PRTR Estimation Manual

16. Housing Manufacturing Industry

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Japan Federation of Housing Organization

Contents

1. Basic Estimation Techniques of Releases and Transfers

The following sections describe the basic procedure for estimating the releases of the Class I Designated Chemical Substances based on the "mass balance in a facility as a whole" method.

Another estimating method to estimate the releases and transfers at each emission point and calculate the total of them is also useful.

1.1 Estimation Procedure for the Releases and Transfers

The overview of the process of estimating releases and transfers of the Class I Designated Chemical Substances based on mass balance of a facility is shown in Fig. 1-0.

Here, the "maximum potential releases to the environment" refers to the maximum amount of the Class I Designated Chemical Substance that could be released to the environment when the waste gas/waste water treatment equipment is not provided. This can be calculated by subtracting the amount shipped-out as products and the amount transferred in waste from the annual amount handled.

(Maximum potential releases to the environment)

= (annual amount handled) - (amount shipped-out as products) - (transfers in waste)

- (amount contained in on-site landfills by the facility)

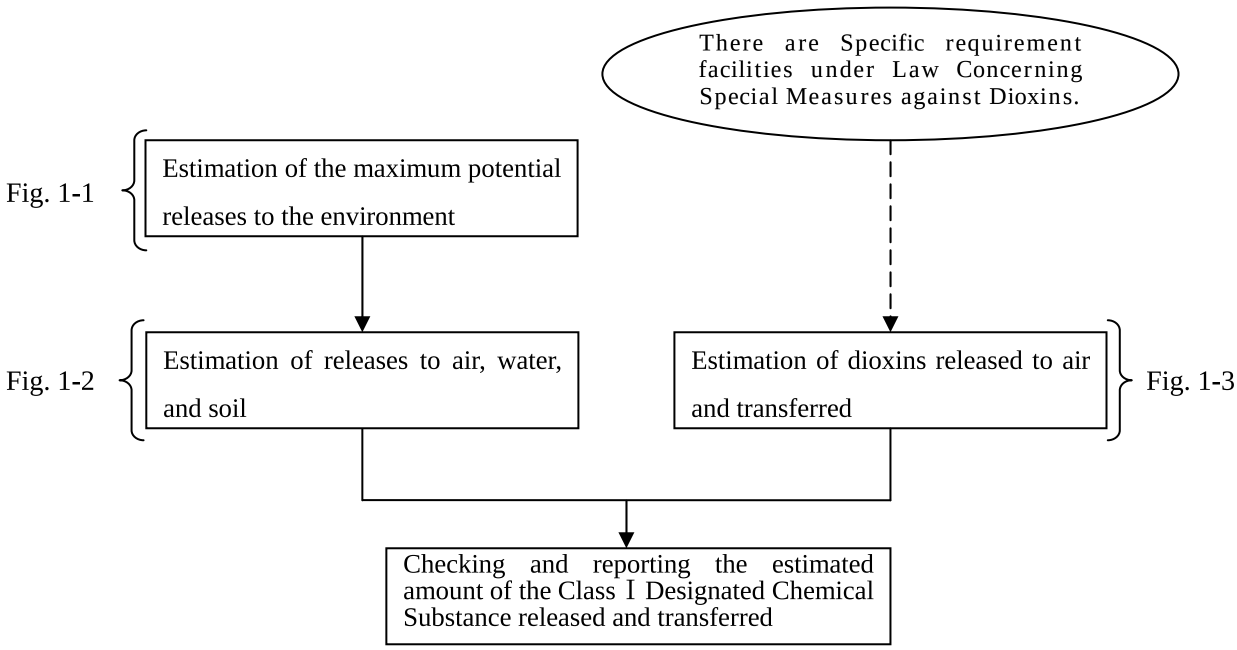


Fig. 1-0 Estimation Procedure for the Releases and Transfers

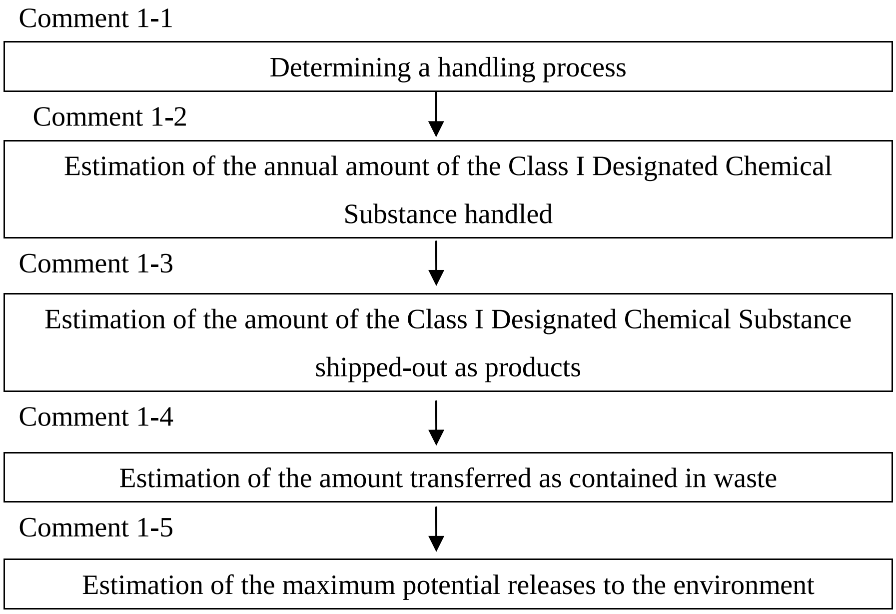


Fig. 1-1 Estimation Procedure for the maximum potential releases to the environment

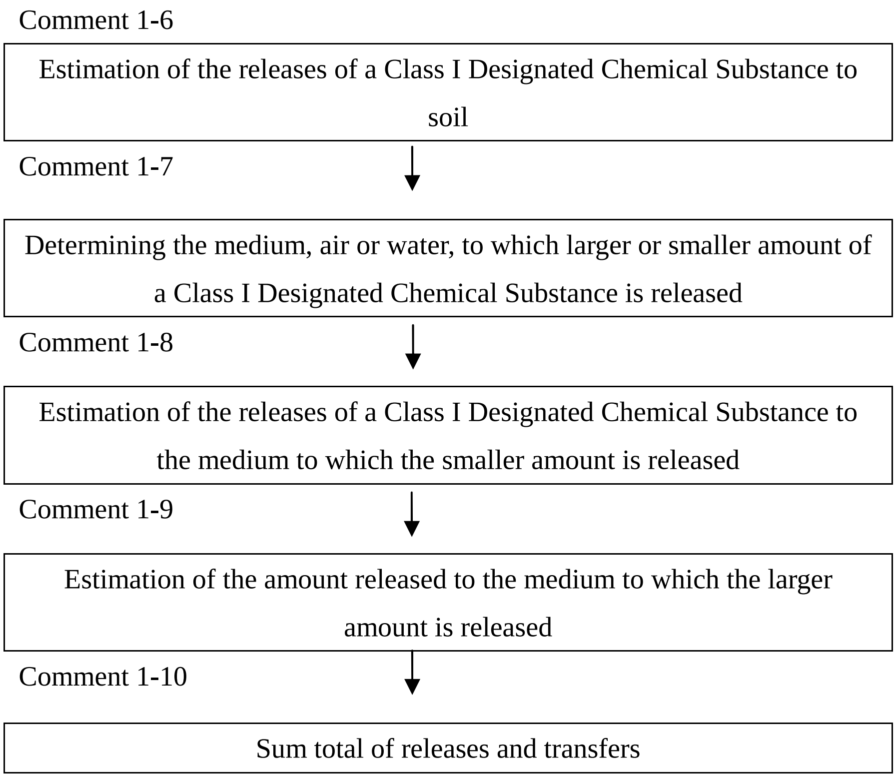


Fig. 1-2 Estimation Procedure for the releases to air, water and soil

Comment 1-11

Estimation of Dioxins released to air

↓ Comment 1-12

Estimation of the amount of dioxins released to water bodies

↓ Comment 1-13

Estimation of the amount of dioxins transferred as contained in waste

↓ Comment 1-14

Sum total of dioxins released and transferred

Fig. 1-3 Estimation Procedure for the released/transferred amount of dioxin from specific requirement facilities

1.2 Comments on Estimation Techniques of Releases and Transfers

1.2.1 Estimation of the maximum potential releases to the environment

Estimations of the maximum potential releases to the environment shall be carried out according to the following procedure (comment 1-1 - comment 1-5) based on Fig. 1-1.

Comment 1-1 Examining the handling process

Examine the process of handling the raw materials or materials containing the Class I Designated Chemical Substances whose releases and transfers are required to be estimated.

(NOTE) (1) If materials are handled in two or more processes, all the processes should be defined in principle, unless the amount handled in these processes is very small and the maximum potential releases/transfers to the environment are considered to be negligible.

Comment 1-2 Estimation of the annual amount of the Class I Designated Chemical Substance handled

The annual amount of the Class I Designated Chemical Substance handled is calculated by multiplying the annual amount of raw materials and materials handled by the content of the substance contained therein examined above (Comment 1-1).

- Estimation of the annual amount of the Class I Designated Chemical Substance handled for each raw material or material

(Annual amount handled of the Class I Designated Chemical Substances)

= (Annual amount of raw materials or materials handled)

× (content% in raw materials or materials) / 100

- Estimation of the annual amount of the Class I Designated Chemical Substance handled throughout the process

(Annual amount of the Class I Designated Chemical Substances handled throughout the handling process)

= (annual amount of the material A handled)

+ (annual amount of the material B handled) + …

Comment 1-3 Estimation of the amount of the Class I Designated Chemical Substance shipped-out as products

a. When the content of the Class I Designated Chemical Substance in a product is known

The amount of the Class I Designated Chemical Substance shipped-out as products is calculated by multiplying the amount of the products of the process (hereinafter "products") shipped-out by the content of the Class I Designated Chemical Substance.

(Amount shipped-out as products) = (amount of products shipped-out)

× (content % in a product) / 100

b. When the content of a Class I Designated Chemical Substance in products is unknown

If the content of a Class I Designated Chemical Substance in products is unknown, use the empirical values instead in order to estimate the amount of the substance shipped-out as products.

(Amount shipped-out as products) = (amount of products shipped-out)

× (content % in a product obtained through experience) / 100

c. When a Class I Designated Chemical Substance is not contained in a product

Although raw materials and materials are used in the handling process, if the resulting products do not contain any Class I Designated Chemical Substance, then the amount of the substance shipped-out as products should be zero.

d. When the content of a Class I Designated Chemical Substance in products is known

(Estimation example)

When paint containing toluene is manufactured and shipped-out

The amount of paint shipped-out and the content of toluene contained therein are examined.

Amount of paint shipped-out = 15t/year = 15,000kg/year

Content of toluene in paint = 70%

The amount of toluene shipped-out as products is calculated as follows.

Amount shipped-out as products = 15,000kg/year × 70% / 100

= 10,500kg/year

e. When the content of a Class I Designated Chemical Substance in products is unknown

(Estimation example)

When pigments are applied to products in the coating process

Pigments containing a Class I Designated Chemical Substance are applied to products, but the content of the pigment components in the products are not known.

In this case, the amount of the Class I Designated Chemical Substance shipped-out is estimated from the annual amount of paint handled, the content of the substance in pigment components, and the ratio of paint transferred to the products.

The annual amount of paint handled and the content of the substance in pigment components (based on MSDS) are:

Annual amount of coating material handled = 15t/year = 15,000kg/year

Content of the Class I Designated Chemical Substance in pigment components = 5%

About 80% of pigment components is known to be transferred to the products.

The amount shipped-out as products can then be calculated as follows.

(Amount of Class I Designated Chemical Substance in pigment components shipped-out as contained in products)

= 15,000kg/year × 5%/ 100 × 80%/ 100

= 600kg/year

f. When a Class I Designated Chemical Substance is not contained in a product

Although raw materials or materials are used in the handling process (e.g. as degreasing or washing detergents, or solvent components in coating material), if the resulting products do not contain any Class I Designated Chemical Substance, the amount of the substance shipped-out as products is zero.

Comment 1-4 Estimation of an amount transferred as contained in waste

If waste containing a Class I Designated Chemical Substance is generated throughout the handling process, the transfers of the substance contained in waste and the amount of the substance contained in on-site landfills are calculated by the following formula.

When the content of a substance is unknown

If the content of a Class I Designated Chemical Substance in waste (e.g. waste paint) is unknown, the content in the unused material, or the empirical value obtained from the analysis or actual measurements is used to estimate the transfers.

(amount transferred as contained in waste)

= (amount of waste generated from the handling process)

× (Class I Designated Chemical Substance content (%) in raw materials or materials) / 100

(NOTE)

(1) Report the amount contained in waste based on the classification of treatment methods as shown below. (If waste is sold to industrial waste management contractors, the transfers are treated as the amount shipped-out as products.)

Type of Treatment of Waste	Classification of Reporting	Remarks
Treated/disposed outside the premises of the facility	Off-site transfer in waste	Off-site waste management method (landfill, incineration, release to sea, etc.)
Waste of no value or minus value is recycled outside the premise of the facility.	Off-site transfer in waste	
Sold to external recycling service company	Reporting not required	Estimate the amount shipped-out as products (Comment 1-3, p4)
When waste is released to on-site landfill within the premises of the business	Release to on-site landfills in the business establishment	Select the classification (Stable type, Controlled type, and Shield type) of landfill
When waste is incinerated,etc.within the premises of the business	Releases	The releases from waste treatment process are estimated.
Transfer to sewage	Transfers to sewage	The releases to sewage are estimated using a formula, and reported as the amount transferred to sewage.
Release to the other waste water treatment facility (e.g. common treatment facility)	Release to water bodies	The releases to water bodies are estimated, and reported as the amount released to the other industrial waste treatment facility. Cf. 1.2.4(p.16)

(2) Waste such as collected dust and sludge generated in the process of waste gas/waste water treatment is not taken into account here, although this will be treated separately below in the section of “Estimation of Releases”.

(Estimation example)

The toluene-based waste paint of 100kg (0.1t) is generated annually in a coating process, though the content of toluene contained therein is not known. The waste paint is handed over to the industrial waste management contractors.

It was found that unused paint contained 30% toluene. Amount of toluene transferred as contained in waste are estimated using content of toluene in purchased paint as waste paint content

Therefore, the estimation of amount transferred as contained in waste is carried out as follows.

(amount transferred as contained in waste) = 100kg/year × 30%/ 100 = 30kg/year

Comment 1-5 Estimation of the maximum potential releases to the environment

The maximum potential release to the environment (air/water/soil) of each Class I Designated Chemical Substance in each handling process is calculated by the following formula.

(Maximum potential releases to the environment)

= (amount handled)

- (amount shipped-out as products)
- (transfers as contained in waste)
- (amount released to on-site landfills by a facility)

(NOTE)

(1) The "amount contained in on-site landfills" can be calculated in the same manner as the "transfers as contained in waste" described in Comment 1-4.

1.2.2 Estimation of Releases to Air, Water, and Soil

Estimations of the releases to air, water and soil are carried out in the following procedure (Comments 1-6 to 1-9) based on Fig. 1-2.

Comment 1-6 Estimation of the releases of a Class I Designated Chemical Substance to soil

The releases to soil are estimated by multiplying the releases of raw materials or materials to soil by the content of a Class I Designated Chemical Substance contained therein.

(Releases to soil) = (releases of the raw materials or materials to soil)

× (content in the raw materials or materials)%/ 100

(NOTE)

(1) The releases to soil should only be considered if leakage of liquids from ground or underground storage equipment, or spillage of liquids or solids when transporting or moving substances from one container to another occurs in the handling process. If no leakage is identified, the amount released to soil should be zero.

(2) The releases of waste to on-site landfill (stable, controlled or shielded landfill site) should be reported as the "amount contained in on-site landfills" rather than the "releases to soil".

Comment 1-7 Determining the medium, air or water, to which larger or smaller amount of a Class I Designated Chemical Substance is released

Examine the following and determine the medium to which larger or smaller amount of the substance is released.

(1) By comparison of vapor pressure and water solubility of the substance, determine the medium to which larger or smaller amount of the substance is released.

(2) By state of the substance (solid/liquid/gas) and the handling method, determine the medium to which larger or smaller amount of the substance is released

(NOTE)

(1) When it is assumed that either of the amount released to air or to water bodies is zero (e.g. process without contacting water) judging from the condition under which the raw materials or materials containing the substance are handled, the releases can be assumed as zero.

Comment 1-8 Estimation of the releases of a Class I Designated Chemical Substance to the medium to which the smaller amount is released

For the medium (air or water) to which the smaller amount of a Class I Designated Chemical Substance is released in the handling process;

(1) Waste gas/waste water treatment is not provided.

(2) Waste gas/waste water treatment is provided.

In both cases, the releases are calculated by using either:

a. Emission factors

b. Physical properties

(1)When waste gas/waste water treatment is not provided

a. Estimation using emission factors

The amount of a Class I Designated Chemical Substance handled is multiplied by an emission factor to obtain the release to air/water.

(Smaller amount of release to air/water)

= (amount of a Class I Designated Chemical Substance handled etc.)

× (emission factor)

b. Estimation using physical properties

The concentration in wastewater (or waste gas) based on the water solubility (or vapor pressure) is multiplied by the amount of wastewater (or waste gas) to obtain the release to water (or air).

(Smaller amount of releases to air/water)

= (amount of wastewater/emission to air from processing)

× (concentration(%) of the Class I Designated Chemical Substance in wastewater / emission to air derived from physical properties) / 100

(Estimation example)

a. Estimation using emission factors

When trichloroethylene is released to air from a storage tank

According to the reference data 1 in the appendix, the emission factor to air of the trichloroethylene in the storage process is 0.23kg/t; i.e. 0.23kg per ton of the amount handled is released.

The annual amount of trichloroethylene handled in this facility was 12t.

Therefore the release to air is estimated as follows.

Releases to air = 0.23kg/t × 12t/year = 2.8kg/year

Notes: The releases in the manufacturing, and washing processes should be estimated in the same manner.

b. Estimation using physical properties

When toluene in paint splattered in the process of spray coating is recovered by a wet booth and released in effluent :

The solubility of toluene in water ranges from 0.54 to 0.58g/L (here, the maximum value 0.58g/L (= 0.58kg/m^3) is used).

The wet booth discharge effluent of 2m^3 per day, operating 200 days per year.

The release to water bodies is estimated as follows.

Releases to water bodies = 0.58kg/m^3 × 2m^3/day × 200days/year

= 232kg/year

=> 230kg/year

(2) When waste gas/waste water treatment is provided

When waste gas/waste water treatment is provided for the medium to which the smaller amount of a substance is released, the following should be estimated.

a. Amount released after waste gas / waste water treatment

b. Amount removed by waste gas / waste water treatment

c. Amount transferred as contained in waste from waste gas / waste water treatment

Having estimated the potential releases in the same manner as (1), the amount released, removed and transferred after treatment is calculated.

○ Estimation of the potential releases for the medium of smaller quantity released ->see (1)

○ Calculation of the releases after waste gas/waste water treatment for the medium of smaller quantity released

(Releases after waste gas / waste water treatment) = (Potential releases) × (1 - removal rate %/ 100)

○ Calculation of the amount of removal by waste gas/waste water treatment

(Amount of removal by waste gas / waste water treatment)

= (potential releases) × (removal rate %) / 100

= (potential releases) - (releases after waste gas/waste water treatment)

○ Calculation of the transfers as contained in waste from waste gas/waste water treatment

(Transfers as contained in waste from waste gas/waste water treatment)

= (potential releases) × removal rate %/ 100 × (1 - decomposition rate%/ 100)

(Estimation example)

a. Estimation using emission factors

When dichloromethane is used as peeling solvent and exhaust gas generated is treated by activated carbon adsorption

- Estimation of the potential releases to air

According to reference data 1, the emission factor of dichloromethane in the process of using solvent is 336kg/t.

The annual amount of dichloromethane handled in this facility is 3.8t.

The release to air is estimated as follows.

Releases to air = 336kg/t × 3.8t

= 1,280kg/year

Notes: The releases in the manufacturing, storage and washing processes should be estimated in the same manner.

- Estimation of the releases to air after treatment

The releases to air after activated carbon adsorption treatment are estimated with the removal rate. When the removal rate is unknown, reference data 2 is used.

Removal rate of activated carbon adsorption treatment = 80%

Releases to air after treatment = 1,280kg/year × (1 - 80%/ 100)

= 256kg/year =>260kg/year

- Estimation of the amount removed by activated carbon adsorption treatment

The amount removed by activated carbon adsorption treatment is obtained from the difference between the releases before and after treatment.

Amount removed by activated carbon adsorption treatment

= potential releases to air – releases to air after treatment

= 1,280kg/year - 260kg/year = 1,020kg/year

- Estimation of the amount contained in the spent carbon generated from activated carbon adsorption treatment (i.e. the transfers as contained in waste)

The amount contained in the spent carbon generated by treatment is estimated using removal rate and decomposition rate of activated carbon adsorption treatment.

Decomposition rate by activated carbon adsorption treatment = 0%

Amount of dichloromethane in the waste carbon generated by activated carbon adsorption treatment

= potential releases to air × (removal rate(%)) - decomposition rate(%)) / 100

= 1,280kg/year × (80% - 0%) / 100 = 1,020kg/year => 1,000kg/year

b. Estimation using physical properties

When toluene contained in paint is recovered by a wet booth and released in effluent which is then treated by activated sludge processing

- Estimation of the releases to water

The water solubility of toluene ranges from 0.54 to 0.58g/L (here, the maximum value 0.58g/L (= 0.58kg/m^3) is used).

The wet booth discharges effluent of 2m^3 per day, operating 200 days per year.

The release to water is thus estimated as follows.

The potential release to water = 0.58kg/m^3 × 2m^3/day × 200days

= 232kg/year

- Estimation of the releases to water bodies after treatment

The releases to water bodies after treatment are estimated using removal rate of activated sludge processing.

When removal rate is unknown, the value of the soluble organic matter in reference data 3 is used.

Removal rate of activated sludge processing = 60%

Releases to water bodies after treatment = 232kg/year × (1 - 60%/ 100)

= 93kg/year

- Estimation of the amount removed by activated sludge processing

The amount removed by activated sludge processing is estimated from difference between the releases before and after activated sludge processing.

Amount removed by activated sludge processing

= Potential releases to water - releases to water after processing

= 232kg/year - 93kg/year = 139kg/year

In this case, however, toluene is not degraded through activated sludge processing but released to air by aeration, which should be treated as the "amount released to air" and reported as such.

This should be recorded in the corresponding space of the worksheet.

Comment 1-9 Estimation of the amount released to the medium to which the larger amount is released

The releases to the medium to which the larger amount is released are estimated as subtracting the releases to soil and the amount of releases, after removed by waste gas/waste water treatment to the medium to which the smaller amount is released, from the total potential release to environment.

(Release to the medium to which the larger amount is released)

= (Maximum potential release to the environment)

- (release to soil)

- (release to the medium to which the smaller amount is released)

- (amount removed by waste gas/waste water treatment in release to the medium to which the smaller amount is released)

(NOTE)

(1) When the waste gas/waste water treatment is provided for the medium to which the larger amount is released, using the value estimated above as the potential release along with the removal and decomposition rate, the release after treatment, the amount removed by treatment,

and the transfers as contained in waste should be calculated.

○ Estimation of the releases after waste gas/waste water treatment

(Releases after waste gas/waste water treatment)

= (Potential releases) × (1 - removal rate %/ 100)

○ Estimation of the amount removed by waste gas/waste water treatment

(Amount removed by waste gas/waste water treatment)

= (Potential releases) × (removal rate %) / 100

= (potential releases) - (releases after waste gas / waste water treatment)

○ Estimation of the transfers as contained in waste generated by waste gas/waste water treatment

(Transfers as contained in waste generated by waste gas/waste water treatment)

= (potential releases) × removal rate %/ 100 × (1 - decomposition rate%/ 100)

Comment 1-10 Sum total of releases and transfers

Sum up the amount of each Class I Designated Chemical Substance released/transferred.

1.2.3 Estimation of the Released/Transferred Amount of the Class I Designated Chemical Substances from Specific Requirement Facilities such as Dioxins

Based on Fig. 1-3, estimations are carried out in the following procedures (Comments 1-11 to 1-14).

The types of the business which have facilities that are designated as “specific requirement facilities” must report the released/transferred amount of the Class I Designated Chemical Substance by actual measurements in accordance with the relevant laws and regulations.

For dioxins, in particular, businesses that are obliged to report under the Law Concerning Special Measures against Dioxins should estimate and report the releases and transfers obtained from the measurements.

Note that the unit used for the notification of Dioxins is mg-TEQ whereas that for other Class I Designated Chemical Substances is kg.

Comment 1-11 Estimation of Dioxins released to air

The amount of Dioxins released to air is estimated based on observed values.

○ Calculation of the amount of Dioxins released to air

(Amount of Dioxins released to air)

= (annual amount of emission) × (concentration of dioxins in emission)

(Estimation example)

○ <u>When dioxins in exhaust gas is released to air from an incinerator</u>

The dioxins level in exhaust gas obtained from the actual measurements is 5ng-TEQ/m^3 (= $5x10^{-6}$mg-TEQ/m^3). The mean amount of emission gas is 8,000m^3/hour and the annual operated hour of the incinerator is 6,000 hours/year.

Therefore the annual amount of emission gas is

8,000m^3/hour × 6,000hour/year = 48,000,000m^3/year.

The amount of dioxins released to air is estimated as follows.

(Releases to air) = 5×10^{-6}mg-TEQ/m^3 × 48,000,000m^3/year

= 240mg-TEQ/year

Comment 1-12 Estimation of the amount of dioxins released to water

The amount of dioxins released to water bodies is estimated based on observed values.

○ <u>Calculation of the amount of dioxins released to water bodies</u>

(Amount of dioxins released to water bodies)

= (annual amount of wastewater) × (concentration of dioxins in wastewater)

(Estimation example)

○ <u>When emission from the incinerator is fed through the washing tower, from which effluent is generated</u>

The dioxins level in effluent is 1ng-TEQ/m^3 (= $1x10^{-6}$mg-TEQ/m^3) based on the actual measurement. The average amount of effluent generated from the washing tower is 30,000m^3/year.

The amount of dioxins released to water bodies is estimated as follows:

(Releases to water bodies) = 1×10^{-6}mg-TEQ/m^3 × 30,000m^3/year = 0.03mg-TEQ/year

Comment 1-13 Estimation of the amount of dioxins transferred as contained in waste

The transfers of dioxins contained in waste are also calculated using the observed values of the substances in waste in the same manner as the releases to air and water bodies.

○ <u>Calculation of the transfers as contained in waste</u>

(Transfers of dioxins contained in waste)

= (annual amount of waste generated) × (concentration of dioxins in waste)

(Estimation example)

○ <u>When treatment of incineration ash generated is commissioned to industrial waste management contractors</u>

The dioxins level in incinerated ash is 0.24ng-TEQ/g (= 0.24×10^{-6}mg-TEQ/g) based on the actual measurement. The annual amount of incinerated ash generated is 1,300t/year (= 1,300,000,000g/year).

The transfers of dioxins contained in waste are calculated as follows.

(Transfers in waste) = 0.24×10^{-6}mg-TEQ/g × 1,300,000,000g/year

= 320mg-TEQ/year

Comment 1-14 Sum total of dioxins released and transferred

The amount of dioxins released/transferred in waste from specific requirement facilities is totaled.

(Sum of dioxins released/transferred)

= (releases to air) + (releases to water bodies) + (transfers as contained in waste)

1.2.4 Checking and Reporting the Estimated Amount of the Class I Designated Chemical Substance Released/Transferred

Comment 1-15 Checking and reporting the estimated releases and transfers

In order to verify the results of the estimation, examine the calculated releases and transfers by comparing them against;

(1) Annual amount handled during the current fiscal year

(2) Reported value of the previous fiscal year.

(NOTE)

(1) Examine the estimated releases and transfers by comparing them with the amount handled during the fiscal year and the reported values of the previous year. If impossible or unreasonable values are identified, check the number of digits and units of data used for the estimations and recalculate so as to judge the validity of the results.

(2) When the emission factors or physical properties were used to estimate the releases and transfers, the calculated values might be overestimated and thus not match with the actual values. (The sum of the releases or transfers never exceeds the annual amount handled.) Check the validity of the estimated values by consulting the equipment manufacturers, performing actual

measurements, etc., and use the data that seem more accurate to calculate the releases and transfers.

Comment 1-16 Entering the data on releases and transfers in the form

Enter the sum total of the releases and transfers of the facility in the appropriate columns of the notification form.

(NOTE)

(1) If effluent is discharged to the sewers rather than water bodies, enter the data in the “amount transferred to the sewages”. If discharged to other industrial waste treatment facility (e.g. common treatment facility), the value calculated by proportionally allocating the “amount released to water bodies after wastewater treatment” according to the respective in put amount to the facility.

2. Estimation Techniques in Typical Processes

The manufacturing process of housing components and parts varies depending on the construction methods. The typical processes include those of coating, bonding, steel frame coating, welding and antiseptic treatment. Moreover, the typical manufacturing processes of housing equipment apparatus include coating and bonding.

Class I Designated Chemical Substances that may be used in the processing

Cabinet Order No.	CAS	Name of substance	Application
1	—	Water-soluble compounds of Zinc (Zinc nitrate, Zinc dihydrogen phosphate)	Conversion coating agent
43	107-21-1	Ethyleneglycol	Coolant
44	110-80-5	Ethyleneglycolmonoethylether	Coating
63	1330-20-7	Xylene	Same as above
65	107-22-2	Glyoxal	Bonding
102	108-05-4	Vinyl acetate	Same as above
145	75-09-2	Dichloromethane (another name; methylene chloride)	Same as above
176	—	Organic tin compounds	Coating
177	100-42-5	Styrene	Same as above
227	108-88-3	Toluene	Same as above
230	—	Lead and its compounds (lead silicate etc.)	Electrodeposition coating
232	—	Nickel and its compounds (nickel nitrate, nickel dihydrogen phosphate)	Conversion coating agent
270	84-74-2	Phthalic acid di-n-butyl	Coating, Bonding
272	117-81-7	Phthalic acid bis (2-ethyl hexyl)	Bonding
304	—	Boron and its compounds	Degreasing
311	—	Manganese and its compounds (manganese nitrate, manganese phosphate, manganese dihydrogen phosphate, manganese carbonate)	Conversion coating agent Pigment

2.1 Painting Process

The process in which steel frame/exterior wall panel/housing facility devices etc. are coated with coating materials by spraying etc. As for the releases to the environment, volatilization to air of the Class I Designated Chemical Substances in the solvent components contained in the coating materials, mixture of solvent components and pigment components in wastewater from wet booth are to be calculated, and likewise the transfer as waste coating materials is to be calculated as well.

In addition, there is a transfer of waste (waste activated carbon etc.) that is generated when the Class I Designated Chemical Substances volatilized from such facilities or equipments are treated at a waste gas treatment facility using activated carbon adsorption processing, etc.

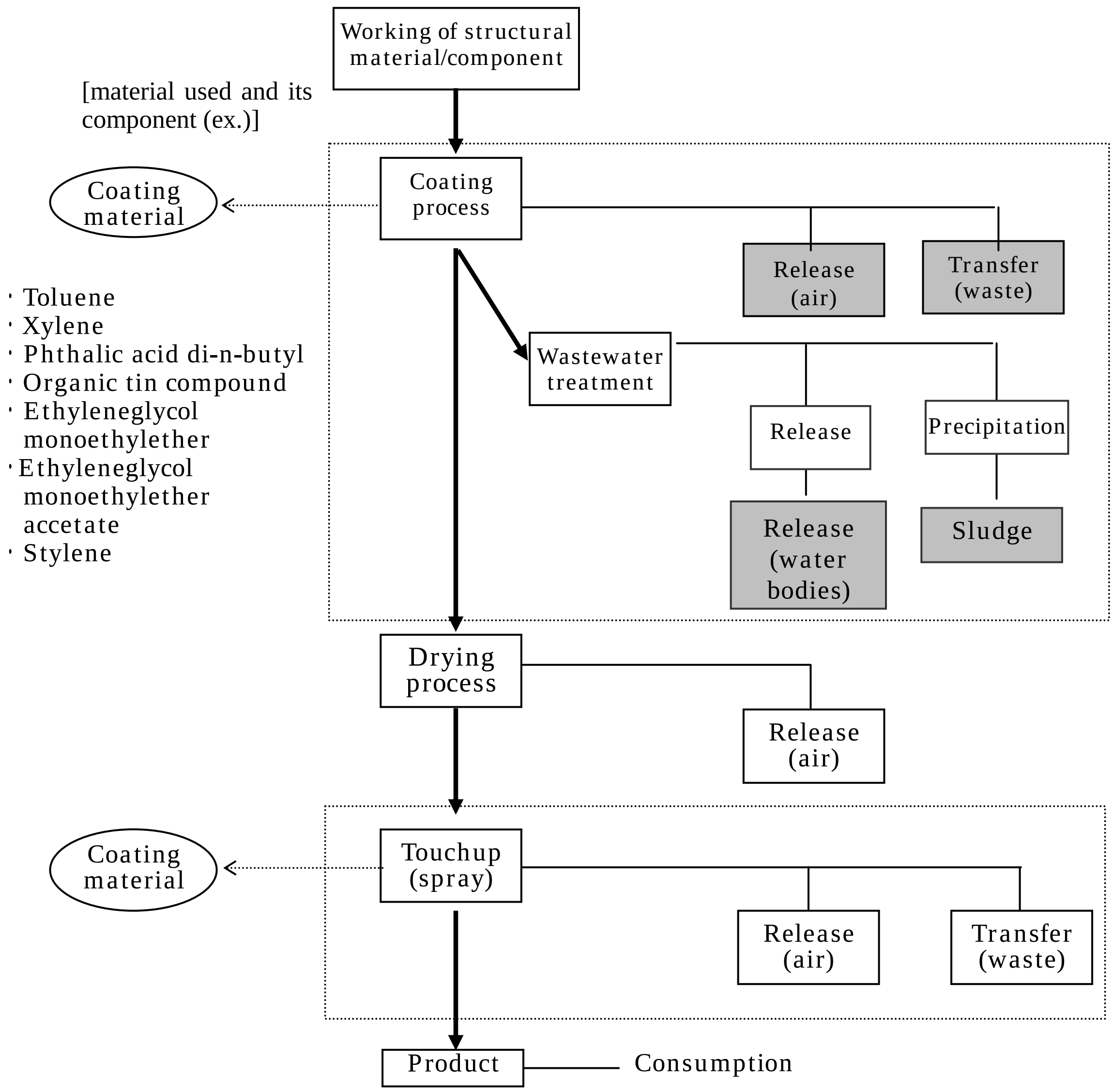
[Example of the Class I Designated Chemical Substances]

(Solvent components) toluene, xylene

(Pigment components) chromium compounds, cadmium compounds

[Example of process diagram]

Coating process (Coating process of steel frame/exterior panel/housing facility devices)



[Procedures of estimation]

I. Solvent component

Estimations of the releases and transfers of solvent component in the coating process are carried out in the following procedure:

(1) Estimation of the handled amount of Class I Substances contained in coating material and thinner	Amount of coating material and thinner handled × Content in coating material and thinner
(2) Estimation of transfers included in waste coating material, waste thinner etc.	Amount of waste coating, waste thinner etc. generated × Content in waste coating material and waste thinner (or content in coating material and thinner)
(3)Estimation of the maximum potential releases to the environment	(Amount handled - transfers)
(4) Estimation of releases to water bodies	Amount of waste water × concentration in waste water (or water solubility)
(5) Estimation of releases to air	(Maximum potential releases to the environment - Releases to water bodies)

II. Pigment component

Estimations of the releases and transfers of pigment component in the coating process are carried out in the following procedure:

(1) Calculation of the handled amount of Class I Substances contained in coating material and thinner	Coating material amount handled × Content in coating material
↓	
(2) Estimation of the amount of products shipped-out	Coating area × Content in coated film
↓	
(3) Estimation of transfers as contained in waste coating material, etc	Amount of waste coating material etc. generated × Content in waste coating material (or content in coating material)
↓	
(4) Estimation of the maximum potential releases to the environment	(Amount handled - amount shipped-out as products - transfers in waste)
↓	
(5) Estimation of releases to water compartment	(Maximum potential releases to the environment)

[Estimation example]

Examples of methods for estimating the releases and transfers in the following facilities and conditions are shown below.

(Outline of the facility)

Process	:	Spray coating of home-building components by airless spray (coating efficiency 70%)
Facility used	:	Airless spray (with a local ventilation, operation inside wet booth)
Waste gas/waste water treatment equipment	:	None (when waste gas/waste water treatment equipment is provided, the removal rate is considered with reference data 2 and 3.)
Coating material used	:	Coating material A (toluene content 30%, manganese carbonate content 20%)
Annual amount of the coating material A used	:	10t/year
Residual coating material in the can	:	150kg when the can is handed over to industrial waste management contractors (the content is unknown)
Wastewater released from the wet type booth	:	$1m^3$/day, 200 days/year operation (without wastewater concentration measurement)

Estimations of the releases and transfers of toluene

(1) Calculation of the annual amount of toluene handled

The annual amount of toluene handled is calculated from the amount of coating material used and the content of toluene contained therein.

(Annual amount of toluene handled)

= (amount of coating material used) × (content% in the coating material)

= 10t/year × 30%/ 100 = 3t/year = 3,000kg/year

(2) Estimation of the transfers as contained in waste

The transfers of toluene contained in waste are estimated from the content of toluene in the coating material and amount of coating material handed over to industrial waste management contractors.

(Transfers as contained in waste)

= (amount handed over to industrial waste management contractors)

× (content% of toluene in the coating material)

= 150kg/year × 30%/ 100 = 45kg/year

(3) Estimation of the maximum potential releases

The maximum potential releases are estimated by subtracting the transfers as contained in waste from the annual amount of toluene handled.

(Maximum potential releases)

= (Annual amount of toluene handled) - (transfers as contained in waste)

= 3,000kg/year - 45kg/year = 2,955kg/year

(4) Releases to water bodies

As the concentration of toluene in wastewater is unknown, release to water bodies is estimated based on the solubility of toluene in water 0.58g/L (0.58kg/m^3)

(Amount released to water bodies)

= (solubility of toluene in water) × (amount of wastewater)

= 0.58kg/m^3 × 1 m^3 /day × 200days/year

= 116kg/year

(5) Releases to air

The amount of toluene released to air is calculated by subtracting release to water bodies from the total maximum potential releases.

(Amount released to air)

= (maximum potential releases of toluene) - (amount released to water bodies)

= 2,955kg/year - 116kg/year = 2,839kg/year

Estimation of the releases and transfers of manganese compounds (Manganese carbonate)

(1) Calculation of the annual amount of manganese handled

Note: When the Class I Designated Chemical Substance is a compound of metal, the amount converted to metal element should be calculated using a conversion factor.

The annual amount of manganese handled is calculated from the amount of coating material used, the content of manganese carbonate contained therein and conversion factor from manganese carbonate to manganese.

(Annual amount of manganese handled)

= (Amount of coating material used) × (content% in coating material)

× (conversion factor)

= 10t/year × 20%/ 100 × 0.487 = 974kg/year

(2) Estimation of the amount shipped-out as products

The amount shipped-out as products is calculated by multiplying the annual amount of manganese carbonate handled by the coating efficiency based on the assumption that the amount of manganese carbonate (for the amount ratio) coated on the products in a coated film has been shipped-out.

(Amount shipped-out as products)

= (annual amount of coating material handled

- annual amount of residual coating material in the can)

× (content% of manganese carbonate in coating material)

× (conversion factor) × (coating efficiency)

= (10,000kg/year - 150kg/year) × 20%/ 100 × 0.487× 70%/100

= 672kg/year

(3) Estimation of the transfers as contained in waste

The amount of manganese carbonate transferred in waste is calculated from the content of manganese carbonate in the waste paint and the amount of the paint sludge generated in wet booth. When the content of manganese in waste paint is unknown, the content in paint should be used.

(Amount transferred contained in waste paint)

= (Amount of residual paint in cans)

× (content% of manganese carbonate in waste paint) × (conversion factor)

= 150kg/year × 20%/ 100 × 0.487 = 15kg/year

(Amount transferred in paint sludge)

= (Amount of paint handled) × (1 - coating efficiency)

× (content% of manganese carbonate in paint sludge) × (conversion factor)

= (10,000 - 150)kg/year × 30%/ 100 × 18%/ 100 × 0.487

= 259kg/year

(Total amount transferred) = (Amount transferred contained in waste paint)

+ (Amount transferred in paint sludge)

= 15kg/year + 259kg/year = 274kg/year

(4) Estimation of the maximum potential releases

The maximum potential amount released is calculated by subtracting the amount shipped-out as products and the transfers in waste from the annual amount of manganese handled .

(Maximum potential releases)

= (annual amount of manganese handled) - (amount shipped-out as products)

- (transfers as contained in waste)

= 974kg/year - 672kg/year-274kg/year = 28kg/year

(5) Releases to air

Since manganese carbonates have no volatility, the amount released to air is zero.

(6) Releases to water bodies

Since the amount released to air is zero, the amount released to water bodies is calculated by considering that the total maximum potential releases go to water bodies.

(Releases to water bodies)

= (maximum potential releases) = 28kg/year

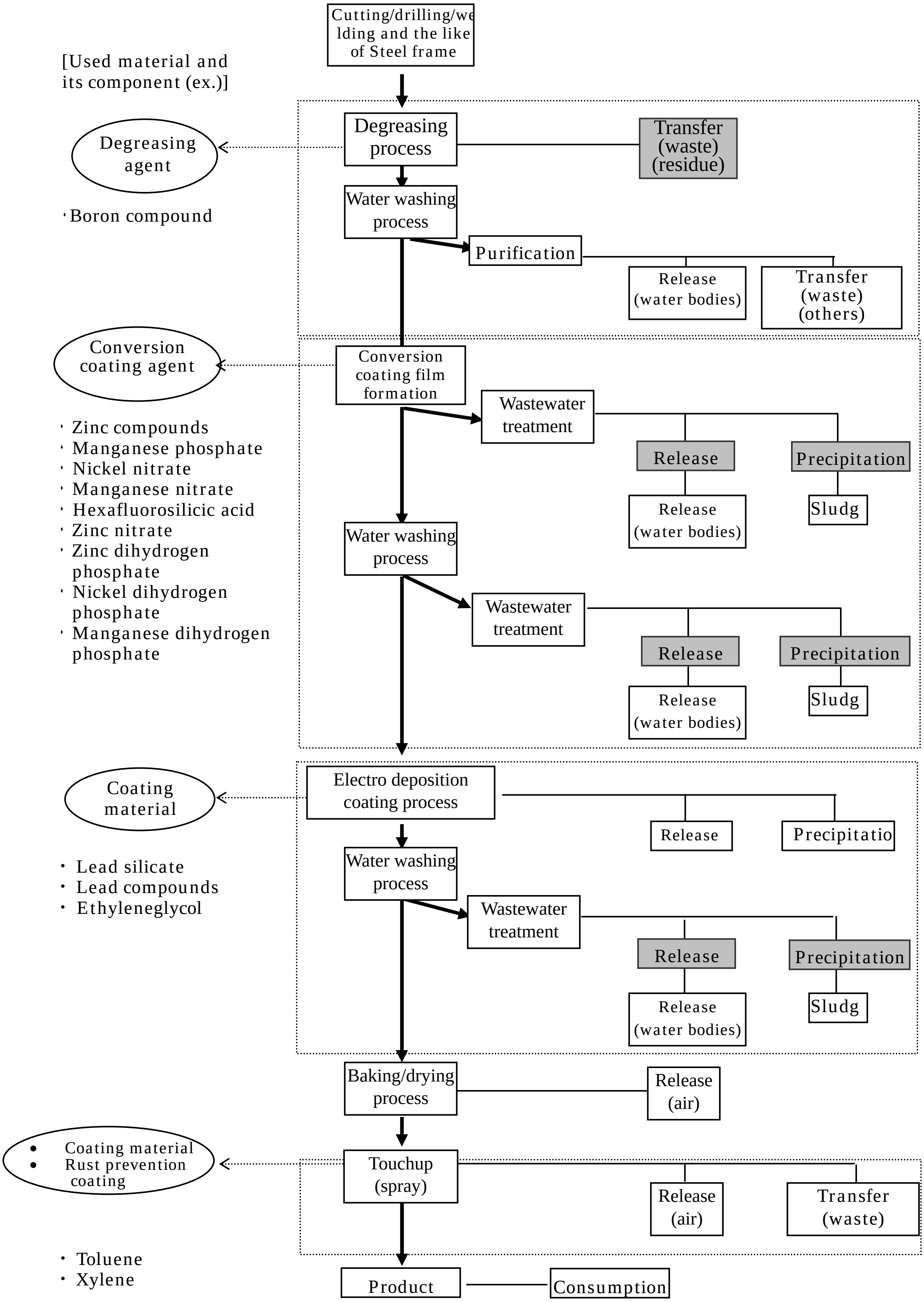
After the calculations, enter the figures for toluene in the coating process (solvent) working sheet, and those for manganese carbonate in the coating process (pigment) working sheet.

2.2 Steel Frame/Electro deposition Coating Process

The process in which the surfaces of steel frame are coated with coating material by electro deposition etc. through the process of degreasing and chemical conversion coating formation.

[Example of process diagram]

Steel frame/electro deposition coating



2.2.1 Degreasing/Washing Process

Degreasing/washing process is that in which greasy dirt attached to the surface of products and parts dissolves or peels off by water-based detergent (e.g. soak washing) or non water-based detergent (e.g. vapor degreasing).

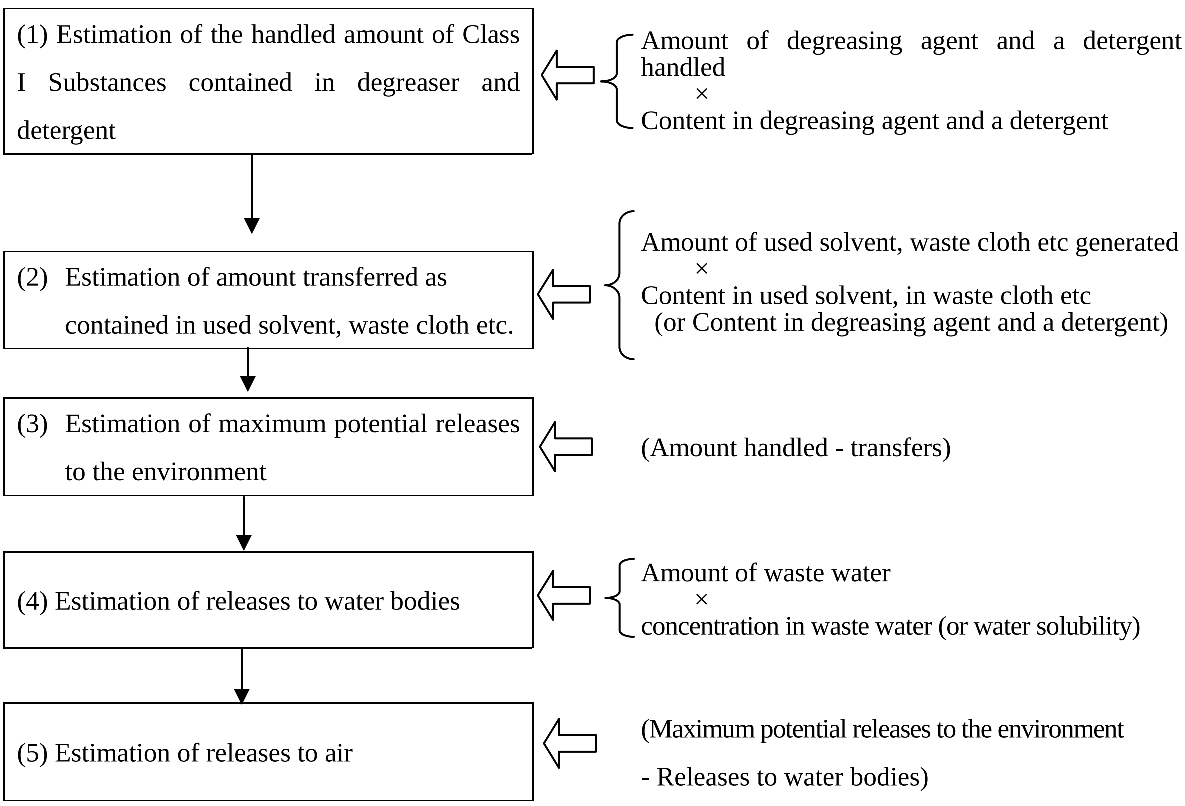
Examples of releases and transfers of the Class I Designated Chemical Substance to the environment in this process include volatilization to air of the substance in washing detergent, releases in effluent generated by washing equipment, and transfers as waste solvent. Moreover, waste (e.g. spent carbon) may be generated when emission or effluent generated in the process is treated by waste gas/waste water treatment equipment, such as activated carbon adsorption.

[Example of the Class I Designated Chemical Substances]

boron compounds, etc.

[Estimation procedure]

Estimations of the releases and transfers in the degreasing/washing process are carried out in the following procedure:



[Estimation example]

Example of methods for estimating the releases and transfers in the following facilities and conditions is shown below.

(Outline of the facility)

Process	:	Degreasing or washing of outer wall parts
Facility used	:	Vapor degreasing type washing station (with exhaust gas line connection and no drainage system)
Waste gas/waste water treatment equipment	:	None
Degreasing agent and detergent used	:	Degreasing A (30 % of boron oxide)
Annual amount of the degreasing agent and detergent A used	:	3t/year
Waste degreasing agent and detergent	:	1.7t. is handed over to industrial waste management contractors (the content of boron oxide is unknown)
Amount of sludge generated at wastewater treatment (the content of boron oxide is 1%(measured))	:	30 t / year

Estimations of the releases and transfers of boron oxide

(1) Calculation of the annual amount of boron oxide handled (as boron)

The annual amount of boron oxide (as boron) handled is calculated by the amount of the degreasing agent and the detergent used, the content of the boron oxide contained in it, and conversion factor to boron.

(Annual amount handled of boron)

= (amount of degreasing agent used) × (content% of boron oxide in degreasing agent) × (conversion factor)

= 3 t/year × 30%/ 100 × 0.311 = 280kg/year

(2) Calculation of the transfers of boron contained in waste

The transfers of boron contained in waste is estimated from the content of boron oxide in the waste degreasing agent, the amount of waste degreasing agent handed over to the industrial waste management contractors and conversion factor to boron.

(Transfers as contained in waste degreasing agent)

= (amount handed over to industrial waste management contractor)

× (content% in degreasing agent) × (conversion factor)

= 1.7 t/year × 30%/ 100 × 0.311= 159kg/year

(Transfers as contained in sludge)

= (amount of sludge handed over to industrial waste management contractor)

× (content% of boron oxide in sludge) × (conversion factor)

= 30 t/year × 1 %/ 100 × 0.311= 93kg/year

(Total amount transferred)

= (Transfers as contained in waste degreasing agent)

+ (Transfers as contained in sludge)

= 159kg/year + 93kg/year = 252kg/year

(3) Estimation of the maximum potential releases

The maximum potential releases are estimated by subtracting the transfers as contained in waste from the annual amount of boron handled.

(Maximum potential releases)

= (Annual amount of boron handled) - (transfers as contained in waste)

= 280kg/tear- 252kg/year = 28kg/year

(4) Releases to air

The releases of boron oxide to air are estimated as zero, because it is non volatile.

(5) Releases to water bodies

As releases to air are zero, releases to water bodies are equal to the maximum potential releases.

(Releases to water bodies) = (Maximum potential releases of boron)

= 28kg/year

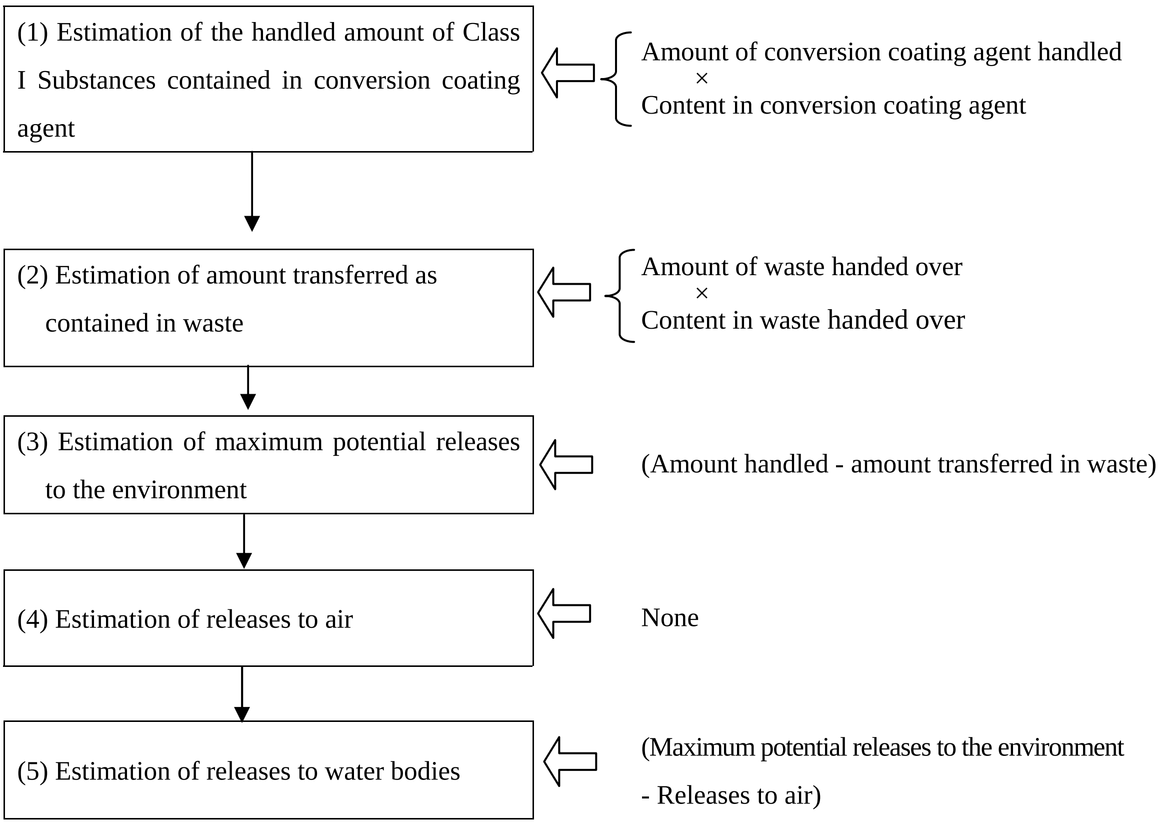
2.2.2 Conversion Coating Process

[Example of the Class I Designated Chemical Substances]

zinc nitrate and zinc phosphate, etc.

[Estimation procedure]

Estimations of the releases and transfers of conversion coating agent are carried out in the following procedure:



[Estimation example]

Process	: Conversion coating of outer wall parts
Facility used	: Conversion coating facility
Waste gas treatment facility	: None
Conversion coating agent	: Conversion coating agent A (30% of zinc nitrate)
Annual amount used of the conversion coating agent A	: 3t/year
Waste from conversion coating agent	: 1.7t. (content is unknown) handed over to the industrial waste management contractors

Estimation of the releases and transfers of zinc nitrate

(1) Calculation of the annual amount of zinc handled

The annual amount of zinc handled is estimated from the amount of the degreasing agent and the detergent used, the content of the zinc nitrate contained in them and conversion factor to zinc.

(Annual amount of zinc handled)

= (Amount of coating material used)

× (content % of zinc nitrate in coating material) × (conversion factor)

= 3 t/year × 30%/ 100 × 0.22 = 198kg/year

(2) Estimation of the transfers of zinc contained in waste

The transfers of zinc contained in waste are estimated from the content of zinc nitrate in the waste of degreasing agent and detergent and the amount of the waste degreasing agent and detergent handed over to the industrial waste management contractor .

(Transfers as contained in waste)

= (Amount handed over to industrial waste management contractor)

× (content% of zinc nitrate in waste) × (conversion factor)

= 1.7 t/year × 30%/ 100 × 0.22 = 112kg/year

(3) Estimation of the maximum potential releases

The maximum potential releases are estimated by subtracting the transfers as contained in waste from the annual amount of zinc handled.

(Maximum potential releases)

= (Annual amount of zinc handled) - (transfers as contained in waste)

= 198kg/year - 112kg/year = 86kg/year

(4) Releases to air

Since zinc nitrate is not volatile, the release to air is zero.

(5) Releases to water bodies

The releases of zinc to water bodies are equal to the maximum potential releases .

(Releases to air) = (maximum potential releases of zinc) - (releases to air)

= 86kg/year - 0kg/year = 86kg/year

After the calculations, enter the figures for zinc nitrate in the conversion coating process (pigment) worksheet.

2.2.3 Electrodeposition Coating Process

For the electrodeposition coating process, see 2.1.

2.3 Bonding Process

The process in which adhesive is applied to materials such as wood, paper, metal, and plastic by brush coating and spraying, whereby the materials are bonded.

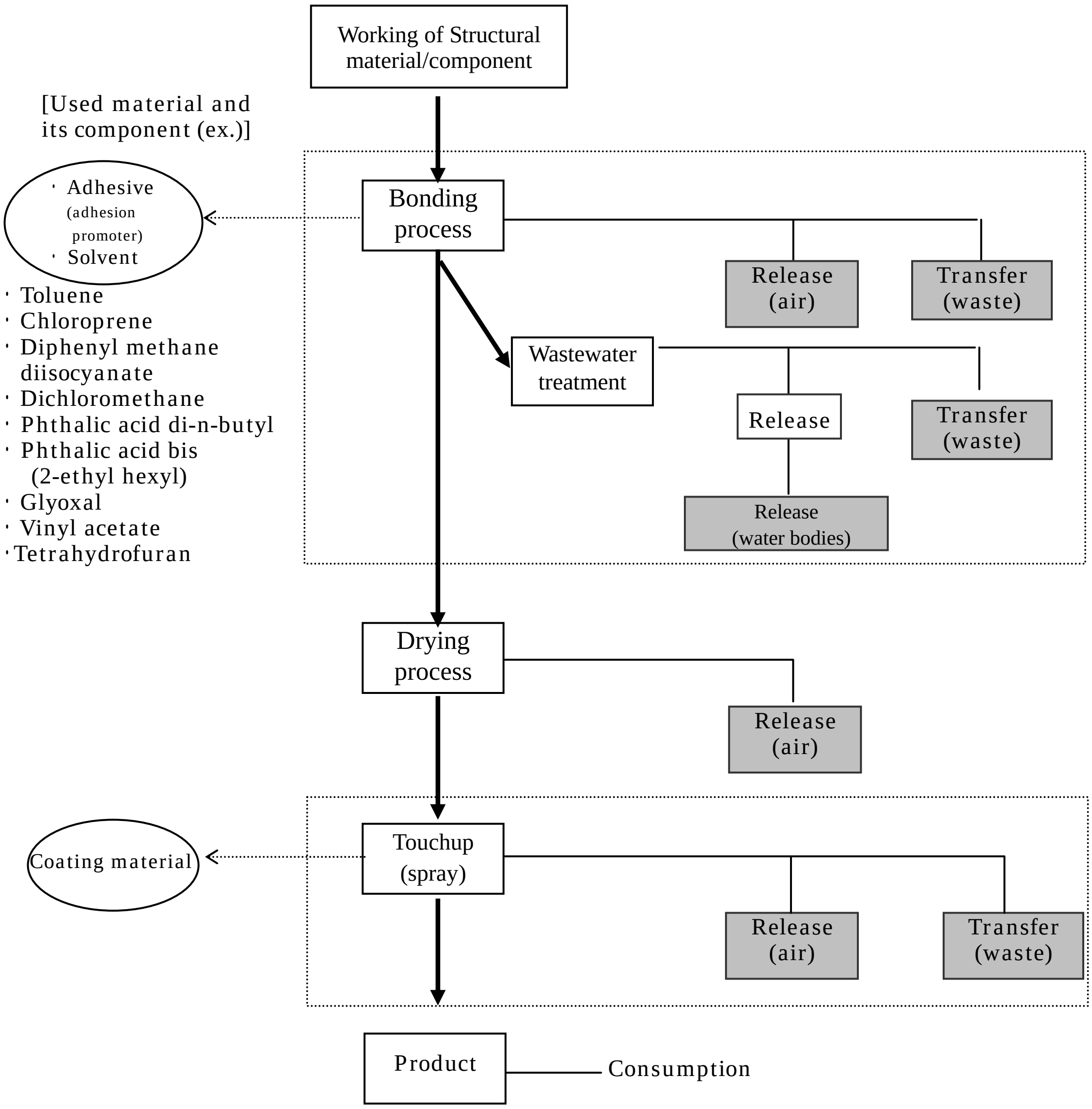
As for releases to the environment, volatilization to air of the Class I Designated Chemical Substances in the solvent components contained in adhesive, mixture of solvent components and chemical additives to wastewater, and the transfer as waste adhesive are to be estimated. In addition, the transfer of waste (waste activated carbon etc.), which is generated when the Class I Designated Chemical substance is vaporized from the apparatus and treated in the waste gas treatment facility of activated carbon adsorption etc. is to be estimated.

[The example of Class I Designated Chemical Substances]

(Solvent components)	toluene, xylene
(Additives)	bis(2-ethylhexyl) phthalate, etc.

[Example of process diagram]

Bonding process drawing



[Procedure of estimation]

I. Solvent component

Estimations of the releases and transfers of solvent component in the bonding process are carried out in the following procedure:

(1) Estimation of the handled amount of Class I Substances contained in bonding adhesive ⇐ Amount of bonding adhesive handled × Content in bonding adhesive

↓

(2) Estimation of amount transferred as contained in waste bonding adhesive ⇐ Amount of waste bonding adhesive generated × Content in bonding adhesive (or content in bonding)

↓

(3) Estimation of maximum potential releases to the environment ⇐ (Amount handled - transfers)

↓

(4) Estimation of releases to water bodies ⇐ Amount of waste water × concentration in waste water (or water solubility)

↓

(5) Estimation of releases to air ⇐ (Maximum potential releases to the environment - Releases to water bodies)

II. Additives

Estimations of the releases and transfers of additives in the bonding process are carried out in the following procedure:

(1) Calculation of the handled amount of Class I Substances contained in bonding adhesive ⇐ Amount of bonding adhesive handled × Content in bonding adhesive

↓

(2) Estimation of the amount shipped-out as products ⇐ Coated area × Content in coated film

↓

(3) Estimation of transfers as contained in waste coating material, etc. ⇐ Amount of waste bonding adhesive generated × Content in waste (or content in bonding adhesive)

↓

(4) Estimation of maximum potential releases to the environment ⇐ (Amount handled - amount shipped-out - transfers)

↓

(5) Estimation of releases to water bodies ⇐ Maximum potential releases to the environment

[Estimation example]

Examples of methods for estimating the releases and transfers in the following facilities and conditions are shown below.

(Outline of the facility)

Process	:	Bonding of housing parts, cut off of bonded edge (3% of an bonded product)
Exhaust air and wastewater treatment facility	:	None
Adhesives used	:	Adhesives A (30% of toluene content, 10% of Di(2-ethylhexyl) phthalate content)
Annual amount used of Adhesives A	:	10t/year
Residual adhesives in the can	:	150kg when the can is handed over to industrial waste management contractors (the content is unknown)

Estimations of the releases and transfers of toluene

(1) Calculation of the annual amount of toluene handled

The annual amount of toluene handled is calculated from the amount of Adhesives A used and the content of toluene contained therein.

(Annual amount of toluene handled)

= (amount of Adhesives A used) × (content in Adhesives A)

= 10t/year × 30%/ 100 = 3t/year = 3,000kg/year

(2) Estimation of the transfers as contained in waste

The transfers of toluene contained in waste are estimated from the content of toluene in waste Adhesives A and amount of waste Adhesives A handed over to industrial waste management contractors.

(Transfers as contained in waste)

= (amount handed over to industrial waste management contractors)

× (content in Adhesives A)

= 150kg/year × 30%/ 100 = 45kg/year

(3) Estimation of the maximum potential releases

The maximum potential releases are estimated by subtracting the transfers as contained in waste from the annual amount of toluene handled .

(Maximum potential releases)

= (Annual amount of toluene handled) - (transfers as contained in waste)

= 3,000kg/year - 45kg/year = 2,955kg/year

(4) Releases to air

The amount of toluene released to air is calculated by considering that the total maximum potential releases go to air, because of no water-used process.

(Amount released to air)

= (maximum potential releases of toluene) = 2,955kg/year

(5) Releases to water bodies

The amount of toluene released to water bodies is zero, because of no water-used process.

Estimations of the releases and transfers of Di(2-ethylhexyl)phthalate

(1) Estimation of the annual amount of Di(2-ethylhexyl)phthalate handled

The annual amount of Di(2-ethylhexyl)phthalate handled is estimated from the amount of the adhesives used and the content of Di(2-ethylhexyl)phthalate contained in it.

(Annual amount handled of Di(2-ethylhexyl)phthalate)

= (Amount of adhesives used) × (content in adhesives)

= 10 t/year × 10%/ 100

= 1,000kg/year

(2) Estimation of the amount shipped-out as products

Those other than solvent component of adhesive agent are assumed to be contained in manufactured goods. In this process, however, 3% is cut off and discarded. Therefore, the remaining 97% is assumed to be shipped-out as products.

(Amount shipped-out as products) = (Annual amount of Di(2-ethylhexyl)phthalate handled)

× (1- discarded ratio)

= 1,000kg/year × (1- (3%/ 100)) = 970kg/year

(3) Estimation of the transfers as contained in waste

The transfers of Di(2-ethylhexyl)phthalate contained in waste is 3% of the bonding part that was cut off and handed over to the industrial waste management contractor.

(Transfers as contained in waste) = (Annual amount of Di(2-ethylhexyl)phthalate handled)

× (discarded ratio)

= 1,000kg/year × 3%/ 100 = 30kg/year

(4) Estimation of the maximum potential releases

Since a maximum potential release is estimated by subtracting the annual amount of Di(2-ethylhexyl)phthalate shipped-out as products and the transfers as contained in waste, from the annual amount of Di(2-ethylhexyl)phthalate handled, so the maximum potential releases is zero in this case.

(Maximum potential releases)

= (Annual amount of Di(2-ethylhexyl)phthalate handled)

- (amount shipped-out as products) - (transfers as contained in waste)

= 1,000kg/year - 970kg/year - 30kg/year = 0kg/year

(5) Releases to air

Since Di(2-ethylhexyl)phthalate compound have little volatility, the amount released to air is zero.

(6) Releases to water bodies

The amount released to water bodies is zero, because of no water-used process.

(Releases to water bodies) = 0kg/year

2.4 Other Processes

2.4.1 Welding Process

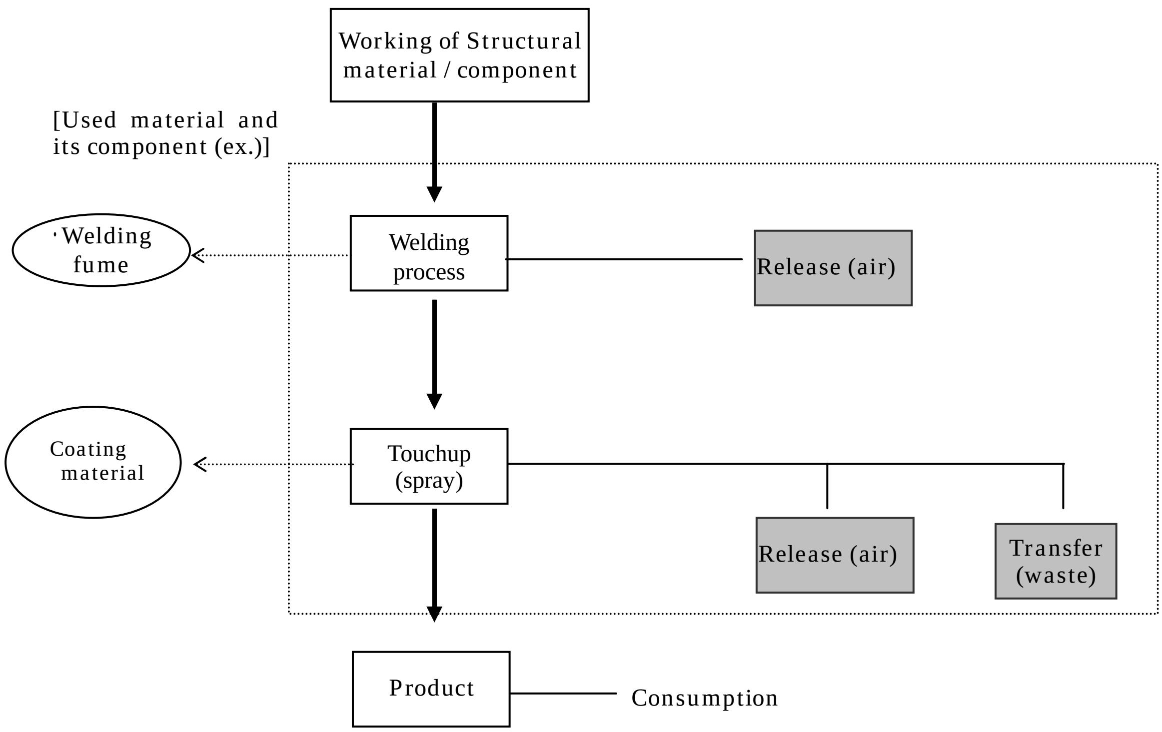
The process in which metal materials to be jointed and worked are welded each other with a weld rod melted by electric arc and gas heating. As releases to the environment, releases to air by volatilization of the Class I Designated Chemical Substances contained in weld rod, raw materials or products, releases to water bodies mixed in wastewater, and a transfer as scrap materials are to be estimated.

[The example of a Class I Designated Chemical Substances]

Nickel, chromium, etc.

[Example of process diagram]

Structural material welding process drawing



2.4.2 Antiseptic Treatment Process

The process in which antiseptic treatment is performed so that wood-destroying fungi cannot attack cellulose etc. which is a major constituent of woody materials.

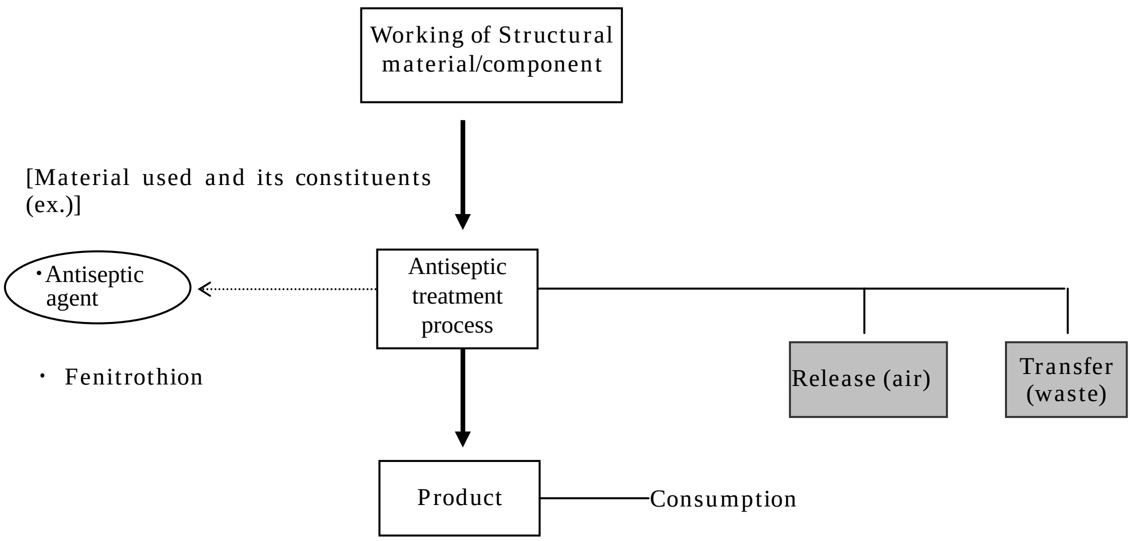
As releases to the environment, releases to air by volatilization of the Class I Designated Chemical Substances contained in raw materials or products, releases to water bodies mixed in wastewater, and a transfer as scrap materials are to be estimated.

[The example of Class I Designated Chemical Substances]

Fenitrothion, etc.

[Example of process diagram]

Antiseptic treatment process drawing



Reference data 1

Example of the emission factors of the Class I Designated Chemical Substances

Substance	Emission source classification	Emission factor
Trichloroethylene	Manufacture	0.001
	Storage	0.23
	Solvent	979
	Cleaning	838
Tetrachloroethylene	Raw manufacture	0.09
	Raw materials	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 monomer	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: Ministry of the Environment)

NOTE) The amount released to air per ton of the amount handled (kg)

The emission factor is shown in the open state at ordinary temperature.

Reference data 2

Removal rate and decomposition rate of typical waste gas treatment equipment

(Source: Kohei Urano, Yokohama National University/Professor)

Treatment equipment	Class I Designated Chemical Substance to be treated					
	Dust particles		Gaseous organic compound		Gaseous inorganic Compounds	
Cyclone	0.6	(0)	0	(0)	0	(0)
Bag filter	0.9	(0)	0	(0)	0	(0)
Electrostatic precipitator	0.9	(0)	0	(0)	0	(0)
Combustion equipment	0	(0)	0.995	(0.995)	0	(0)
Absorber (scrubber) [a)]	0.8	(0)	0	(0)	0.8	(0.8)
Activated carbon adsorber	0.1	(0)	0.8	(0)	0.5	(0)

a) The absorber using acid or alkaline solution

The decomposition rate is shown in brackets.　The difference between the removal rate and the decomposition rate is equivalent to the amount of waste, such as collected ash or spent carbon.

If the removal rate or decomposition rate cannot be obtained by the actual measurements or by referring to the information on similar cases with regard to waste gas treatment equipment, use the values in the above table as the general values.

When waste gas is treated by two kinds of treatment equipment connected in series, estimate the overall removal rate R by using the removal rate of the first device R1 and that of the second device R2 as shown below.

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

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

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

<u>The collected ashes, ash filter and spent carbon are waste, which should be converted and calculated as the transfers.</u>

Reference data 3

Removal rate and decomposition rate of typical waste water treatment equipment

(Source: Kohei Urano, Yokohama National University/Professor)

Classification of equipment	Treatment Class I Designated Chemical Substances							
	Suspended inorganic Compounds [b)]		Suspended organic compound		Soluble inorganic Compounds [c)]		Soluble organic compound	
Plain sedimentation equipment	0.4	(0)	0.2	(0)	0	(0)	0	(0)
Coagulating precipitation equipment	0.8	(0)	0.7	(0)	0	(0)	0	(0)
Biodegradation equipment [a)]	0.7	(0)	0.7	(0.3)	0	(0)	0.6	(0.4)
Membrane filtration equipment	1.0	(0)	1.0	(0)	0	(0)	0	(0)
Activated carbon adsorption equipment	0.1	(0)	0.1	(0)	0.2	(0)	0.8	(0)

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/organic compound) means that the substance exists in the form of particles in effluent. These are the values obtained for rather persistent substances when they are treated by devices.

c) "Soluble" (inorganic/organic compound) means that the substance dissolves in effluent. These are the values obtained for rather persistent substances when they are treated by devices.

The decomposition rate is shown in brackets. The difference between the removal rate and the decomposition rate is equivalent to the amount of waste (e.g. sludge).

If the removal rate or decomposition rate cannot be obtained by the actual measurements or by referring to the information on similar cases with regard to wastewater treatment equipment, use the values in the above table as the general values.

When waste water is treated by two kinds of treatment equipment connected in series, estimate the overall removal rate R by using the removal rate of the first device R1 and that of the second device R2 as shown below.

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

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

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

<u>The sludge and spent carbon,etc. are waste, which should be converted and calculated as the transfers.</u>