PRTR Estimation Manual

14. Laundry & Dry Cleaning Industry

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All Japan Laundry & Dry-cleaning Association

Contents

1. Class I Designated Chemical Substances related to the Industry

Cleaning means washing clothes, other textiles and leather products using solvents or detergents, in their original forms. It is classified roughly into dry cleaning with organic solvents and laundry with water. The Class I Designated Chemical Substances used as solvents in dry cleaning processes, or the substances contained in the solvents are the following eight listed. The Class I Designated Chemical Substances used as dry cleaning or laundry detergents, or the substances contained in the detergents are the following four.

Dry cleaning solvents
and Class I Designated Chemical Substances used as dry cleaning solvents

No.	Name of substance	Cabinet Order No.	Notes
1	Tetrachloroethylene	200	
2	HCFC-225 (Dichloropentafluoro propane)	144	To be abolished in 2020
3	1,1,1-trichloroethane	209	Manufacturing and sales prohibited in 1996
4	CFC-113 (Trichlorotrifluoroethane)	213	Manufacturing and sales prohibited in 1996
5	Ethylbenzene	40	Petroleum solvent component
6	Xylenes	63	Petroleum solvent component
7	1, 3, 5-trimethyl benzene	224	Petroleum solvent component
8	Toluene	227	Petroleum solvent component

Detergents
and Class I Designated Chemical Substances used as detergents

No.	Name of substance	Cabinet Order No.	Notes
1	Linear alkylbenzene sulfonic acid and salts thereof	24	C(10 - 14)
2	Polyoxyethylene alkyl ether	307	C (12 - 15)
3	Polyoxyethylene phenyl ether	308	
4	Polyoxyethylene nonylphenyl ether	309	

2. Estimation techniques of releases and transfers of Class I Designated Chemical Substances used in cleaning processes

To estimate releases and transfers of the Class I Designated Chemical Substances, an actual measurement is conducted when this is possible. However, when this is difficult, estimation techniques by using empirical factors and physical properties are employed. The estimation techniques are prepared to be applicable to all types of facilities, but a plant without corresponding facilities should exclude them.

Also, the factors, actual values, literature values or estimation techniques used in this manual are those that have been generally accepted. However, when a plant has more suitable values and estimation techniques, these can be employed without depending on the provided techniques.

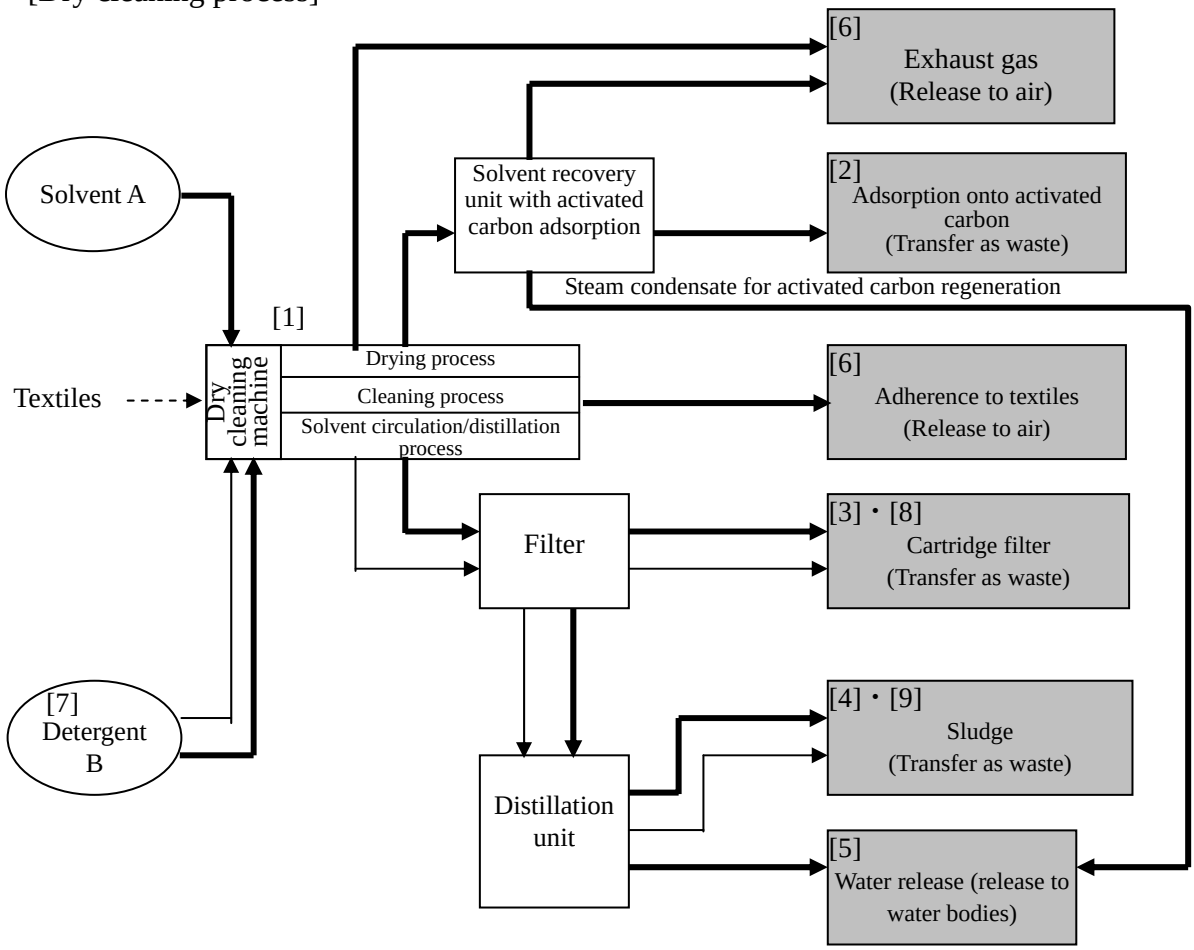
3. Outline of releases of the chemicals to air, water and land in cleaning processes

Cleaning means washing clothes, other textiles and leather products using solvents or detergents, in their original forms. It is classified roughly into dry cleaning with organic solvents and laundry with water. The process and the releases and transfers of the chemicals are explained in the following.

3.1 Dry cleaning process

The dry cleaning process is a process for removing dirt, stain, soil, etc. on textile products with organic solvents and detergents. Some organic solvents and detergents include the Class I Designated Chemical Substances. Releases of the chemicals to the environment can be illustrated in the following chart, depending on structures of dry cleaning machines, internal or external units for solvent recovery, filters, distillation unit, etc.

[Dry cleaning process]



[1] (A + B), [2], [3], [4], [5], and [6] show the flow of dry cleaning solvents.

[7], [8], and [9] show the flow of dry cleaning detergents (surfactants).

3.2 Premise of the estimation of the amount handled, released and transferred

(1) Estimation of the annual amount of solvents handled

Dry cleaning solvents, or the Class I Designated Chemical Substances contained in the solvents (No.1 through No.4), are estimated as a single component (the content is 100 %).
Annual amount used of the substances (No.5 through No.8), each of which is a component contained in petroleum solvents, are estimated by using the contents in MSDS*[1]. The amount of each substance contained in detergents should also be estimated, as well as the amount of the substance handled as solvents.

(2) Estimation of the transfers of the adsorbent solvents at the replacement of activated carbon in the adsorbed solvent recovering unit

When such unit is used and activated carbon is exchanged, the transfers of solvents adsorbed on the activated carbon is estimated. The amount of solvents adsorbed on the activated carbon shall be 5% by the conventional data.

(3) Estimation of the transfers of the residual solvents in a filter at the replacement of a cartridge filter

When a cartridge filter is used and exchanged, the transfers of the solvents in the filter is estimated. The amount of solvents in a filter is 2 liters per standard load weight of the washer (kg) based on the conventional data.

(4) Estimation of the transfers of the residual solvents in distillated sludge

When solvents are regenerated using a distillation unit and sludge is generated, the transfers of the residual solvents in the sludge is estimated. The amount of the solvents in the sludge is obtained by the factors from the reference *[2].

(5) Releases to water bodies

Releases to water bodies are required to be reported in principle. However, the releases are not required to be reported usually, because the releases in any of the solvents used on this industry are negligibly small.

(6) Releases to air

Anything other than the following is considered as releases to air: The transfers of the adsorbed solvents at the activated carbon replacement, the transfers of the filter residual solvents, and the transfers of the residual solvents in the distilled sludge.

(7) Annual amount of surfactant for detergents handled

The annual amount of surfactant in detergents handled is estimated by using the contents in MSDS.

(8) Estimation of the transfers of filter residual detergents at the replacement of a cartridge filter

When a cartridge filter is used and the cartridge filter is exchanged, the transfers of the detergents in the filter are estimated.

(9) Estimation of transfers of residual detergents in distilled sludge

When solvents are regenerated using a distillation, sludge is generated, and the amount transferred of the detergents in the sludge is estimated.

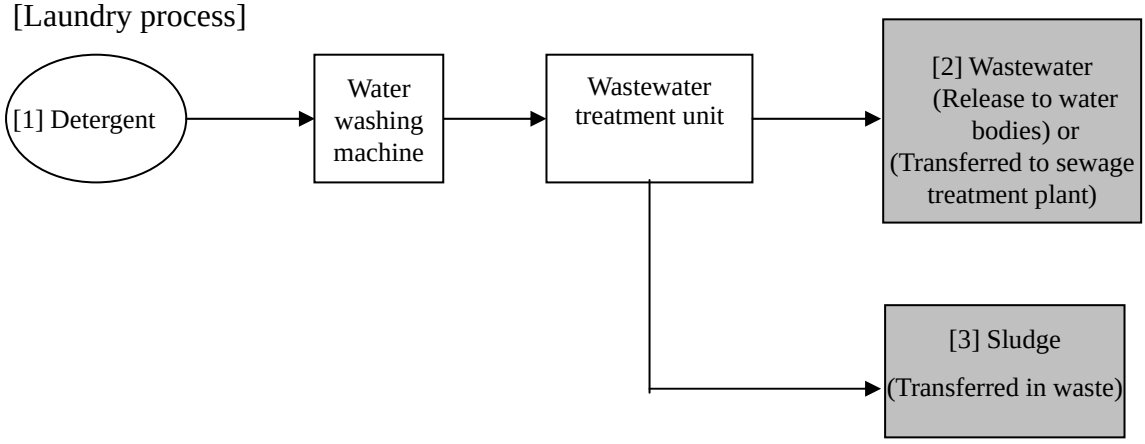
*1 MSDS.
Industries should understand the components, properties and handling methods of chemical substances contained in the products which are handled in their own workplace. MSDS (Material Safety Data Sheet) is the data sheet for providing users with information on the identification of a chemical substances, the content, properties about corresponding products, safety and handling method, etc., when a manufacturer produces and sells the subject chemical substances.

*2 Factors
The values in the "Manual for proper use of Tetrachloroethylene" published by All Japan Laundry & Dry-cleaning Association, were used in this manual also as the factors.

3.3 Laundry process

The laundry process is a process for removing dirt, stain, soil, etc. on textiles using water and detergents. Some detergents include the Class Ⅰ Designated Chemical Substances. The releases and transfers to the environment are: (1) the releases to the water bodies such as rivers, lakes and sea, (2) the transfers to sewers, and (3) the transfers of sludge from wastewater treatment unit.

[Laundry process]



3.4 Premise of the estimation of the amount handled, released and transferred

(1) Estimation of the annual amount of the Class I Designated Chemical Substances in detergents handled

By annual amount handled of detergents, and contents of Class I Designated Chemical Substances in detergents from MSDS, the annual amount of the Class I Designated Chemical Substances in detergents handled is estimated.

(2) Estimation of the releases to water bodies for public use or the transfers to sewers

The releases to water bodies or the transfers to sewers are estimated by the factors derived from the degradation rate in the reference*[3], on the assumption that a wastewater treatment unit is installed.

(3) Transfers as waste

The transfers as waste are estimated by the factors derived from the residual ratio of class I designated substances in sludge (sludge residual ratio) in the reference *4, on the condition that a wastewater treatment unit is installed.

*3, *4 (factors):
The degradation rate and sludge residual ratio depend on each wastewater treatment facility.
In this manual, the values reported in the references below were employed as the factors. There have been few studies in this field, and some facilities may show higher performance than those in the references. Under such circumstances, namely, when the values obtained by a facility are judged to show higher performance than the above designated values, these values should be adopted. There is no need for the facility to adhere to the values in this manual.

*3 Environ. Toxicol. Chem. Vol. 17, 1709-1710, 1998
*4 Wat. Res. Vol. 28, No.5, pp.1131-1142

4. Estimation techniques and examples of releases and transfers

4.1 Estimation technique of the amount of tetrachloroethylene handled, released and transferred

№	Estimation item		Estimation technique	Notes
[1]	Annual amount handled Annual amount of solvent handled		= A + B	
		A	= a + b – c	
		a	Annual purchased amount (kg)	
		b	Stock amount at the beginning of the term (kg)	
		c	Stock amount at the end of the term (kg)	
	Annual handled amount of solvent contained in detergents	B	= (d + e - f) x solvent content (%)/100	Solvent content is based on MSDS
		d	Annual amount purchased	
		e	Stock amount at the beginning of the term (kg)	
		f	Stock amount at the end of the term (kg)	
	※ Reporting is not required when the value of [1] is less than 1,000kg.			
[2]	Transfers of adsorbed solvent at the replacement of activated carbon in a solvent recover unit		= g x 5 (%)/100 x h	Absorption amount is set at 5 (%)
		g	Replaced activated carbon weight (kg)	
		h	Replacement frequencies (times)	Replacement at 5,000-6,000 washing cycles
[3]	Transfers of residual solvent in a filter at the replacement of a cartridge filter		= 2 liters x i x 1.62 x j	Solvent specific gravity is 1.62
		i	Standard load weight of washer (kg)	
		j	Replacement frequencies (times)	Replacement at 500-800 washing cycles
[4]	Transfers of residual solvent in distilled sludge		= i x k x l	
		k	Annual washer operation frequencies (times)	
		l	Factor of filter type ・Spin disc/diatomaceous earth filter = 0.008 ・Cartridge filter = 0.004	Based on the reference values
[5]	Releases to water bodies (from a water separator)		Reporting is required ”release to water bodies 0.0kg”. (Because the annual amount is 300mg on the basis of 0.1mg/liter water or less of the control concentration of the releases to water bodies, 10 liters per day of released water and 300 days/annual operation.)	
[6]	Releases to air		= [1] - ([2] + [3] + [4])	

4.2 Example of estimating the amount of tetrachloroethylene handled, released and transferred

Conditions for the estimation example:

Standard load weight of a washer = 30 kg Filter = cartridge type
Operation times of the washer per year = 1,500 times
Amount of activated carbon of a solvent adsorption recovery unit = 60 kg
Solvent content in a detergent = 30 %
Content of Polyoxyethylene alkyl ether in the detergent = 50 %
Amount of the detergent charge = 0.5 %

№	Estimation item		Estimation technique	Application / estimated value
[1]	Annual amount handled		= A + B	1,323
	Annual amount of solvent handled	A	= a + b – c	1,200
		a	Annual purchased amount (kg)	1,000
		b	Stock amount at the beginning of the term (kg)	500
		c	Stock amount at the end of the term (kg)	300
	Annual handled amount of solvent contained in detergent	B	= (d + e - f) x solvent content (%)/100	123
		d	Annual amount purchased	400
		e	Stock amount at the beginning of the term (kg)	50
		f	Stock amount at the end of the term (kg)	40
	※ Reporting is not required when the value of [1] is less than 1,000kg.			Reporting is required
[2]	Transfers of adsorbed solvent at the replacement of activated carbon in a solvent adsorption recovery unit		= g x 5 (%)/100 x h	3
		g	Replaced activated carbon weight (kg)	60
		h	Replacement frequencies (times)	1
[3]	Transfers of solvent residue in a filter at the time of replacement of a cartridge filter		= 2 liter x i x 1.62 x j	291.6
		i	Standard load weight of washer (kg)	30
		j	Replacement frequencies (times)	3
[4]	Transfers of residual solvent in distilled sludge		= i x k x l	180
		i	Standard load weight of washer (kg)	30
		k	Annual washer operation frequencies (times)	1,500

		l	Factor of filter type ・Spin disc/diatomaceous earth filter = 0.008 ・Cartridge filter = 0.004	0.004
[5]	Releases to water bodies (from the water separator)		Reporting is required ”release to water bodies 0.0kg”. (Because the annual amount is 300mg on the basis of 0.1mg/liter water or less of the control concentration of the releases to water compartments, 10 liters per day of released water and 300 days/annual operation.)	
[6]	Releases to air		= [1] - ([2] + [3] + [4])	848.4

4.3 Estimation techniques of the amount of Class I Designated Chemical Substances handled, released and transferred in dry cleaning detergents

№	Estimation item		Estimation technique	Notes
[7]	Annual amount handled		= (d + e - f) x Class I Designated Chemical Substance content (%)/100	Class I Designated Chemical Substances Content is based on MSDS. If more than one Class I Designated Chemical Substances are included, estimate individually.
		d	Annual amount purchased (kg)	
		e	Stock amount at the beginning of the term (kg)	
		f	Stock amount at the end of the term (kg)	
	※ Reporting is not required when the value of [7] is less than 1,000kg.			
[8]	Transfers of residual solvent in a filter at the replacement of a cartridge filter		= 2 liter x i x j x m (%)/100 x 1(specific gravity) x Class I Designated Chemical Substances content (%)/100	The specific gravity of detergent is 1.
		i	Standard load weight of washer (kg)	
		j	Replacement frequencies (times)	
		m	Amount of charges of detergent (%)	
[9]	Transfers of residual solvent in distilled sludge		= [7] – [8]	

4.4 Example of estimating the amount of Class I Designated Chemical Substances handled, released and transferred in dry cleaning detergents

Class I Designated Chemical Substance: Polyoxyethylene alkyl ether

Conditions for the estimation example:

Content of Polyoxyethylene alkyl ether in detergent = 50%

№	Estimation item		Estimation technique	Notes
[7]	Annual amount handled		= (d + e - f) x Class I Designated Chemical Substance content (%)/100	205
		d	Annual amount purchased (kg)	400
		e	Stock amount at the beginning of the term (kg)	50
		f	Stock amount at the end of the term (kg)	40
	※ Reporting is not required when the value of [7] is less than 1,000kg.			Reporting is not required
[8]	Transfers of residual solvent in a filter at the replacement of a cartridge filter		= 2 liter x i x j x m (%)/100 x 1(specific gravity) x Class I Designated Chemical Substances content (%)/100	0.90
		i	Standard load weight of washer (kg)	30
		j	Replacement frequencies (times)	3
		m	Amount of charges of detergent (%)	0.5
[9]	Transfers of residual solvent in distilled sludge		= [7] – [8]	204.1

4.5 Estimation techniques of the amount of Class I Designated Chemical Substances handled, released and transferred in petroleum solvents

(Xylenes, Toluene, Ethyl benzene)

№	Estimation item		Estimation technique	Notes
[1]	Annual amount handled		= A + B	
	Annual handled amount of the substance contained in solvent	A	= (a + b – c) x substance content in solvent (%)/100	Substance content in solvent is based on MSDS
		a	Annual purchased amount (kg)	
		b	Stock amount at the beginning of the term (kg)	
		c	Stock amount at the end of the term (kg)	
	Annual handled amount of the substance contained in detergent	B	= (d + e - f) x substance content in detergent (%)/100	Substance content in detergent is based on MSDS
		d	Annual amount purchased (kg)	
		e	Stock amount at the beginning of the term (kg)	
		f	Stock amount at the end of the term (kg)	
	※ Reporting is not required when the value of [1] is less than 1,000kg.			
[2]	Transfers of adsorbed solvent at the replacement of activated carbon in a solvent adsorption recovery unit		No	No recovery unit with activated carbon adsorption system.
[3]	Transfers of solvent residue in a filter at the replacement of a cartridge filter		= 2 liter x i x 0.8 x j x substance content in solvent (%)/100	Solvent specific gravity is 0.8
		i	Standard load weight of washer (kg)	
		j	Replacement frequencies (times)	Replacement at 500-800 washing cycles
[4]	Transfers of residual solvent in distilled sludge		= i x k x 0.022 x substance content in solvent (%)/100	0.022 is a factor based on IFI reference value
		i	Standard load weight of washer (kg)	
		k	Annual washer operation frequencies (times)	
[5]	Releases to water compartments (from a water separator)		Reporting of 0.0kg is required. (There is little possibility that the targeted Class I Designated Chemical Substances are distributed to water from a water separator. Each of the substances is water-insoluble and its value is very close to zero.)	
[6]	Releases to air		= [1] - ([2] + [3] + [4])	

To estimate the amount of Class I Designated Chemical Substances handled, released and transferred in dry cleaning detergents, apply the estimation technique for tetrachloroethylene (4.1).

4.6 Example of estimating the amount of Class I Designated Chemical Substances handled, released and transferred in petroleum solvent

Class I Designated Chemical Substances: Containing Xylenes

Conditions for the estimation example:

Standard load weight of the washer = 30 kg Filter = cartridge type

Operation times of the washer per year = 1,500 times

Xylene content in solvent = 2 % (Based on MSDS)

Xylene content in detergent = <1 %

№	Estimation item		Estimation technique	Notes
[1]	Annual amount handled		= A + B	1,020
	Annual amount of solvent handled	A	= (a + b – c) x 2%/100	1,020
		a	Annual purchased amount (kg)	50,000
		b	Stock amount at the beginning of the term (kg)	1,500
		c	Stock amount at the end of the term (kg)	500
	Annual handled amount of solvent contained in detergent	B	= (d + e - f) x substances content in detergent (%)/100	0
		d	Annual amount purchased	The content in detergents (less than 1%) is regarded as 0.
		e	Stock amount at the beginning of the term (kg)	
		f	Stock amount at the end of the term (kg)	
	※ Reporting is not required when the value of [1] is less than 1,000kg.			Reporting is required
[2]	Transfers of adsorbed solvent at the replacement of activated carbon in a solvent adsorption recovery unit		No	No recovery unit with activated carbon adsorption system.
[3]	Transfers of residual solvent in filter at the replacement of the cartridge filter		= 2 liter x i x 0.8 x j x 2%/100	2.88
		i	Standard load weight of washer (kg)	30
		j	Replacement frequencies (times)	3
[4]	Transfers of residual solvent in distilled sludge		= i x k x 0.022 x 2 %/100	19.8
		i	Standard load weight of washer (kg)	30
		k	Annual washer operation frequencies (times)	1,500
[5]	Releases to water bodies (from a water separator)		Reporting of 0.0kg is required. (There is little possibility that the targeted Class I Designated Chemical Substances are distributed to water from a water separator. Each of the substances is water-insoluble and its value is very close to zero.)	
[6]	Releases to air		= [1] - ([2] + [3] + [4])	997.32

As for the estimation example of the Class I Designated Chemical Substances handled, released and transferred in dry cleaning detergents, apply the example of tetrachloroethylene (4.1).

4.7 HCFC-225, CFC-113, 1,1,1-trichloroethane

To estimate HCFC-225, CFC-113, 1,1,1-trichloroethane, apply the estimation technique of tetrachloroethylene. As for the specific gravity in the estimation item [3], transfers of residual solvent in a filter, and the factor of filter in the estimation item [4], transfers of residual solvent in distilled sludge, employ the following values.

№	Estimation item	HCFC-225	CFC-113	Trichloroethane
[3]	Transfers of residual solvent in a filter at the replacement of a cartridge filter	Specific gravity of solvent 1.55	Specific gravity of solvent 1.58	Specific gravity of solvent 1.32
[4]	Transfers of residual solvent in distilled sludge	Factor of filter type ・cartridge = 0.002	Factor of filter type ・cartridge = 0.002	Factor of filter type ・Spin disc = 0.008 ・Diatomaceous earth filter = 0.0025 ・Cartridge filter = 0.005

4.8 Estimation technique of the amount of Class I Designated Chemical Substances handled, released and transferred in laundry detergents

№	Estimation item		Estimation technique	Notes
[1]	Annual amount handled		= (a + b – c) x Class I Designated Chemical Substances content (%)/100	Class I Designated Chemical Substances content is based on MSDS
		a	Annual purchased amount (kg)	
		b	Stock amount at the beginning of the term (kg)	
	Annual handled amount of Class I Designated Chemical Substance in detergent	c	Stock amount at the end of the term (kg)	
	※ Reporting is not required when the value of [1] is less than 1,000kg.			
[2]	Releases to the water bodies or transfers to sewers		= [1] x d	The factors calculated by the degradation rate in the reference when a wastewater treatment facility is equipped
		d	Factor of each Class I Designated Chemical Substance *1 Linear alkylbenzene sulfonic acid and salts = 0.02 Polyoxyethylene alkyl ether = 0.02 Polyoxyethylene Octyl phenyl ether = 0.05 Polyoxyethylene Nonyl phenyl ether = 0.05	
[3]	Transfers of waste remained in activated sludge		= [1] x e	The factors calculated by sludge residual ratio in the reference when a wastewater treatment facility is equipped
		e	Factor of each Class I Designated Chemical Substance *2 Linear alkylbenzene sulfonic acid and salts = 0.001 Polyoxyethylene alkyl ether = 0.001 Polyoxyethylene Octylphenyl ether = 0.2 Polyoxyethylene Nonylphenyl ether = 0.2	

*1 Environ. Toxicol. Chem. Vol. 17, 1709-1710, 1998

*2 Wat. Res. Vol. 28, No. 5, pp. 1131-1142

4.9 Example of estimating the amount of Class I Designated Chemical Substances handled, released and transferred in laundry detergents

Class I Designated Chemical Substance: Linear alkylbenzene sulfonic acid and salts contained

Conditions for the estimation example:

Content of Normal alkylbenzene sulfonic acid sodium salt in detergent = 50%

№	Estimation item		Estimation technique	Notes
[1]	Annual amount handled		= (a + b – c) x Class I Designated Chemical Substances content (%)/100	1,025
	Annual handled amount of Class I Designated Chemical Substance in detergent	a	Annual purchased amount (kg)	2,000
		b	Stock amount at the beginning of the term (kg)	100
		c	Stock amount at the end of the term (kg)	50
	※ Reporting is not required when the value of [1] is less than 1,000kg.			Reporting is required
[2]	Releases to the water bodies or transfers to sewers		= [1] x d	20.5
		d	Factor of each Class I Designated Chemical Substance Linear alkylbenzene sulfonic acid and salts = 0.02	
[3]	Transfers of waste remained in activated sludge		= [1] x e	1.03
		e	Factor of each Class I Designated Chemical Substance Linear alkylbenzene sulfonic acid and salts = 0.001	