: 1.00 approximately (24°C/4°C)⁶⁾ logPow: Uncertain</p> </div> </div>
[4] Trioctylamine	<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;">  </div> <div> <p>Molecular formula: C₂₄H₅₁N CAS: 1116-76-3 ENCS: 2-143 MW: 353.67 mp: -34.6°C³⁾ bp: 366.0°C³⁾ sw: 0.050mg/L (25°C)³⁾ Specific gravities: 0.809g/cm³⁷⁾ logPow: 10.35⁷⁾</p> </div> </div>

(Note 1) *N,N,N,N*-Tetraalkyl (or alkenyl, at least one of the alkyl or alkenyl group is C₈~ C₂₄, others are C₁~ C₅) quaternary ammonium salt

(Note 2) Hexadecyl(trimethyl)ammonium bromide

(Note 3) Aliphatic alkyl (at least one of the alkyl groups is C₈~ C₂₄, others are C₁~ C₅) quaternary ammonium salt

<p>[5] 2-Benzylideneoctanal</p> 	<p>Molecular formula: C₁₅H₂₀O CAS: 101-86-0 ENCS: 3-2657 (2-Alkyl(C₄-C₆) cinnamic aldehyde)) MW: 216.32 mp: 29.2°C⁸⁾ bp: 175.05°C (15mmHg)⁸⁾ sw: Insoluble in water³⁾ Specific gravities: 0.950~0.961³⁾ logPow: Uncertain</p>
<p>[6] Methanamine</p> 	<p>Molecular formula: CH₅N CAS: 74-89-5 ENCS: 2-129 MW: 31.06 mp: -93°C⁹⁾ bp: -6°C⁹⁾ sw: Very soluble in water²⁾ Specific gravities: 0.7⁹⁾ logPow: -0.71⁹⁾</p>

References

- Information Material 1, Review Sheet for Class I Specified Chemical Substances and Monitoring Chemical Substances, from the 8th Committee on Safety of Chemical Substances in the fiscal year 2017, Pharmaceutical Affairs Committee, Pharmaceutical Affairs and Food Sanitation Council; the 173rd Review Committee by Subcommittee on Chemical Substances and Chemical Substances Council; the 180th Chemicals Evaluation Subcommittee, Environmental Health Committee, Central Environment Council (December 22, 2017)
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- U.S. National Library of Medicine, PubChem (<https://pubchem.ncbi.nlm.nih.gov/>, Retrieved on November, 2022)
- Ministry of Health, Labour and Welfare, Japan, Trimethyl(octadecan-1-yl)ammonium chloride, Safety Data Sheet, Workplace Safety Wwbsite (2017) (<https://anzeninfo.mhlw.go.jp/anzen/gmsds/112-03-8.html>, Retrieved on November, 2022)
- OECD, Tetramethylammonium hydroxide, SIDS Initial Assessment Report, SIAM 22, 18-21 April 2006 (2006)
- O'neil, M.J. (ed), The Merck Index, 15th ed., The Royal Society of Chemistry (2013)
- Ministry of Health, Labour and Welfare, Japan, Trioctylamine, Safety Data Sheet, Workplace Safety Wwbsite (2012) (<https://anzeninfo.mhlw.go.jp/anzen/gmsds/1116-76-3.html>, Retrieved on November, 2022)
- U.S. EPA, Estimation Programs Interface (EPI) Suite v4.11 (<https://www.epa.gov/tsc-screening-tools/download-epi-suite-tet-estimation-program-interface-v411>)
- International Labour Organization (ILO), Methanamine, International Chemical Safety Cards (ICSCs), ICSC: 0178 (2002)

3. Surveyed site and procedure

In the Detailed Environmental Survey, the sampling and analysis of specimens was entrusted to prefectural governments and government-designated cities across Japan, and some specimens were sampled and analysed by private analytical laboratories.

(1) Organisations responsible for sampling

Local communities	Organisations responsible for sampling *1	Surveyed media			
		Surface water	Sedi-ment	Wild-life	Air
Hokkaido	Environmental Promotion Section, Environment Division, Department of Environment and Lifestyle, Hokkaido Prefectural Government and Research Institute of Energy, Environment and Geology, Hokkaido Research Organization	○	○		
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	○	○		
Ibaraki Pref.	Ibaraki Kasumigaura Environmental Science Center	○	○		○*2
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	○			○
Saitama City	Saitama City Institute of Health Science and Research	○			○
Chiba Pref.	Chiba Prefectural Environmental Research Center	○	○		
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	○			
Nagano Pref.	Nagano Environmental Conservation Research Institute	○	○		○
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 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	○	○	○	○*2
Osaka City	Osaka City Institute of Public Health and Environmental Sciences	○	○		
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	○		○	
Kobe City	Natural Environmental Symbiotic Division, Environmental Preservation Branch, Environment Bureau, Kobe City and Kobe City Institute of Health and Environmental Science	○	○		
Nara Pref.	Nara Prefecture Landscape and Environment Center	○	○		
Wakayama Pref.	Wakayama Prefectural Research Center of Environment and Public Health	○	○		○
Okayama Pref.	Okayama Prefectural Institute for Environmental Science and Public Health	○	○	○	
Yamaguchi Pref.	Yamaguchi Prefectural Institute of Public Health and Environment	○	○	○	○*3
Tokushima Pref.	Tokushima Prefectural Public Health, Pharmaceutical and Environmental Sciences Center				○

Local communities	Organisations responsible for sampling *1	Surveyed media			
		Surface water	Sedi-ment	Wild-life	Air
Kagawa Pref.	Kagawa Prefectural Research Institute for Environmental Sciences and Public Health	○	○		○
Ehime Pref.	Ehime Prefectural Institute of Public Health and Environmental Science	○	○		
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	○	○		○
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	○	○	○	○
Okinawa Pref.	Okinawa Prefectural Institute of Health and Environment	○			

(Note 1) *1: Organisations responsible for sampling are described by their official names in FY 2021

(Note 2) *2: Those organizations cooperated with a private analytical laboratory in sampling specimens.

(Note 3) *3: That organization sampled at one surveyed site and cooperated with a private analytical laboratory in sampling specimens at the other surveyed site.

(2) Surveyed sites and target chemicals

The numbers of target chemicals (groups) and the numbers of surveyed sites, etc. by surveyed medium in the detailed environmental survey were as shown in the following table.

The target chemicals and the national distribution map of the survey sites for each medium are shown in Table 2-1-1 and Figures 2-1-1 for surface water, Table 2-1-2 and Fig.2-1-1 for sediment, Table 2-1-3 and Fig.2-1-2 for wildlife Table 2-1-4 and Fig.1-1-3 for air.

In addition, about 20 sites were selected as survey sites per target chemical. To obtain data for areas to be expected to high concentrations in the general environment survey sites are selected based on information regarding releases and emissions. Among the sites considering to rank in the top of PRTR emissions, it was included the surrounding sites where samples can be taken in the survey sites.

Surveyed media	Numbers of local communities	Numbers of target chemicals	Numbers of surveyed sites	Numbers of samples at a surveyed site
Surface water	44	5	74	1
Sediment	32	1	39	3
Wildlife	9	1	10	3
Air	23*	1	23	3
All media	46	6	107	

(Note) *: For 1 of the 23 organizations, it was sampled at one surveyed site and cooperated with a private analytical laboratory in sampling specimens at the other surveyed site. And 2 organizations were cooperated with a private analytical laboratory in sampling specimens.

(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) Detection limit

The detection limits of analysed values reported by the analytical laboratory are not necessarily the same because of differences in the properties of specimens and in the available measurement equipment. To enable summarisation, therefore, a unified detection limit is predetermined and the analytical values reported by the analytical laboratory are summarised by the following procedure.

Treatment of measured value as an undetected value in high-sensitivity analysis

In the case of high-sensitivity analysis, in which the detection limit of the analytical laboratory is lower than the

unified detection limit, any measured value lower than the unified detection limit is treated as an undetected value in the nationwide summary (see schematic (A)).

Elimination of undetected values in low-sensitivity analysis from summary subject

When the detection limit of the analytical laboratory is higher than the unified detection limit, any target chemical not detected is eliminated from the subject of the summary (see schematic (B)).

When the instrument detection limit (IDL) and the method detection limit (MDL) are given in the analytical method, which is described in reports on the investigation of the development of analytical methods for chemicals and adopted in the Initial Environmental Survey (hereafter, the Initial Environmental Survey Analytical Method), if the IDL measured by the analytical laboratory is lower than the given IDL, the MDL of the Initial Environmental Survey Analytical Method is used as the detection limit by the analytical laboratory.

When IDL and MDL are not given in the Initial Environmental Survey Analytical Method, the detection limit is predetermined by the following procedure.

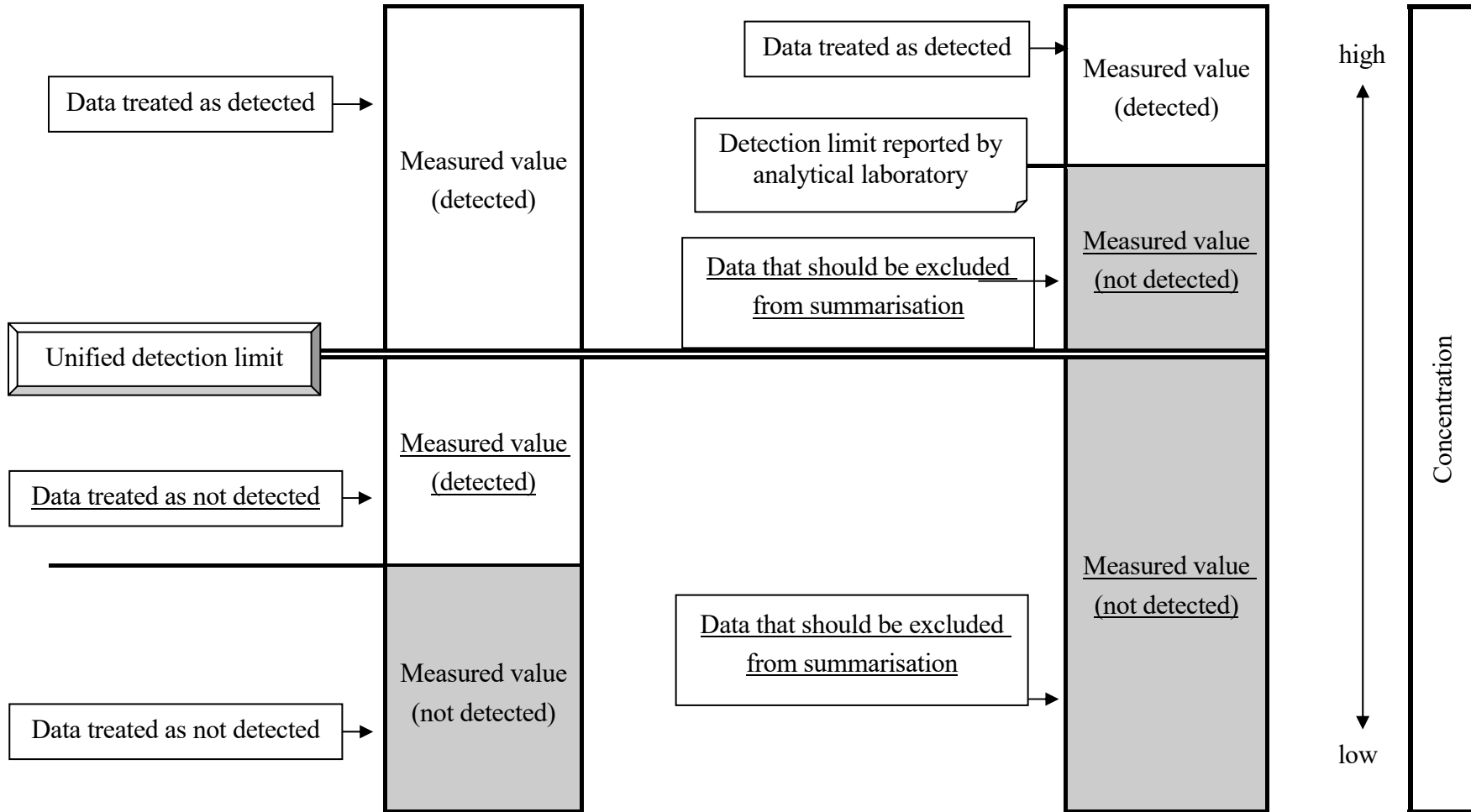
When the analytical laboratory calculates the appropriate IDL and MDL following the calculation method stated in the analytical method development instruction manuals, this calculated MDL is used as the detection limit by the analytical laboratory.

When the appropriate IDL and MDL are not calculated by the analytical laboratory, one of the following procedures was employed to establish the detection limit by the analytical laboratory.

- deduction from the IDL and MDL calculated for the corresponding chemical by Initial Environmental Survey Analytical Method or other analytical laboratories
- deduction from the lowest calibration curve concentration and the results of recovery tests
- deduction from the results of addition and collection tests, the results of operation blank tests, and the signal/noise ratio (S/N ratio) obtained from the chromatogram of environmental specimens

(A) Detection limit reported by analytical laboratory \leq Unified detection limit

(B) Detection limit reported by analytical laboratory $>$ Unified detection limit



Schematic of procedure for data summarisation

Table 2-1-1 List of surveyed sites (surface water) and target chemicals in the Detailed Environmental Survey in FY2021

Local communities	Surveyed sites	Target chemicals				
		[1]	[2]	[3]	[4]	[5]
Hokkaido	Suzuran-ohashi Bridge, Riv. Tokachi (Obihiro City)	○	○			
	Inou-ohashi Bridge, Riv. Ishikari (Asahikawa City)	○	○			
	Ishikarikakokyo Bridge, Mouth of Riv. Ishikari (Ishikari City)	○				○
Sapporo City	Nakanuma of Riv.Toyohira (Sapporo City)	○	○	○		○
	Daiichishinkawa-bashi Bridge, Riv. Shin (Sapporo City)	○	○	○		○
Iwate Pref.	Toyosawa-bashi Bridge, Riv. Toyosawa (Hanamaki City)					○
Miyagi Pref.	Futatsuya-bashi Bridge, Riv. Hasama (Tome City)				○	
	Sakura-hodoukyou Bridge, Riv. Shiroishi (Shibata Town)				○	
Sendai City	Hirose-ohashi Bridge, Riv. Hirose (Sendai City)	○			○	○
Akita Pref.	Akita Canal (Akita City)	○	○	○	○	○
Yamagata Pref.	Goten-bashi Bridge, Riv. Mogami (Murayama City)			○	○	
	Mouth of Riv. Mogami (Sakata City)				○	○
Ibaraki Pref.	Tonekamome-ohashi Bridge, Mouth of Riv. Tone (Kamisu City)	○	○	○		○
Tochigi Pref.	Tagawa Kyubun Area Head Works, Riv. Tagawa (Utsunomiya City)	○	○		○	
Gunma Pref.	Furutone-bashi Bridge, Riv. Ishida (Ota City)	○				
	Hanataka-bashi Bridge, Riv. Usui (Takasaki City)	○				
	Nakase-bashi Bridge, Riv. Usui (Annaka City)		○			
Saitama Pref.	Shinsen-hashi Bridge, Riv. Motokoyama (Honjo City)		○			
	Akigaseshusuizeki of Riv. Arakawa (Shiki City)	○	○		○	
	Shiki-ohashi Bridge, Riv. Yanase (Miyoshi Town)	○	○	○	○	
Saitama City	Nakadote-hashi Bridge, Riv. Kamo (Saitama City)					○
Chiba Pref.	Asai-bashi Bridge, Riv. Yourou (Ichihara City)	○	○	○		○
	Coast of Ichihara and Anegasaki	○	○	○	○	○
Tokyo Met.	Mouth of Riv. Arakawa (Koto Ward)	○	○	○		○
	Mouth of Riv. Sumida (Minato Ward)	○	○	○		○
Yokohama City	Kamenoko-bashi Bridge, Riv.Tsurumi (Yokohama City)	○	○	○	○	
	Yokohama Port		○		○	○
	Yoshikura-bashi Bridge, Riv.Kashio (Yokohama City)	○	○		○	
Kawasaki City	Mouth of Riv. Tama (Kawasaki City)	○	○	○		○
	Front of Chidori Town, Keihin Canal, Port of Kawasaki	○	○			
	Front of Ougi Town, Keihin Canal, Port of Kawasaki	○	○	○		○
Niigata Pref.	Lower Riv. Shinano (Niigata City)	○	○		○	○
Toyama Pref.	Offshore of Imizu City, Toyama bay					○
Ishikawa Pref.	Mouth of Riv. Sai (Kanazawa City)	○	○	○	○	○
Fukui Pref.	Shimizuyama-bashi Bridge, Riv. Hino (Fukui City)	○				
	Sakae-bashi Bridge, Riv. Takeda (Sakai City)	○				
Nagano Pref.	Tategahana-bashi Bridge, Riv. Shinano (Nakano City)	○	○			
	Lake Suwa (center)	○	○			○
Shizuoka Pref.	Shimizu Port					○
	Kaketsuka-bashi Bridge, Riv. Tenryu (Iwata City)					○
Aichi Pref.	West of Shiomi Wharf, Nagoya Port					○
Nagoya City	Minatoshinbashi Bridge, Riv. Hori (Nagoya City)	○	○	○	○	○
Mie Pref.	Yokkaichi Port	○	○	○		○
	Toba Port					○
Shiga Pref.	Lake Biwa (center, offshore of Minamihira)				○	○
	Lake Biwa (center, offshore of Karasaki)				○	○
Kyoto City	Miyamae-bashi Bridge, Riv. Katsura (Kyoto City)	○	○	○		○
Osaka Pref.	Mouth of Riv. Yamato (Sakai City)	○	○			○
Osaka City	Kema-bashi Bridge, Riv. Oh-kawa (Osaka City)	○	○	○		○
	Osaka Port	○	○	○		○
Hyogo Pref.	Offshore of Himeji	○				
	Aboshi Port		○			
	Koakamatsu-bashi Bridge, Riv. Chigusa (Sayo Town)	○				
Kobe City	Kobe Port (center)	○				○
Nara Pref.	Taisho-bashi Bridge, Riv. Yamato (Oji Town)	○		○		○
Wakayama Pref.	Kinokawa-ohashi Bridge, Mouth of Riv. Kinokawa (Wakayama City)					○

Local communities	Surveyed sites	Target chemicals				
		[1]	[2]	[3]	[4]	[5]
Okayama Pref.	Sasagase-bashi Bridge, Riv. Sasagase (Okayama City)	○				
	Offshore of Mizushima					○
Yamaguchi Pref.	Tokuyama Bay					○
	Offshore of Hagi					○
Kagawa Pref.	Takamatsu Port		○		○	○
Ehime Pref.	Mishima area, Riv. Iwamatsu (Uwajima City)					○
Fukuoka Pref.	Kabura-bashi Bridge, Riv. Raizan (Itoshima City)	○	○	○		
	Offshore of Omuta		○	○		
Kitakyushu City	Dokai Bay		○			○
Fukuoka City	Hakata Bay	○	○	○		○
Saga Pref.	Imari Bay					○
Kumamoto Pref.	Front of Yahata pool, Yatsushiro Sea	○				
	Umedo Port, Yatsushiro Sea	○				
Oita Pref.	Mouth of Riv. Oita (Oita City)	○	○			○
Okinawa Pref.	Minatohara-bashi Bridge, Mouth of Riv. Tengan (Uruma City)		○			
	Fukko-bashi Bridge, Riv. Tengan (Okinawa City, Uruma City)		○			
	Naha Port		○			
	Horikawa-bashi Bridge, Riv. Yuhi (Nanjo City, Yaese Town)		○			

[1] Cyclopolydimethylsiloxanes, [2] Tetraalkylammonium salts, [3] Tetramethylammonium hydroxide, [4] Trioctylamine, [5] 2-Benzylideneoctanal

Table 2-1-2 List of surveyed sites (sediment) and target chemical in the Detailed Environmental Survey in FY2021

Local communities	Surveyed sites	Target chemical
		[5] 2-Benzylideneoctanal
Hokkaido	Ishikarikakokyo Bridge, Mouth of Riv. Ishikari (Ishikari City)	○
Iwate Pref.	Toyosawa-bashi Bridge, Riv. Toyosawa (Hanamaki City)	○
Sendai City	Hirose-ohashi Bridge, Riv. Hirose (Sendai City)	○
Akita Pref.	Akita Canal (Akita City)	○
Yamagata Pref.	Mouth of Riv. Mogami (Sakata City)	○
Ibaraki Pref.	Tonekamome-ohasi Bridge, Mouth of Riv. Tone (Kamisu City)	○
Chiba Pref.	Coast of Ichihara and Anegasaki	○
Tokyo Met.	Mouth of Riv. Arakawa (Koto Ward)	○
	Mouth of Riv. Sumida (Minato Ward)	○
Yokohama City	Yokohama Port	○
	Mouth of Riv. Tama (Kawasaki City)	○
	Front of Ougi Town, Keihin Canal, Port of Kawasaki	○
Niigata Pref.	Lower Riv. Shinano (Niigata City)	○
Toyama Pref.	Offshore of Imizu City, Toyama bay	○
Ishikawa Pref.	Mouth of Riv. Sai (Kanazawa City)	○
Nagano Pref.	Lake Suwa (center)	○
Shizuoka Pref.	Shimizu Port	○
	Kaketsuka-bashi Bridge, Riv. Tenryu (Iwata City)	○
Aichi Pref.	West of Shiomi Wharf, Nagoya Port	○
Nagoya City	Minatoshinbashi Bridge, Riv. Hori (Nagoya City)	○
Mie Pref.	Yokkaichi Port	○
	Toba Port	○
Shiga Pref.	Lake Biwa (center, offshore of Minamihira)	○
	Lake Biwa (center, offshore of Karasaki)	○
Kyoto City	Miyamae-bashi Bridge, Riv. Katsura (Kyoto City)	○
Osaka Pref.	Mouth of Riv. Yamato (Sakai City)	○
Osaka City	Kema-bashi Bridge, Riv. Oh-kawa (Osaka City)	○
	Osaka Port	○
Kobe City	Kobe Port (center)	○
Nara Pref.	Taisho-bashi Bridge, Riv. Yamato (Oji Town)	○
Wakayama Pref.	Kinokawa-ohashi Bridge, Mouth of Riv. Kinokawa (Wakayama City)	○
Okayama Pref.	Offshore of Mizushima	○
Yamaguchi Pref.	Tokuyama Bay	○
	Offshore of Hagi	○
Kagawa Pref.	Takamatsu Port	○
Ehime Pref.	Mishima area, Riv. Iwamatsu (Uwajima City)	○
Kitakyushu City	Dokai Bay	○
Fukuoka City	Hakata Bay	○
Saga Pref.	Imari Bay	○
Oita Pref.	Mouth of Riv. Oita (Oita City)	○

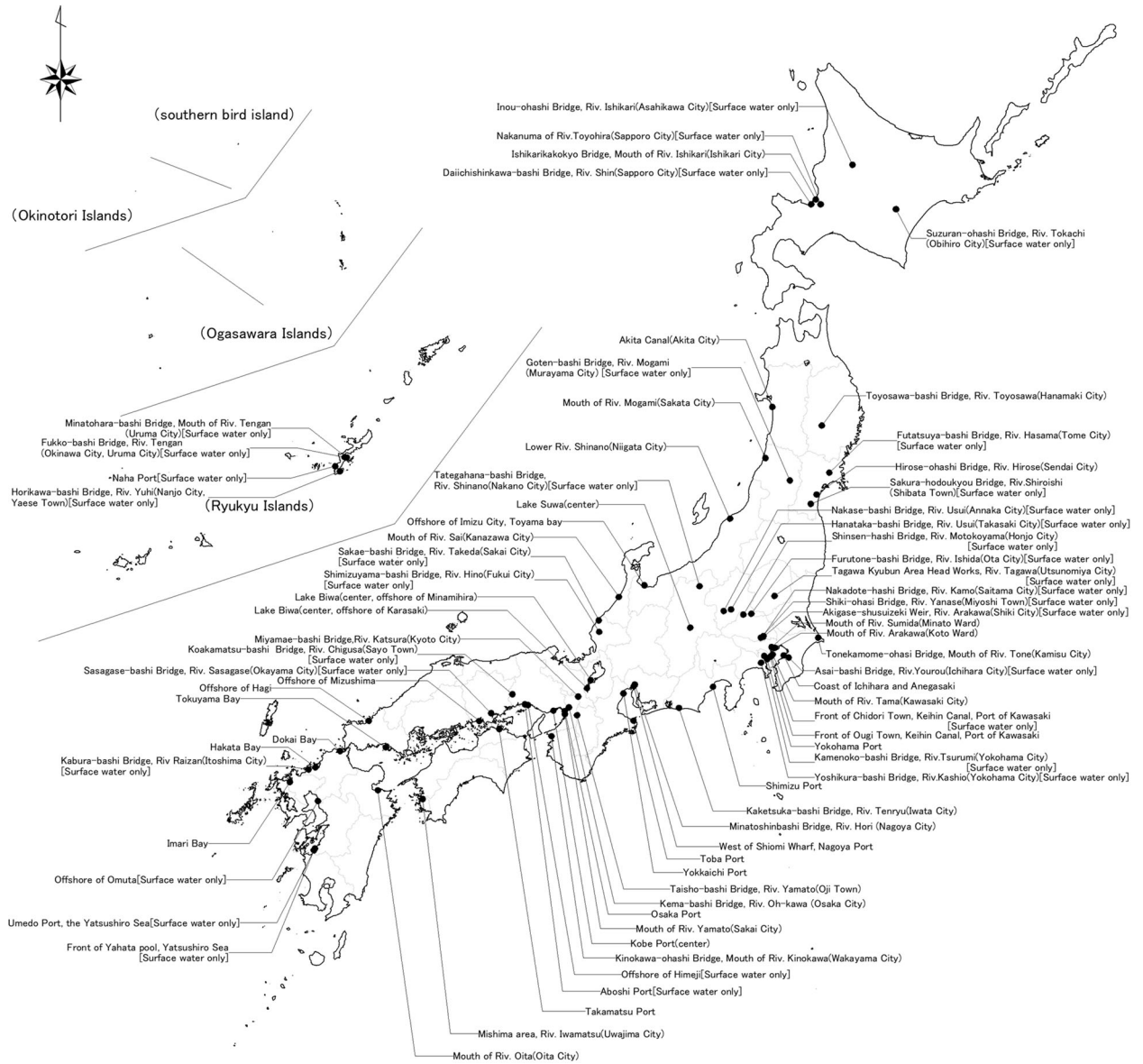


Figure 2-1-1 Surveyed sites (surface water and sediment) in the Detailed Environmental Survey in FY2021

Table 2-1-3 List of surveyed sites (wildlife) and target chemical in the Detailed Environmental Survey in FY2021

Local communities	Surveyed sites	Wildlife species	Target chemical
			[1] Cyclopolydimethylsiloxanes
Iwate Pref.	Yamada Bay	Blue mussel (<i>Mytilus galloprovincialis</i>)	○
		Greenling (<i>Hexagrammos otakii</i>)	○
Tokyo Met.	Tokyo Bay	Sea bass (<i>Lateolabrax japonicus</i>)	○
Yokohama City	Yokohama Port	Blue mussel (<i>Mytilus galloprovincialis</i>)	○
Kawasaki City	Offshore of Ogishima Island, Port of Kawasaki	Sea bass (<i>Lateolabrax japonicus</i>)	○
Osaka Pref.	Osaka Bay	Sea bass (<i>Lateolabrax japonicus</i>)	○
Hyogo Pref.	Offshore of Himeji	Sea bass (<i>Lateolabrax japonicus</i>)	○
Okayama Pref.	Offshore of Mizushima	Striped mullet (<i>Mugil cephalus</i>)	○
Yamaguchi Pref.	Tokuyama Bay	Striped mullet (<i>Mugil cephalus</i>)	○
Oita Pref.	Mouth of Riv. Oita (Oita City)	Spanish mackerel (<i>Scomberomorus niphonius</i>)	○



Figure 2-1-2 Surveved sites (wildlife) in the Detailed Environmental Survey in FY 2021

Table 2-1-4 List of surveyed sites (air) and target chemical in the Detailed Environmental Survey in FY2021

Local communities	Surveyed sites	Target chemical
		[6] Methanamine
Sapporo City	Sapporo City Institute of Public Health (Sapporo City)	○
Sendai City	Tsutsujigaoka Park (Sendai City)	○
Ibaraki Pref.	Tsukuba-Takano Air Quality Monitoring Station (Tsukuba City)	○
Saitama Pref.	Center for Environmental Science in Saitama (Kazo City)	○
Saitama City	Saitama City Public Health Center (Saitama City)	○
Tokyo Met.	Tokyo Metropolitan Research Institute for Environmental Protection (Koto Ward)	○
	Chichijima Island (Ogasawara Village)	○
Kanagawa Pref.	Kanagawa Environmental Research Center (Hiratsuka City)	○
Kawasaki City	Daishi Air Quality Monitoring Station (Kawasaki City)	○
Ishikawa Pref.	Ishikawa Prefectural Institute of Public Health and Environmental Science (Kanazawa City)	○
Nagano Pref.	Nagano Environmental Conservation Research Institute (Nagano City)	○
Aichi Pref.	Handashi-Touyouchou Air Quality Monitoring Station (Handa City)	○
Nagoya City	Chikusa Ward Heiwa Park (Nagoya City)	○
Mie Pref.	Mie Prefecture Health and Environment Research Institute (Yokkaichi City)	○
Kyoto City	Fushimi Ward Office (Kyoto City)	○
Osaka Pref.	Osaka Joint Prefectural Government Building, Building 2 Annex (Osaka City)	○
Wakayama Pref.	Wakayama Prefectural Research Center of Environment and Public Health (Wakayama City)	○
Yamaguchi Pref.	Yamaguchi Prefectural Institute of Public Health and Environment (Yamaguchi City)	○
	Yamaguchi Prefecture Shunan General Government Office Air Quality Monitoring Station (Shunan City)	○
Tokushima Pref.	Tokushima Prefectural Public Health, Pharmaceutical and Environmental Sciences Center (Tokushima City)	○
Kagawa Pref.	Kagawa Prefectural Research Institute for Environmental Sciences and Public Health (Takamatsu City)	○
Saga Pref.	Saga Prefectural Environmental Research Center (Saga City)	○
Oita Pref.	Oita City Misa Elementary School (Oita City)	○



Figure 2-1-3 Surveyed sites (air) in the Detailed Environmental Survey in FY2021

4. Summary of survey results

The detection ranges and the detection limits are shown in Table 1-2. The survey results are summarized as follows.

In surface water, 3 out of 5 target chemicals (groups) were detected. Target chemicals were categorized by analytical methods such as structurally similar chemicals capable of simultaneous analyses.

[1] Cyclopolydimethylsiloxanes

- [1-1] Octamethylcyclotetrasiloxane: 19 of the 38 valid sites
- [1-2] Decamethylcyclopentasiloxane: 36 of the 42 valid sites
- [1-3] Dodecamethylcyclohexasiloxane: 29 of the 44 valid sites

[2] Tetraalkylammonium salts

- [2-1] Hexadecyl(trimethyl)ammonium salt: 30 of the 42 valid sites
- [2-2] Trimethyl(octadecyl)ammonium salt: 31 of the 42 valid sites
- [2-3] Didecyl(dimethyl)ammonium salt: 33 of the 42 valid sites

[3] Tetramethylammonium hydroxide: 1 of the 23 valid sites

In sediment, the target chemical was detected.

[5] 2-Benzylideneoctanal: 36 of the 40 valid sites

In wildlife, the target chemicals group was detected. Target chemicals were categorized by analytical methods such as structurally similar chemicals capable of simultaneous analyses.

[1] Cyclopolydimethylsiloxanes

- [1-1] Octamethylcyclotetrasiloxane: 6 of the 10 valid sites
- [1-2] Decamethylcyclopentasiloxane: 9 of the 10 valid sites
- [1-3] Dodecamethylcyclohexasiloxane: 5 of the 10 valid sites

In air, the target chemical was not detected.

Table 1-2 Summary of the detection ranges and the detection limits in the Detailed Environmental Survey in FY 2021

No.	Target chemicals	Surface water [ng/L]		Sediment [ng/g-dry]		Wildlife [ng/g-wet]		Air [ng/m ³]	
		Detection range and frequency	Detection limit	Detection range and frequency	Detection limit	Detection range and frequency	Detection limit	Detection range and frequency	Detection limit
[1]	Cyclopolydimethylsiloxanes*								
	[1-1] Octamethylcyclotetra siloxane	nd ~ 82 19/38	2.8			nd ~ 15 6/10	2.4		
	[1-2] Decamethylcyclopenta siloxane	nd ~ 190 36/42	4.7			nd ~ 540 9/10	2.3		
	[1-3] Dodecamethylcyclohexa siloxane	nd ~ 24 29/44	2.9			nd ~ 10 5/10	1.1		
[2]	Tetraalkylammonium salts*								
	[2-1] Hexadecyl(trimethyl) ammonium salt	nd ~ 12 30/42	1.3						
	[2-2] Trimethyl(octadecyl) ammonium salt	nd ~ 170 31/42	3.3						
	[2-3] Didecyl(dimethyl) ammonium salt	nd ~ 17 33/42	0.97						
[3]	Tetramethylammonium hydroxide*	nd ~ 350 1/23	120						
[4]	Trioctylamine	nd 0/19	0.26						
[5]	2-Benzylideneoctanal*	nd 0/44	15	nd ~ 72 36/40	0.13				
[6]	Methanamine*							nd 0/23	79

(Note 1) Detection frequency is based on the number of sites, thus means (the number of detected sites/the number of surveyed sites). A site where data was not available was excluded from the number of surveyed sites. A site where the data became invalid under a unified detection limit was also excluded. In sediment, wildlife and air, 3 samples were measured for a site, and the detection in more than one out of samples from a site can be defined as one detected site.

(Note 2) Detection range is based on the number of samples and therefore can be shown as “nd~” even if a target chemical is detected in all sites.

(Note 3) means the medium was not surveyed.

(Note 4) * connote target substances or points selected for survey in light of documentation or submittals regarding emissions.

(Note 5) Concentrations of Tetraalkylammonium salts are stated as chloride.