4-3 Data used for calculating the released or transferred quantity such as emission factors

4-3-1 Examples of emission factors of specified substances into the atmosphere

The following table lists the emission factors of some volatile organic substances into the atmosphere.
Note that these factors are not absolute values.
If you think they do not fit into the actual situation of your business establishment, you can use factors that you think are more accurate or the values obtained through experience.

Name of substance	Classification of source	Emission factor (kg/t-quantity handled)
trichloroethylene	Manufacture	0.001
	Storage	0.23
	Solvent	979
	Cleaning	838
tetrachloroethylene	Manufacture	0.09
	Raw material	0.0003
	Storage	0.086
	Solvent	643
	Cleaning	790
dichloromethane	Manufacture	0.002
	Storage	0.26
	Solvent	336
	Cleaning	891
1,2-dichloroethane	Manufacture	0.14
	Raw material	0.048
	Storage	0.083
	Solvent	822
Vinyl chloride	Manufacture	0.06
	Raw material	0.81
acrylonitrile	Manufacture	0.006
	Raw material	0.33
	Storage	0.08
benzene	Manufacture	0
	Raw material	0.002
	Storage	0.04
	Solvent	658

(source)
reports at review meeting of source of air pollutant and revies meeting of source of air pollutant comissioned by Environment Agency in 1996

NOTE) Accuracy of the emission factor is to be further improved

4-3-2 Examples of emission factors of the gasoline in a storage tank into the atmosphere

The following table lists the examples of emission factors of gasoline in a storage tank into the atmosphere. Use those factors after converting the quantity using the vapor pressure of the specified substances stored.

Volume (kL)	**Fixed-roof tank**	
	Acceptance loss (kg/kL quantity brought in)	
—	1.0	
Volume (kL)	**Fixed-roof tank**	**Floating roof tank**
	Breathing loss (kg/number of days for reception)	**Discharge loss (kg/kL quantity delivered)**
100	14.9	0.010791
200	23.6	0.007999
300	30.9	0.006714
400	37.5	0.005929
500	43.5	0.005384
600	49.1	0.004976
700	54.4	0.004656
800	59.5	0.004395
900	64.3	0.004177
1,000	69.0	0.003991
2,000	109.5	0.002958
3,000	143.5	0.002483
4,000	173.9	0.002193
5,000	201.8	0.001991
6,000	227.8	0.001840
7,000	252.5	0.001722
8,000	276.0	0.001625
9,000	298.5	0.001545
10,000	320.3	0.001476
12,000	361.7	0.001364
14,000	400.3	0.001275
16,000	438.1	0.001205
18,000	473.9	0.001145
20,000	508.4	0.001094
22,000	541.7	0.001050
24,000	574.1	0.001011
26,000	605.6	0.000977
28,000	636.3	0.000946
30,000	666.2	0.000918
35,000	738.3	0.000859
40,000	807.0	0.000811
45,000	872.9	0.000771
50,000	936.5	0.000736

(cont'd)

Volume (kL)	Fixed-roof tank	Floating roof tank
	Breathing loss (kg/number of days for reception)	**Discharge loss (kg/kL quantity delivered)**
55,000	997.9	0.000707
65,000	1115.4	0.000658
70,000	1172.0	0.000637
75,000	1227.1	0.000618
80,000	1281.1	0.000601
85,000	1333.9	0.000586
90,000	1385.8	0.000571
95,000	1436.6	0.000558
100,000	1486.5	0.000546
120,000	1673.6	0.000505
140,000	1860.4	0.000472
	Gas station (underground tank)	
	Acceptance loss (kg/kL quantity brought in)	**Refueling loss (kg/kL quantity oil fed)**
—	1.08	1.44

(source)

Investigation in general release of hydrocarbons commissioned by Atmosphere Preservation Bureau of Environmental Agency in March 1985. (Calculated based on Report on research survey of total system of prevention of hydrocarbon vaporization in oil industry summarized by Agency of Natural Resources and Energy in March 1975.)

NOTES:

1. As for chemical substance storage facilities, convert the above value of gasoline by using the ratio of the value of gasoline vapor pressure (vapor pressure of specified substance/vapor pressure of gasoline 420 mmHg (30 ℃)).
2. Breathing loss of stationary roof tank with pressure vent shall be 1.9 times the above value (by actual measurement in Chiba Prefectural Government)
3. If vapor return facility is operated, multiply the above value by [100－recovery rate % (standard value 85% if unknown)]÷100

4-3-3 Emission factors listed in manuals of each industry

Manuals by types of industries created by industrial organizations list the emission factors, which are shown below.
Note that even if the name of the process is the same, the factors may not be applied to different industries because raw materials and materials handled or other handling conditions may be different.

Category of business		Organization Name	Page listed
a)	Gas station	Petroleum Association of Japan, Japan National Federation Petroleum Commercial Associations	III-250
b)	Automobile maintenance industry	Japan Automobile Dealers Association and others	III-251
c)	Cleaning industry	All Japan Laundry & Dry-cleaning Association	III-252
d)	Industrial cleaning industry	Japan Industrial Conference on Cleaning	III-254
e)	Painting industry	Japan Chemical Industry Association and others	III-257
f)	Electroplating industry	Federation of Electroplating Industyr Association Japan and others	III-258
g)	Fused zinc plating industry	Japan Galvanizers Association	III-259
h)	Asbestos industry	Japan Asbestos Association	III-260
i)	Cement fiber board industry	Cement Fiverboard Industries Association	III-261
j)	Valve manufacturing industry	Japan Valve Manufactures Association	III-262
k)	Optical glassware manufacturing industry	Japan Optical Glass Manufactures Association	III-264
l)	Aluminum alloy manufacturing industry	Japan Aluminum Alloy Refiners Association	III-265
m)	Pig iron casting industry	Japan Cast Iron Foundry Association and others	III-267
n)	Nonferrous metal casting industry	Japan Non-ferrous Alloy Casting Association	III-270
o)	Die casting industry	Japan Diecasting Association	III-271
p)	Paper industry	Japan Paper Association	III-272
q)	Metal thermal treatment industry	Heat Treatment Trade Association of Japan	III-273
r)	Paint manufacturing industry	Japan Paint Manufactures Association	III-274
s)	Printing ink manufacturing industry	Japan Printing Ink Makers Association	III-275
t)	Reinforced plastics manufacturing industry	Japan Reinforced Plastics Society	III-276
u)	Auto chemical manufacturing industry	Japan Auto Chemical Industry Association	III-279
v)	Fiber board manufacturing industry	Japan Fiverboard and Particleboard Manufactures Association	III-280

a) Emission factors at gas station

Content of specified substance in fuel oil (liquid) handled at gas station (Average value in the Industry)

(Unit: wt%)

	Premium Gasoline	**Regular Gasoline**	**Kerosene**	**Light Oil**
Benzene	0.51	0.64	0.01	0.00
Toluene	20.8	9.1	0.1	0.03
Xylene	8.5	6.1	1.1	0.22
Ethyl benzene	1.7	1.4	0.3	0.04
1, 3, 5-trimethylbenzene	1.1	0.9	0.7	0.13

Emission factors by specified article/specified substance at gas station

Process	**Raw material containing specified substance**	**Specified substance**	**Emission factor when the specified article or specified substance is unloaded from a tank lorry to an underground tank (at the time of acceptance)**	**Emission factor when fueling is performed from a measuring machine to a car**
Oiling	Premium gasoline	Benzene	0.0021277	0.0026793
		Toluene	0.0246417	0.0310303
		Xylene	0.0028771	0.0036231
		Ethyl benzene	0.0006483	0.0008164
		1, 3, 5-trimethylbenzen	0.0001204	0.0001516
	Regular gasoline	Benzene	0.0025759	0.0032437
		Toluene	0.0107540	0.0135421
		Xylene	0.0020498	0.0025812
		Ethyl benzene	0.0005316	0.0006694
	Kerosene	Xylene	0.0000009	0.0000009

NOTE) The foregoing factors can not be used at other than gas stations.

(Source of data) Use of the actual measurements conducted by the association of industry or the member enterprise

(Reference) Petroleum Association of Japan, Japan National Federation Petroleum Commercial Association; PRTR system and Gas station (March 2003)

b) Emission factors in automobile maintenance industry

	Process	Raw material containing specified substance	Specified substance	Emission factor			
				Atmosphere	Water area	Waste	
1	LLC recovery/filling work (removal of coolant from a radiator and filling thereof)	LLC	Ethylene glycol		0.05[1]	0.95[1]	(Waste oil)
2	Car air-conditioner maintenance work (removal of coolant from car air-conditioner and filling thereof	Coolant	CFC12	0.0036 [2] kg/cour air-conditioner			
3	Painting process	Paint, thinner	Toluene			6%[3]	(Waste paint, waste thinner)
			Xylene			3%[3]	

1) The unit is the release (transfer) to a handled quantity.

2) The unit is the release (leakage) to the number of recovered (coolant filled) air-conditioners.

3) The unit is a percentage content in the waste and waste thinner.

NOTE) The foregoing factors can not be applied to categories other than automobile chemical-article manufacturing industry.

(Source of data) Use of the actual measurements conducted by the association of industry or the member enterprise

(Reference) Japan small and Medium Enterprise Corporation; Calculation manual of chemical substance release or the like [for the industries other than the chemical industry] automobile maintenance industry, Japan Automobile Dealers Association, Japan AutoBody Repair Cooperative Associations, Japan Automobile Service Promotion Association and others (January 2001)

c) Emission factors in cleaning industry

Process	**Raw material containing specified substance**	**Specified substance**	**Emission factor (waste)**				
			Waste activated carbon 1) (%/times)	**Filter residue (L/(kg/times) times)**	**Distillation sludge (kg/kg) 3)**		
					Spin disc filter	**Diatomaceous earth filter**	**Cartridge-type filter**
1 Dry cleaning process	Dry cleaning solvent	Tetrachloroethylene	5	2	0.008	0.008	0.004
		HCFC-225, CFC-113	5	2	0.002	0.002	0.002
		Trichloroethane	5	2	0.008	0.0025	0.005
	Dry cleaning detergent 4)	Polyoxyethylenealkyl ether		2			
	Petroleum solvent	Toluene, Xylene, Ethylbenzene, 1, 3, 5-trimethylbenzene		2	0.022	0.022	0.022

1) The unit is an adsorption quantity to the weight of an activated carbon (per replacement of activated carbon)

2) The unit is a remaining quantity (volume) per cleaning load (per filter replacement)

3) The unit is a residue (mass) per annual cleaning load

4) The specified substance of dry cleaning detergent is calculated so that the total quantity equals to the transfer.

(Source of data) Waste activated carbon, filter residue: set by the association of the industry (by the actual measurement values conventionally adopted)

Distillation sludge: Tetrachloroethylene: Japan Cleaning Environmental Preservation Center, Petroleum solvent in tetrachloroethylene proper use manual: Reference value by IFI

Unit: g-release/kg-handled quantity

	Process	**Raw material containing specified substance**	**Specified substance**	**Emission factor [4)]**	
				Water area	**Waste (sludge) [5)]**
2	Laundry process	Laundry detergent	Normal chain alkylbenzenesulfonic acid and its salts	0.02	0.001
			Polyoxyethylenealkyl ether	0.02	0.001
			Polyoxyethyleneoctylphenyl ether	0.05	0.2
			Polyoxyethylenenonylphenyl ether	0.05	0.2

4) The unit is the ratio of release to the handled quantity

5) Sludge generated by activated sludge treatment

(Source of data) Water area : Environ. Toxicol. Chem. Vol.17, p1709-1710(1998)
Sludge : Wat. Res. Vol.28 No.5, p1131-1142

NOTE) The foregoing factors can not be used in industries other than cleaning industry.

(Reference) Japan Small and medium Enterprise Corporation Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Cleaning industry: Japan Cleaning Environmental Preservation Center (January 2001)

d) Emission factors in industrial cleaning industry

Process	Raw material containing specified substance	Specified substance	Percentage content in waste			Equation to calculate the transfer in a waste
			Oil/detergent percentage contents in waste oil (%)		Activated carbon adsorption quantity (kg/L)	
Degreasing washing process	Water-type detergent	2-aminoethanol, Normal chain alkylbenzenesulfonic acid and its salts or the like	Oil-soluble oil content 1)	0.7		Cleaned waste liquid quantity × (1 - oil percentage content ÷ 100) × specified substance percentage content of detergent ÷ 100
			Water-soluble oil content 1)	4.8		
	Quasi-water type detergent	Ethyleneglycolmonomethyl ether, hyleneglycolmonoethyl ether or the like	Dissolved pollutant	5.0	0.0225 3)	Cleaned waste liquid × (1 - dissolved pollutant percentage content ÷ 100) × specified substance percentage content of detergent ÷ 100＋waste rinse liquid quantity × (detergent percentage content of detergent in waste rinse liquid ÷ 100) × specified substance percentage content of detergent ÷ 100 + waste activated carbon × detergent adsorption quantity × specified substance percentage content of detergent
			Detergent in waste rinse liquid 2)	5.0		
	Chloro fluoro solvent	Dichloromwthane, Trichloroethylene, Tetrachloroethylene, HCFC-225, HFE, HFC	Dissolved oil in waste liquid of steam tank 1)	20	Saturated surface coverage × 0.1	Cleaned waste liquid × (1 - detergent percentage content in waste liquid ÷ 100)
			Dissolved oil in waste liquid of distiller 1)	50		

(cont’d)

Process	Raw material containing specified substance	Specified substance	Percentage content in waste			Equation to calculate the transfer in a waste
			Oil/detergent percentage contents in waste oil (%)		Activated carbon adsorption quantity (kg/L)	
Degreasing washing process	hydrocarbon type solvent	Toluene, Xylene, Ethylbenzene, 1, 3, 5-trimethylbenzene or the like	Detergent percentage content in waste liquid (with vacuum distillation regenerator) [2]	75 (4.5)	Saturated surface coverage × 0.1	Cleaned waste liquid × (1 - detergent percentage content in waste liquid ÷ 100) × specified substance percentage content of detergent÷100
			Detergent percentage content in waste liquid (without vacuum distillation regenerator) [2]	95 (9.0)		

1) The unit is a oil percentage content in waste oil.

2) The unit is detergent percentage content % in waste liquid (In the parenthesis of the hydrocarbon-type solvent is 1,3,5-trimethylbenzene percentage content % in the detergent in the waste liquid).

3) The unit is the detergent adsorption quantity/activated carbon) kg/L).

NOTE) The foregoing factors can be used even for a type of business other than the industrial cleaning industry if the same process is adopted.

Activated carbon adsorption quantity of specified substance in detergent

(g/kg-activated carbon)

Specified Substance	**Adsorption equilibrium concentration (ppm)**				
	10	**50**	**100**	**500**	**1000**
Dichloromethane	25	—	66	—	159
Trichloroethylene	199	—	332	—	494
Tetrachloroethylene	392	—	547	—	694
trans-1, 2-dichloroethylene	69	—	143	—	262
HCFC-141b	—	90	130	230	300
HFE	—	330	390	540	620

* The foregoing data are at 20 to 25 °C.

NOTE) The foregoing factors can be used even for a type of business other than the industrial cleaning industry if the same process is adopted.

(Source of data) Use of the actual measurements conducted by the association of the industry and its member enterprise
(Reference) Japan Small and Medium Enterprise Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Industrial cleaning industry, Japan Industrial Conference on Cleaning (January 2001)

e) Emission factors in painting industry

Unit : % (percentage content in waste)

Process	Raw material containing specified substance	Specified substance	Waste		
			Paint scum	Waste circulated liquid	
				Water washing booth	Oil booth
Painting	Paint	Solvent components (toluene, xylene or the like)	0.2	0.01	0.1

NOTE) The foregoing factors can be used for all painting processes.

(Source of data)	Set from the actually measured values
(Reference)	Japan Small and Medium Enterprise Corporation; Calculation manual if chemical substance release or the like [edited for the chemical industry] Painting process, Japan Fluid Power Association, Japan High Grade Cast Iron Association, Japan Construction Equipment Manufacturers Association, Electronic Industries Association of Japan, The shipbuilders' Association of Japan, Japan Auto Parts Industries Association, Japan Automobile Manufacturers Association, Inc., Japan Paint Manufacturers Association, Japan Industrial Painting Cooperative Federation, Japan Chemical Industry Association (January 2001)

f) Emission factors in electroplating industry

Unit: -(Transfer to handled quantity)

	Process	**Raw material containing specified substance**	**Specified substance**	**Emission factor**	
				Waste 1)	
1	(Chromium (VI) compound) decorative chromium plating hard chromium plating Chromate treatment	Plating liquid Chromate liquid	Chrome and chromium (III) compound 2)	0.3	(Sludge)
2	(Chromium (III) compound) decorative chromium plating hard chromium plating Chromate treatment	Plating liquid Chromate liquid	Chrome and chromium (III) compound		
3	Electrolytic nickel and nickel alloy plating Electroless nickel plating	Plating liquid Nickel cathode	Nickel compound (Nickel sulfate, nickel chloride, nickel sulfamate)		
4	Lead plating Lead alloy plating	Plating liquid Lead/lead alloy cathode	Lead and its compounds (lead fluoroborate, sulfonic acid-strain lead compounds)		

1) The value can be used only if a coagulating sedimentation device is installed as a waste water clarification device.

2) A plating liquid/chromate liquid containing chromic acid anhydride and sodium dichromate are used. However, as they are existent in the form of chromium (III) compound in the sludge, calculate the quantity of chromium and chromium (III) compound in waste by multiplying the value converted into the quantity of chrome by the factor.

NOTE) The foregoing factors can not be used in a type of business other than electroplating industry.

(Source of data) Use of the actual measurements conducted by the association of the industry and a member enterprise
(Reference) Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Electroplating industry, Federation of Electro Plating Industry Association, Japan (revised in April 2002)

g) Emission factors in fused zinc plating industry

	Process	Raw material containing specified substance	Specified substance	Emission factor							Remarks
				Atmosphere			Waste $^{3)}$				
				Emission from a local emission 1)	Emission from a liquid surface 1)	Emission from a dust collecting device 2)	Dross	Dust	Collected dust	Sludge	
1	Flux treatment process	Flux agent	Water-soluble compounds of zinc (zinc chloride)	1 mg/Nm^3	1 mg/Nm^3	0.034%		0.12%	0.034%	0.004%	
2	Fused zinc plating process	Pig lead	Lead and its compounds			2.46%	0.98%	4.51%	2.46%	0.14%	Big article-plating factory
							1.00%	5.55%	3.33%	0.22%	Small article-plating factory
3	Pickling process	Acid for cleaning	hydrogen fluoride and its water-soluble salts (hydrofluoric acid)	0.8 cm^3/Nm^3	0.3 cm^3/Nm^3						

1) The unit is the concentration in the exhaust gas.

2) The unit is the composition of the collected dust which is not scavenged by the dust collecting device and is exhausted outside.

3) The unit is the percentage content in the waste.

(Source of data) The local emission of the water-soluble compound of zinc and its emission from a liquid surface: the recommended value of the allowable concentration of zinc chloride in the working environment of ACGIH
Other than the foregoing: The arithmetic average of the measured values conducted by the several member enterprises in the association of the industry

(Reference) Japan Small and medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Fused zinc plating industry, Japan Galvanizers Association (January 2001)

h) Emission factors in asbestos industry

Process	**Raw material containing specified substance**	**Specified substance**	**Emission factor**		
			The atmosphere [1)]		**Waste** [2)]
			In case of a dust collector with a bag opening and blending	**In case of dust collectors other than the dust collector with a bag opening and blending**	**(Remaining quantity to be disposed of in the raw asbestos bag)**
Manufacturing process of asbestos-contained article	Raw asbestos	Asbestos	0.001 mg/Nm^3	0.002 mg/Nm^3	0.008 g/kg

1) The unit is the concentration in the exhaust gas.

2) The unit is the quantity of the asbesto residue/handled quantity
(the residue asbestos of 0.4 g/raw asbestos bag of 50 kg)

(Source of data)	Experiment results conducted by the association of the industry
(Reference)	Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Asbesto industry, Japan Asbestos Association (January 2001)

i) Emission factors in cement fiber board industry

	Process	**Raw material containing specified substance**	**Specified substance**	**Emission factor**			
				The atmosphere 1)		**Waste 2)**	
				In case of a dust collector with a bag opening and blending	**In case of dust collectors other than the dust collector with a bag opening and blending**	**(Remaining quantity to be disposed of in the raw asbestos bag)**	**Sludge**
1	Manufacturing process of asbestos-contained article	Raw asbesto	Asbestos	0.001 mg/Nm3	0.002 mg/Nm3	0.008 g/kg 2)	0.15 –3)
2	Laminate process	Adhesive	Toluene, Xylene, n-butyl=benzyl phthalate, di-n-butyl phthalate, di-n-octyl phtalate			12 g/kg 4)	

1) The unit is the concentration in the exhaust gas.

2) The unit is the remaining quantity of asbestos/handled quantity (asbestos quantity of 0.4 g/raw asbestos bag of 50 kg).

3) The ratio of the asbestos percentage content in the sludge to the asbestos percentage content in the raw material

4) The unit is the remaining quantity of the adhesive/handled quantity (adhesive quantity of 240 g/adhesive container of 20 kg).

NOTE) The foregoing factors can not be used in the industries other than the cement fiber board industry.

(Source of data) The remaining quantities of the asbestos in the sludge and of the adhesive components in the container; according to the actual measurements conducted by the member establishment in the industrial association

(Reference) Data other than the foregoing; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Cement fiber board industry, Cement Fiber Board Industrial Association (January 2001)

j) Emission factors in valve manufacturing industry

Unit: - (Release/handled quantity)

	Process	**Raw material containing specified substance**		**Specified substance**	**Emission factor or the like**	
					The atmosphere	**Water area**
1	Dissolution process	Raw material	Bronze casting material	Selenium and its compounds (metal selenium)	0.001	0
				Lead and its compounds (metal lead)	0.001	0
			Brass casting material	Lead and its compounds (metal lead)	0.00005	0
			Iron casting material	Manganese and its compounds (metal manganese)	0.0001	0
				Chromium and its compounds (metal chromium)	0.0001	0
				Molybdenum and its compounds (metal molybdenum)	0.0001	0
				Nickel	0.0001	0
2	Casting process	Bond of casting/ core sand (phenol resin, furan resin)		Acetaldehyde	0.005	0
				Formaldehyde	0.005	0
				Xylene	0.005	0
				Phenol	0.005	0
3	Degreasing/ washing process	Degreasing/ washing agent		Dichloromethane	0.8	0
4	Plating process 1)	Plating liquid	Chromium plating	Chromium (VI) compound	0	0
				Chromium and chromium (III) compound	0	0.001
				Boron and its compounds	0	0.004
			Nickel plating	Nickel compounds	0	0.0006
			Copper plating	Water-soluble copper salts	0	0.0006
5	Assembling process 2)	Adhesive solvent		Toluene	1	0
6	Painting process 3)	Painting solvent		Toluene	1	0
				Xylene	0.7	0

1) Since the release of the plating treatment liquid to the air is almost zero, 0 is assumed for air emission factor. If the waste liquid containing hexavalent chromium compound is reduced and the coagulating sedimentation of the compound is performed, calculate the quantity separately from those of hexavalent chromium compound since chromium compounds other than hexavalent chromium compounds are generated as sludge.

2) Since the release of toluene to water area and transfer of toluene to waste are almost zero, 0 is assumed as the emission factor to water and waste emission factor.

3) Since the releases of toluene and xylene to the water area are almost zero, 0 is assumed as the emission factor to water.

NOTE) The foregoing factors can not be used in the industries other than the valve manufacturing industry.

(Source of data) Findings by the association of the industry (December 2000)
(Reference) Japan small and Medium Enterprises Corporation; Calculation manual of chemical substance or the like [edited for the industries other than the chemical industry] Valve manufacturing industry, Japan Valve Manufacturers Association (January 2001)

k) Emission factors in optical glassware manufacturing industry

Unit: % (release/handled quantity)

Process	Raw material containing specified substance	Specified substance	Emission factor※				
			Air	Water	Waste		
					Collected dust	Wastewater-treated sludge	Waste liquid
1 Blending process + dissolution process	Raw material (optical glass)	Arsenic and its compounds, hydrogen fluoride and its water-soluble salts	0.21	0.0075	0.66	0.0425	
		Boron and its compounds	0.14	0.0075	0.73	0.0425	
		Lead and its compounds	0.07	0.0005	0.80	0.0495	
		Antimony and its compounds	0.07	0.0075	0.80	0.0425	
		Other specified substances	0.07	0.0025	0.80	0.0475	
2 Grinding/ polishing		Compounds of metals or the like (other than lead and its compounds)		0.0025		0.0975	3～5
		Lead and its compounds		0.0005		0.0995	

* The above emission factor to air applies only when a dust collector is installed and that to the water applies when a wastewater purification equipment is installed.

NOTE) The foregoing factors can be used even in the industries other than the optical glass article manufacturing industry if the same kind of process is adopted.

(Source of data) According to the actual measurements conducted by the association of the industry or its member enterprise (Values in experiences based on the actually measured values)

(Reference) Japan Optical Glass Manufacturers Association; Calculation manual of PRTR release/transfer as applied to optical glass raw materials (January 2002)

l) Emission factors in aluminum alloy manufacturing industry

Unit: g-Release/kg-handled quantity

Process	**Specified substance**	**Raw material used**	**Manufactured article**	**Emission factor**		
				Air 1)	**Waste**	
					Dust 2)	**Dross 3)**
Dissolution process	Antimony and its compounds	Metal antimony ingot	Aluminum-10% antimony	0.001	0	30
	Chromium and chromium (III) compound	Metal chromium piece	Aluminum-5% chromium	0	0.0006	15
	Nickel	Metal nickel plate 4)	AC8A.2	0	0	3.5
		Metal nickel piece 5)	AC8A.2	-	0.005	11
	Beryllium and its compound	Aluminum-2.5% beryllium ingot	AC7A.1	0	0 9)	0
	Boron and its compound	KBF_4 powder	Aluminum-4% boron	0.08	0.002	3.5
	Manganese and its compound	Metal manganese piece 6)	Aluminum-10% manganese	0	0.03	15
		Aluminum-10% manganese ingot 7)	AD3.1	-	0.08	16
		Aluminum can (UBC) 8)	Can Source metal (RSI)	0.63	0.20	77

1) When a bag filter-type dust collector is installed.

2) A pattern may vary depending on the surface condition of a material used and an addition method.

3) Varies depending on the quantity of dross generated and the content of aluminum alloy in the dross.

4) Example of raw material; Metal nickel plate, aluminum-nickel ingot

5) Example of raw material; Metal nickel piece

6) Example of raw material; Metal manganese piece

7) Example of raw material; Aluminum-manganese ingot

8) Manganese in the raw material (Referential data)

9) Dross is not generated after an aluminum-beryllium ingot is added.

NOTE) The foregoing factors can be used even in the industries other than the aluminum alloy manufacturing industry if the same kind of process is adopted.

(Source of data)	Results of the actual measurements conducted by the association of the industry (November to December 2000 to November to December 2001)
(Reference)	Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Aluminum alloy manufacturing industry, Japan Aluminum Alloy Refiners Association (revised in May 2002)

m) Emission factors in pig iron casting industry

Unit: - (Release/handled quantity)

	Process	**Raw material containing specified substance**	**Specified substance**	**Emission factor**				
				Finished article		**Air**	**Waste**	
				Cupola dissolution	**Induction furnace dissolution**		**Cupola dissolution**	**Induction furnace dissolution**
1	Dissolution	Preparation agent	Manganese and its compounds (manganese)	80	98	0	20	2
			Chromium and chromium (III) compound (chromium)	85	98	0	15	2
			Molybdenum and its compounds	95	100	0	5	0
		Spheroidizing agent	Nickel	100	100	0	0	0
		Inoculant	Barium and its compounds (barium)	0	0	0	100	100

NOTE) Since barium is used for forging process, the same factor applies both for cupola dissolution and induction furnace dissolution. Since the substance is floated as an oxide first, settled, becomes deposited dust, and then released as waste in any cases, 0 is assumed as air emission factor.

(cont'd)

Process	Raw material containing specified substance	Specified substance	Emission factor		
			Finished article	The atmosphere	Waste
2 Casting process	Resin bond	Phenol	0	0	0
	Resin hardener	1,3,5-trimethylbenzene	0	100	0

NOTE) Since the phenol contained in phenol resin and the bond of the cold box is almost converted into urethane resin by hardening reaction, the remaining quantity is considered very little and 0 is assumed as the emission factor of the substance to be discharged as a waste.

Since 1,3,5-trimethylbenzene contained in phenol resin and the hardener of the cold box is used as a solvent, 100 is assumed as the air emission factor.

(cont’d)

Process	Raw material containing specified substance	Specified substance	Painting method	Emission factor						
				Finished article			Air	Waste		
				Big article	Middle article	Small article		Big article	Middle article	Small article
3 Painting process	Solvent	Toluene, Xylene		0	0	0	100	0	0	0
	Paint	Ethyleneglycolmono ethylether acetate, Chromium and chromium (III) compound, Lead and its compounds	Dipping painting	—	80	80	0	—	20	20
			Spray painting (air gun)	40	35	30	0	60	65	70
			Spray painting (airless gun)	60	55	50	0	40	45	50
			Air electrostatic painting	—	60	50	0	—	40	50
			Airless electrostatic painting	—	70	65	0	—	30	35

* Example of big casting	;	Bed of machine tool, Frame of printing press, Vessel engine
Example of middle casting	;	Engine parts for automobile, transmission case, hydraulic valve
Example of small casting	;	Cast article for electric appliance, joint parts or the like

NOTE) The foregoing factors can not be used in the industries other than the pig iron casting industry.

(Source of data)	According to the actual measurements conducted by the association of the industry
(Reference)	Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Japan Cast Iron Foundry Association, Japan Malleable Cast Iron Association, Japan High Grade Cast Iron Association (January 2001)

n) Emission factors in nonferrous metal casting industry

Unit: - (Content in waste/content in raw material)

Process	**Raw material containing specified substance**		**Specified substance**	**Waste factor**	
				Slag	**Dust**
Dissolution process	Casting material	Bronze casting or the like	Lead and its compounds (metal lead)	0.3	0.6
		Aluminum-bronze casting	Nickel	0.8	0.4
			Manganese and its compounds (metal manganese)	0.9	0.7
		High strength brass casting or the like		1.0	0.2

(Source of data)	Analytical results by average factories
(Reference)	Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Nonferrous metal casting industry, Japan Nonferrous Metal Casting Association (January 2001)

o) Emission factors in die casting industry

Process	Raw material containing specified substance	Specified substance	Molten alloy	Emission factor	
				The atmosphere 1)	Waste (Slag) 2)
Dissolution/ holding furnace	Source metal component	Beryllium and its compounds (metal beryllium)	Zinc alloy	0.0063	6.5
	Flux component	Water-soluble compounds of zinc (zinc chloride)	Zinc alloy	0.55	
		Hydrogen fluoride and its water-soluble salts (hydrogen fluoride)	Aluminum alloy (Reverberatory furnace)	0.02	
			Aluminum alloy (Crucible furnace)	0.0015	

1) The unit is the ratio of release to handled quantity.

2) The unit is the ratio of the beryllium concentration in the slag to that of the molten Source metal of beryllium.

NOTE) The foregoing factors can not be used in the industries other than the die casting industry.

(Source of data)
Set from the actually measured values conducted by the association of the industry.
(Reference)
Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Die casting industry, Japan Die Casting Association (January 2001)

p) Emission factors in paper industry

Unit: % (release or the like/handled quantity)

	Process	Raw material containing specified substance	Specified substance	Emission factor			
				Air	Water	Removed and treated quantity by wastewater treatment (activated sludge)	Generated quantity (handled quantity)
1	Kraft pulp bleaching process 1)	(By-product)	Chloroform	75	7.5	17.5	[87.8 × chlorine addition rate (%) – 92.7] + [401 × hypo addition rate (%) –15] 2)
2	Paper/ painting process	Antiseptic agent, solvent of slime controlling agent	N, N-dimethylformaldehyde	0.5	95.1	4.4	

1) When a cleaning tower is installed before the wastewater treatment process

2) The unit is g-generated quantity/t-pulp treated quantity.

NOTE) The foregoing factors can not be used in the industries other than the paper industry.

(Source of data)

Generated quantity of chloroform; Trade journal of Japan Technical Association of the Pulp and Paper Industry 53 (10) 998 to 104 (1999)

Removal and treatment efficiency of activated sludge by N,N-dimethylformaldehyde; List of existing chemical substance safety data pursuant to Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances published by Japan Chemical Industry Ecology-Toxicology & Information Center (1992)

Other than the foregoing; According to the actually measured values conducted by the association of the industry or its member enterprise

(Reference)

Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Paper industry, Japan Paper Association (January 2001)

q) Emission factors in metal thermal treatment industry

Process	**Raw material containing specified substance**	**Specified substance**	**Content of chlorinated organic solvent in waste oil (－)**	
			With a solvent recovery device	**Without a solvent recovery device**
Degreasing/ steam washing process	Degreasing/washing agent	Dichloromethane Tetrachloroethylene Trichloroethylene	0.40	0.75

NOTE) The foregoing factors can be used even in the industries other than the metal thermal treatment industry if the same kind of process is adopted.

(Source of data)

Japan Small and Medium Enterprises Corporation; Achievement manual of self-managed plan on chlorinated organic solvent in metal washing

(Reference)

Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for the industries other than the chemical industry] Metal thermal treatment industry, Nihonkinzokunetsushorikougyoukai (January 2001)

r) Emission factors or the like in paint manufacturing industry

Unit: % (release/handled quantity)

Process	**Raw material containing specified substance**	**Specified substance**	**Air emission factor**	
			Closed equipment	**Open equipment**
Manufacture of paint	Raw material of paint	Toluene and equivalent	0.8	1.1
		Xylenes, styrene, ethylbenzene or the like	0.5	0.7
		Ethanol amine, Ethylcellosolve or the like	0.2	0.4

NOTE) The foregoing factors can not be used in the industries other than the paint manufacturing industry.

(Source of data)

According to the actually measured data and the experimental data taken by the member enterprise in the association of the industry

(Reference)

Japan Paint Manufacturers Association; Estimation manual of release from manufacturing process – Coping with PRTR Law by paint manufacturing works- (May in 2001)

s) Distribution rate in printing ink manufacturing industry

Process	**Components of raw material of printing ink**		**Distribution rate (%)**[1]					
		(Conditions such as boiling point of specified substance)	**Air emission**			**Transfer (in waste)**		
			Open system or a small lot	Central value	Closed system or a big lot	Open system or a small lot	Central value	Closed system or a big lot
Manufacture of printing ink	Solvent	Boiling point 120 °C or less	55	45	35	45	55	65
		121 to 190 °C	45	35	25	55	65	75
		191 to 260 °C	35	25	15	65	75	85
		261 °C or higher	15	10	5	85	90	95
	Solid (Powder)	With a dust collector	0			100		
		Without a dust collector	10			90		

1) The factor is used for dividing the sum of release and transfer, which is calculated using the handled quantity and the yield of the finished article (Sum of release and transfer = handled quantity x (1 – yield)), into the release (to air) and the transfer (in waste).

NOTE) The foregoing factor can not be used in the industries other than the printing ink manufacturing industry.

(Source of data) According the findings of the questionaire conducted to the member enterprises in the association of the printing ink manufacturing industry

(Reference) Printing Ink Manufacturers Association; Imposition of obligation on member enterprises to implement PRTR and provide MSDS – its outline and manual – (April 2001)

t) Emission factors in reinforced plastics manufacturing industry

Separate Table 1: Emission factor of styrene monomer contained in the resin for lamination and the gel coat to the atmosphere in open-mold molding (A series) process
(The quantity of styrene monomer emitted per the resin used or the gel coat of 1 ton is indicated in kg)

Unit: Styrene monomer kg/resin for lamination or gel coat of 1 ton

Content of styrene monomer in resin for lamination or gel coat (wt%) 1)			25	30	35	40	45	50	55
Lamination by manual work		Resin of conventional type	28	34	42	55	68	81	94
		Resin of low-vaporization type 2)	21	23	26	28	30	32	37
Lamination mainly conducted by machine	Spray method where an exhaust gas treatment equipment is not installed	Resin of conventional type	38	46	63	95	127	159	191
		Resin of low-vaporization type 2)	23	28	39	58	79	99	119
	Spray method where an exhaust gas treatment equipment is not installed 3)	Resin of conventional type	29	35	49	73	98	123	147
		Resin of low-vaporization type 2)	18	22	30	45	60	76	91
	If a resin is impregnated so as not to allow the same to be atomized from a short distance 4)	Resin of conventional type	24	29	35	42	49	56	63
		Resin of low-vaporization type 2)	15	19	21	26	31	35	39
Filament winding molding method 8)		Resin of conventional type	41	50	60	72	85	97	109
		Resin of low-vaporization type 2)	27	32	39	47	55	63	71
Spraying and hardening of gel coat	if an exhaust gas treatment equipment is not installed		100	120	151	198	244	291	338
	if an exhaust gas treatment equipment is installed 3)		73	88	110	144	178	206	246
	Spraying which is not atomized, spraying with a brush or the like 7)		56	76	96	117	137	158	178
When hardening is performed by covering an sprayed area with a sheet after an impregnation process is completed			Vaporization coefficient of the resin of a conventional type × 0.80 or 0.85 5)						
When hardening is performed by covering an sprayed area with a sheet without an impregnation process			Vaporization coefficient of the resin of a conventional type × 0.50 or 0.55 6)						

1) The content of this styrene monomer is a numerical value in which the component of styrene later added by a molder is also contained. However, for the other additives such as powder, filler and glass, each numerical value is a value before an additive is added. If a seasonal type is furnished for the resin for lamination or the gel coat (if the content of styrene varies), make calculations assuming that the spring/fall type is used for the year.

2) The resin of low-vaporization type is of a resin containing paraffin and a low-odor resin. Other than the foregoing are regarded as conventional type resins.

3) It is common to both the resin for lamination and the gel coat. However, note that the difference between a case that the exhaust gas treatment equipment is installed and that the equipment is not installed is included in the transfer. For example, if it is of the resin for lamination, a conventional-type resin is used and the content of styrene monomer is 40 wt%, (95 to 73) kg/ton is calculated as the transfer.

4) An airless resin spray (provided that the material is not atomized) is assumed.

5) Adopt the numerical value of 0.80 in the case of the lamination made by a manual working and that of 0.85 in the case of the lamination mainly prepared by a machine

6) Adopt the numerical value of 0.50 in the case of the lamination made by a manual working and that of 0.55 in the case of the lamination mainly prepared by a machine

7) Refer to EECS report (dated July 17, 2001) entitled “Emission Factors for Non-Atomized Application of Gel Coats used in the Open Molding of Composites” for details of the gel coat spray test in which the material is not atomized. EECS: Engineering Environmental Consulting Services

8) The emission factor data in the filament winding molding method is based on the data of “Dow Filament Winding Emission Study”.

Separate Table 2: Emission factors of methyl methacrylate to the atmosphere in the gel coat spray and hardening process (A series)

Content of methyl methacrylate in gel coat (wt%) [1]	1	5	10	15	20
Quantity of methyl methacrylate emitted to the atmosphere from gel coat of 1 ton (kg)	6.75	33.75	67.5	101.25	135

1) The content of methyl methacrylate monomer is a numerical value in which the component of methyl methacrylate monomer later added by a molder. However, for the other additives such as powder, filler and glass, the numerical value is a value before an additive is added.
As the content of methyl methacrylate is indicated in wt%, the content is calculated as [wt% / 100] in a calculation formula.
If the content indicates intermediate values of each described numerical values, it is desirable that the emission factor is calculated by a proportional allotment.

NOTE) The foregoing factors can not be used in the industries other than the reinforced plastics manufacturing industry.

(Source of data)
Emission factors based on the investigations of the following reference
Name of Reference: Composites Fabricators Association dated July 23, 2001
(Reference)
Japan Small and Medium Enterprises Corporation, Calculation manual of chemical substance release or the like [edited for chemical industry] Reinforced plastics manufacturing industry, The Japan Reinforced Plastics Society (January 2001 (to be revised around January 2003)

u) Emission factors in auto chemical manufacturing industry

	Process	Raw material containing specified substance	Specified substance	Emission transfer factor [1)]
1	Tank lorry outlet and hose connection section, leaked quantity from tank inlet	Raw material of auto chemical finished article, Finished article	Ethylene glycol or the like	40 g/times
2	Remaining quantity of sodium molybdate in a bag		Sodium molybdate	2 g/bag
3	Adsorbed quantity to waste cloth		Ethylene glycol or the like	95 g/sheet
4	Remaining quantity in tank lorry		Ethylene glycol or the like	10 kg/tank lorry
5	Remaining liquids in finished article/raw material tanks		Ethylene glycol or the like	0.1 vol%

1) When the material is washed away: the emission to a water area
When the materials are collected and are handed over to a disposal company: transfer

NOTE) The foregoing factor can not be used in the industries other than the auto chemical article manufacturing industry.

(Source data)
According to the actual measurements conducted by the member enterprises in the association of the industry
(Reference)
Japan Small and Medium Enterprises Corporation; Calculation manual of chemical substance release or the like [edited for chemical industry] Auto chemical article manufacturing industry, Japan Auto Chemical Industry Association (January 2001)

v) Emission factors in fiber board manufacturing industry

Unit: －

Process	**Raw material containing specified substance**	**Specified substance**	**Reduction due to reaction and capture**
Manufacture of fiber board (bonded)	Adhesive	Formaldehyde	0.4

(Source of data)

Set based on the theoretical values

(Reference)

Japan Fiber Board Manufacturers Association; [Report on formaldehyde] Description Manual (April in 2001)

4-3-4 Painting method and painting adhesion efficiency

Use the following painting adhesion efficiencies to calculate the releases to the finished articles such as pigments in painting process.

		Flat plate	**Beverage can**		**Large size pipe**	**Aluminum building material**	**Car**		**Electric appliance**	**Wood construction material**	**Construction machinery, rolling stock**
			Internal surface	External surface			Top coat	Interior			
Air spray		40～50%	50～60%	20～30%	—	20～30%	20～30%	40～50%	30～40%	40～50%	50～60%
Low pressure air spray		50～60%	60～70%	30～40%	—	30～40%	—	50～60%	40～50%	50～60%	50～60%
Airless spray		60～70%	80～90%	60～70%	70～80%	40～50%	—	—	—	60～70%	60～70%
Air airless spray		65～75%	80～90%	60～70%	75～85%	40～50%	—	—	—	65～75%	65～75%
Electrostatic painting	Air	60～70%	—	60～70%	—	60～70%	40～50%	70～80%	60～70%	60～70%	65～75%
	Airless	70～80%	—	80～90%	—	65～75%	—	—	—	70～80%	70～80%
	Bell	80～90%	—	—	—	75～85%	60～70%	—	70～80%	80～85%	80～90%
	Disk	—	—	—	—	—	—	—	—	—	—

(direct measurement by painting makers)

4-3-5 Current efficiency and electrochemical equivalent of metal precipitated in plating process

To calculate the quantity released as a finished product in a plating process, use the following current efficiencies and electrochemical equivalents.

Metal deposited	Metal plating liquid	Current coefficient (%)	Electrochemical equivalent (g/A･time)
Zinc	Acid plating liquid	95	1.220
	Alkaline plating liquid	90	1.220
Cadmium	Alkaline plating liquid	95	2.097
Silver	Alkaline plating liquid	100	4.026
Chromium	Chrome acid plating liquid	13	0.323
Copper	Acid plating liquid	95	1.185
	Alkaline plating liquid	60	1.185
Lead	Fluoroboric acid plating liquid	100	3.866
Nickel	Acid plating liquid	90	1.095

(source： Junior class plating authored by Kiyoshi Maruyama, published by Nikkan Kogyo Shimbun in 1995)

4-3-6 Rejection rate and decomposition rate in representative exhaust gas device and wastewater treatment device

Your can use the values in the following table as the general values if the removal rate or the decomposition rate can not be obtained by the actual measurements or by referring to the information of similar cases with regard to the exhaust gas device and the wastewater treatment device.
As the data such as the removal rate varies with a range from the minimum to the maximum due to the factors such as the physical conditions of a substance to be removed as shown in the table, use the values which are considered to be closer of the actual conditions of an establishment.
In addition, if these values are considered not to match with the actual conditions of the establishment, use the values which are considered to be more accurate by contacting a device manufacturer or using the values obtained through experiences.

Removal efficiency and decomposition rate (%) of exhaust gas treatment device

Treatment device		**Substance to be treated**					
		Dust particles		**Gaseous organic compound**		**Gaseous inorganic compound**	
		Removal efficiency	Decompo-sition rate	Removal efficiency	Decompo-sition rate	Removal efficiency	Decompo-sition rate
Cyclone	Representative value	60	0	0	0	0	0
	Minimum to maximum	60 - 90	0	-	-	-	-
	Factor taking up minimum to maximum	Particle size		-	-	-	-
Bag filter	Representative value	95	0	0	0	0	0
	Minimum to maximum	90 - 99.9	0	-	-	-	-
	Factor taking up minimum to maximum	Particle size		-	-	-	-
Electric dust collector	Representative value	90	0	0	0	0	0
	Minimum to maximum	90 - 99	0	-	-	-	-
	Factor taking up minimum to maximum	Particle size		-	-	-	-
Combustion equipment	Representative value	0	0	99.5	99.5	0	0
	Minimum to maximum	-	-	95 - 99.5	95 - 99.5	-	-
	Factor taking up minimum to maximum	-	-	Combustibility of substance		-	-

(cont'd)

Treatment device		**Substance to be treated**					
		Dust particles		**Gaseous organic compound**		**Gaseous inorganic compound**	
		Removal efficiency	Decomposition rate	Removal efficiency	Decomposition rate	Removal efficiency	Decomposition rate
Absorber a) (scrubber)	Representative value	80	0	0	0	93	93
	Minimum to maximum	60 - 99	0	20 - 99※	0	80 - 99	80 - 99
	Factor taking up minimum to maximum	Particle size		* Limiting to water-soluble substances		Reactivity with acid/alkali	
Activated carbon adsorber	Representative value	10	0	87	0	50	
	Minimum to maximum	0 - 30	0	30 - 99	0	20 - 99	
	Factor taking up minimum to maximum	Concentration and degree of adsorption of substance					

(Set according to the results of the questionaire conducted to the exhaust gas treatment device manufacturer in 2001)

a) absorver using acid or alkaline solution

The difference between the removal efficiency and the decomposition rate becomes equal to the quantity of waste such as collected ash or spent carbon.

Removal efficiency and decomposition rate (%) of exhaust water treatment device

Treatment device		Substance to be treated							
		Suspended b) inorganic compounds		**Suspended b) organic compuonds**		**Soluble c) inorganic compounds**		**Soluble c) organic compunds**	
		Removal efficiency	Decomposition rate	Removal efficiency	Decomposition rate	Removal efficiency	Decomposition rate	Removal efficiency	Decomposition rate
General precipitation	Representative value	40	0	20	0	0	0	0	0
	Minimum to maximum	40 - 50	—	20 - 50	—	—	—	—	—
	Factor taking up minimum to maximum	Particle size of suspended substance				—	—	—	—
Coagulating sedimentation	Representative value	80	0	70	0	0	0	0	0
	Minimum to maximum	66 - 95	—	90 - 95	—	0 - 10	—	0 - 10	—
	Factor taking up minimum to maximum	Particle size of suspended substance				Kind of coagulant			
Microbial decomposing a)	Representative value	70	0	70	30	0	0	60	40
	Minimum to maximum	70 - 80	0	70 - 80	30	—	—	60 - 95	40 - 70
	Factor taking up minimum to maximum	Adsorptive property to sludge				—	—	Decomposability of substance	

(cont'd)

Treatment device		**Substance to be treated**							
		Suspended b) inorganic compounds		**Suspended b) organic compuonds**		**Soluble c) inorganic compounds**		**Soluble c) organic compunds**	
		Removal efficiency	Decomposition rate	Removal efficiency	Decomposition rate	Removal efficiency	Decomposition rate	Removal efficiency	Decomposition rate
Membrane filter	Representative value	100	0	100	0	0	0	0	0
	Minimum to maximum	—	—	—	—	70 - 98*	0	90 - 95*	0
	Factor taking up minimum to maximum	—	—	—	—	* In case of reverse osmosis membrane (RO)			
Actibated carbon adsorber	Representative value	10	0	10	0	20	0	80	0
	Minimum to maximum	0 - 10	0	0 - 10	0	0 - 20	0	80 - 90	0
	Factor taking up minimum to maximum	Adsorptive property of substance							

(Set according to the results of the questionaire conducted to the exhaust gas treatment device manufacturer in 2001)

a) These are the values obtained for rather persistent substances when they are treated by devices using aerobic microbes such as those to which activated sludge method, submerged biofilter method, biological contact aeration method, and rotary disc method are adopted.

b) "Suspended" (inorganic or organic compound) means that the specified substance exists in the form of particles in effluent.

c) "Soluble" (inorganic or organic compound) means that the specified substance dissolved in effluent.
The difference between the removal efficiency and the decomposition rate becomes equal to the quantity of waste.

Calculate the releases after exhaust gas or water treatment by using the removal efficiency as shown below.

$$\text{Released quantity after exhaust gas or water treatment} = \text{Released quantity before exhaust gas or water treatment} \times (100 - \text{Removal efficiency of exhaust gas or water treatment}) \div 100$$

Calculate the quantity in waste such as spent activated carbon generated by exhaust gas or water treatment by using the removal efficiency and the decomposition rate as shown below.

$$\text{Quantity contained in waste by exhaust gas or water treatment} = \text{Released quantity before exhaust gas or water treatment} \times (\text{Removal efficiency of exhaust gas or water treatment} - \text{Decomposition rate of exhaust gas or water treatment})$$

When it is considered that the specified substance treated by an absorber is released in the form of effluent, the quantity in waste generated by exhaust gas treatment calculated in the above formula becomes equal to the release to water.
If it is considered that the specified substance treated by activated sludge process is released to air by aeration, the quantity in waste from effluent treatment calculated by using the above formula becomes equal to the air emission.

When the substance is treated by two kinds of treatment devices connected in series, calculate the overall removal efficiency R by using the removal efficiency of the first device R1 and that of the second devece R2 as shown below.

$$R = R1 + (1 - R1) \times R2 = R1 + R2 - R1 \times R2$$

When three kinds of treatment devices connected in series, calculate the overall removal efficiency R by using the following formula in the same way.

$$R = R1 + R2 + R3 - R1 \times R2 - R1 \times R3 - R2 \times R3 + R1 \times R2 \times R3$$

4-3-7 Guideline to judge to which medium, air or water, larger quantity is released

Use Henry's constant in the following table to judge to which medium, air or water, larger quantity is emitted. The bigger Henry constant is, the more likely that larger quantity is released to air.

Liable to be released to water ↔ Leable to be released to air				
$H \leqq 0.025$	$0.025 < H < 6.2$	$6.2 \leqq H \leqq 99$	$99 < H < 2.5 \times 10^4$	$2.5 \times 10^4 \leqq H$
example: nitroglycerin	example: nitrobenzene, hydroquinone, nonylphenol, hydrazine, phenol	example: vinyl acetate, acrylonitrile	example: 1,3-butadinene, 2-ethylhexyl methacrylate, toluene, benzene, p-dichlorobenzene	example: CFC-115, HCFC-133

(prepared by Review Committee on Calculation of Release under PRTR System)

(NOTE)

① Refer to this table if an empirical judgment may not be performed.

② H is Henry's constant ($Pa \cdot m^3/mol$)

(= vapor pressure (Pa) × molecular weight (g/mol) ÷ water solubility (g/m^3 = mg/L))

Vapor pressure and water solubility at about 25 °C are normally used. See 4-2-6 (→ pIII-227). If a temperature is set in the process handled, use that value.

③ If a substance does not get in contact with water, all the quantity is regarded as air emission.

4-3-8 Major unit conversion table

Use the following unit conversion tables as required to calculated the release, etc.

a) Length

① Unit before converted	② Unit after converted	③ Coefficient which converts the unit in item ① into that in item ②	Examples of application
cm	m	0.01 (10^{-2})	5cm=5×0.01=0.05m
mm		0.001 (10^{-3})	12mm=12×0.001=0.012m
μm		0.000001 (10^{-6})	52 μm=52×10^{-6} =5.2×10^{-5}m(0.000052m)
km		1,000 (10^{3})	12km=12×1,000=12,000m

To convert the value in the unit in ① to that in the unit in ②, multiply the value in the unit in ① by the coefficient in ③. To convert the value in the unit in ② to that in the unit in ①, divide the value in the unit in ② by the coefficient in ③.

b) Area

① Unit before converted	② Unit after converted	③ Coefficient which converts the unit in item ① into that in item ②	Examples of application
cm^2	m^2	0.0001 (10^{-4})	150cm^2=150×0.0001=0.015m^2
mm^2		0.000001 (10^{-6})	230mm^2=230×10^{-6} =2.3×$10^{-4}$$m^2$(0.00023$m^2$)
km^2		1,000,000 (10^{6})	2.4km^2=2.4×10^{6} =2.4×$10^{6}$$m^2$(2,400,000$m^2$)

To convert the value in the unit in ① to that in the unit in ②, multiply the value in the unit in ① by the coefficient in ③. To convert the value in the unit in ② to that in the unit in ①, divide the value in the unit in ② by the coefficient in ③.

c) Volume

① **Unit before converted**	② **Unit after converted**	③ **Coefficient which converts the unit in item ① into that in item ②**	**Examples of application**
cm^3	m^3	0.000001 (10^{-6})	270cm^3=$270\times10^{-6}=2.7\times10^{-4}$m^3 (0.0027m^3)
mL			270mL=$270\times10^{-6}=2.7\times10^{-4}$m^3 (0.0027m^3)
cc			270cc=$270\times10^{-6}=2.7\times10^{-4}$m^3 (0.0027m^3)
mm^3		0.000000001 (10^{-9})	5,700mm^3=5,700$\times10^{-9}$ =5.7$\times10^{-6}$m^3(0.0000057m^3)
km^3		1,000,000,000 (10^9)	1.3km^2=1.3$\times10^9$ =1.3$\times10^9$m^3(1,300,000,000m^3)
L		0.001 (10^{-3})	47L=47$\times$0.001=0.047m^3

To convert the value in the unit in ① to that in the unit in ②, multiply the value in the unit in ① by the coefficient in ③. To convert the value in the unit in ② to that in the unit in ①, divide the value in the unit in ② by the coefficient in ③.

d) Mass

① **Unit before converted**	② **Unit after converted**	③ **Coefficient which converts the unit in item ① into that in item ②**	**Examples of application**
t	kg	1,000 (10^3)	1,500t = 1,500$\times$1,000 = 1,500,000kg
g		0.001 (10^{-3})	740g=740$\times$0.001=0.74kg
mg		0.000001 (10^{-6})	82mg=82$\times10^{-6}$ =8.2$\times10^{-5}$kg(0.000082kg)
μg		0.000000001 (10^{-9})	550 μg=550$\times10^{-9}$ =5.5$\times10^{-7}$kg(0.00000055kg)
ng		0.000000000001 (10^{-12})	66ng=66$\times10^{-12}$ =6.6$\times10^{-11}$ kg (0.000000000066kg)
pg		0.000000000000001 (10^{-15})	340pg=340$\times10^{-15}$ =3.4$\times10^{-13}$kg (0.00000000000034kg)

To convert the value in the unit in ① to that in the unit in ②, multiply the value in the unit in ① by the coefficient in ③. To convert the value in the unit in ② to that in the unit in ①, divide the value in the unit in ② by the coefficient in ③.

e) Concentration

① **Unit before converted**	② **Unit after converted**	③ **Coefficient which converts the unit in item ① into that in item ②**	**Examples of application**
kg/L	kg/m^3	1,000 (10^3)	1.7kg/L=1.7×1,000 =1,700kg/m^3
g/L		1 (10^0)	23g/L=23×1=23kg/m^3
mg/L		0.001 (10^{-3})	460mg/L=460×0.001 =0.46kg/m^3
g/m^3			460g/m^3=460×0.001 =0.46kg/m^3
µg/L		0.000001 (10^{-6})	37µg/L=37×10^{-6} =3.7×10^{-5}kg/m^3 (0.000037kg/m^3)
mg/m^3			37mg/m^3=37×10^{-6} =3.7×10^{-5}kg/m^3 (0.000037kg/m^3)
ng/L		0.000000001 (10^{-9})	910ng/L=910×10^{-9} =9.1×10^{-7}kg/m^3 (0.00000091kg/m^3)
µg/m^3			910µg/m^3=460×10^{-9} =9.1×10^{-7}kg/m^3 (0.00000091kg/m^3)
pg/L		0.000000000001 (10^{-12})	39pg/L=39×10^{-12} =3.9×10^{-11}kg/m^3 (0.000000000039kg/m^3)
ng/m^3			39mg/m^3=39×10^{-11} =3.9×10^{-11}kg/m^3 (0.000000000039kg/m^3)

To convert the value in the unit in ① to that in the unit in ②, multiply the value in the unit in ① by the coefficient in ③. To convert the value in the unit in ② to that in the unit in ①, divide the value in the unit in ② by the coefficient in ③.

f) Pressure

① **Unit before converted**	② **Unit after converted**	③ **Coefficient which converts the unit in item ① into that in item ②**	**Examples of application**
atm	Pa	101,325 (101,325)	1.2atm=1.2×101,325 =121,590Pa
bar		100,000 (10^5)	1.1bar=1.1×100,000 =110,000Pa
kgf/cm^2		98,069 (101,325÷1.0332)	0.98kgf/cm^2=0.98×98,069 =96,108Pa
mmHg		133.32 (101,325÷760)	765mmHg=765×133.32 =101,990Pa

To convert the value in the unit in ① to that in the unit in ②, multiply the value in the unit in ① by the coefficient in ③. To convert the value in the unit in ② to that in the unit in ①, divide the value in the unit in ② by the coefficient in ③.