PRTR Estimation Manual

# 19. Automobile Chemical Manufacturing Industry

**January 2001**

## Japan Auto Chemical Industry Association

Manual for Estimating Releases and Transfers for Manufacturing Processes of Automobile Chemical Manufacturing Industry

## Contents

# 1. Introduction

Automobile chemicals are the chemical products used for automobiles, including many kinds of products which relate to driving, safety and maintenance of automobiles. Also their manufacturing processes and methods are diversified.

In this manual, among the products including the Class I Designated Chemical Substances (PRTR Chemicals), the high production volume articles, namely, engine antifreeze coolant, brake fluid and solid, paste or liquid type polish wax for automobile (including coating agents and waxes for car washing machines) are taken up. For each article the model manufacturing process and the points of releases and transfers for its process are shown, and the methods of calculating releases and transfers of PRTR chemicals are clarified. This manual shows only the calculation method of releases and transfers from daily operations. For calculation of releases and transfers by opening tanks for a periodic inspection or an emergency operation, this manual may be used only as a consultation.

## 2. Estimation of releases and transfers and the guidance for reporting

In section 5, the methods of calculation of releases and transfers are shown for engine antifreeze coolant, brake fluid and polish wax for automobiles. These methods are the steps to estimate releases and transfers where engineering calculation(4.1), direct measurement or the emission factors can be applicable to the points of releases and transfers. There are, however, many points of releases and transfers where engineering calculation method(4.1) is not applicable, and where no data of direct measurement and no emission factor are available. As a result there are some points where the estimations of releases and transfers are difficult. If the estimation method for releases and transfers is available for the equipment by each company's standard, such method should be used separately from the methods in this manual.

Effort should be made to establish more accurate method estimating releases and transfers, for instance, as direct measurement by individual business, where no valid estimation method is available. Meanwhile, the amount of releases and transfers obtained by the procedure of section 4 should be totaled as air emissions, release to water bodies, release to soil and off-site transfers as waste, respectively, on the specified format. To obtain more accurate figures, the following procedure is recommended.

That is: calculate percentage of each item from the totaled amount, and then multiply the total amount of releases and transfers calculated by mass balance by percentage of each item. The result should be reported by the specified reporting format.

The calculation examples of releases and transfers, or percentage of each item are shown in the manual.

## 3. Notes for estimating releases and transfers

(1) Classification of releases and transfers

- a. Releases to POTWs (sewerage) are treated as “transfer”.
- b. Releases to public water bodies are treated as “release”.

(2) In case total amount of releases and transfers is calculated from the mass balance

- a. In case the actual volume (weight) is larger than the indicated volume (weight) of product, the difference should be added to the total volume (weight) of the product in calculation.
- b. In calculating stocks of product, semi-finished product and raw materials, the amount left in pipelines should be calculated, assuming as 100% filled.

(Liquid volume in the pipeline = $\pi r^2 L$

r: radius of the pipe, L: length of the pipe)

(3) In case there are other methods of calculation than those in this manual to obtain releases and transfers of the individual equipment, such methods may be applied. (ex; a cut-off volume is fixed for the operation of the line change by the operation manual)

(4) Treatments of samples for testing and stocked samples

- a. Samples for testing: Treatment of samples after testing: When the waste water treatment was made, sum up as “release” or “transfer” after the point of release by (1) above.
  - (a)Treated as industrial waste: sum up as “transfer”
  - (b) Excess testing samples: When treated as industrial waste, these are summed up as “transfer”. When returned to the products these are no relation to releases or transfers.
- b. Stocked samples: When treated as industrial waste these are summed up as “transfer”. When returned to the products these are no relation to releases or transfers.

## 4. Engineering calculation, measurement and emission factor for calculating releases and transfers

### 4.1. Engineering calculation

As for the calculation method of the breathing loss and the acceptance loss of storage tanks is quoted from “Manual for calculating the quantity of released pollutant under the PRTR system”, outcome of the PRTR pilot program 2000. (Indicated below as “refer to the Manual”)

### 4.2. Measurement

(1) Leakage amount from the joint portions of a tank truck discharge port and hose and a tank reception port

: 40g/time (=0.04kg/time)

(Notes: The value is applicable to the estimation of the leakage amount at the reception from the container and the drum can.)

(2) Residual amount in the 20kg bag of sodium molybdate

: 2g/bag (= 0.002kg/bag)

(Notes: The value is applicable to the other chemicals similar to sodium molybdate and the same package.)

(3) In case when ethylene glycol (EG) is wiped off with waste cloth and disposed of as industrial waste, the amount of absorption in waste cloth.

: 95g/sheet (=0.095kg/sheet)

Backgrounds of calculation of the amount of absorption

・Absorption of EG per 1g of waste cloth = 2.7g

(The average value of measurement by member companies of Japan Auto Chemical Industry Association, JACA)

・Weight of a sheet of waste cloth on average = 70g (measured)

・Absorption of EG per sheet of waste = 2.7 x 70 = 189g

・Supposing 50% of a sheet area absorbs EG, = 189/2 = 94.5g

Rounded off to the integer = 95g/sheet = 0.095kg/sheet

(Notes: In cases where the plural waste clothes are used for wiping operation, the average number of sheets should be used.

0.095/sheet x average number of sheets/wiping)

(4) Tank truck residual amount

This is considered to be in the range of about 0.5 to 10L (kg)/unit though it differs depending on the piping and pump structure, etc. If the residual amount of the tank truck of its own company is unknown, it is set as 10L (kg)/truck.

### 4.3. Emission factor and others

(1) The residual amount in the tank of liquid products and raw materials such as engine antifreeze coolant and brake fluid

The residual amount in the tank is set as 0.1vol% of the tank charge stock capacity from the research on the results of the actual condition of JACA member companies. (simple average values)

(Notes: This value is only applicable to the products having similar viscosity as the engine antifreeze coolant or the brake fluid.)

(2) Others

(a)The release to air of solid chemicals at room temperature like bisphenol A and sodium molybdate may be regarded as zero, because of their vapor pressures are negligibly small.

(b) Definition of terms

Residual liquid: Residual liquid left in the tank surface and the pipeline after the transfer by pumping of the holding liquid

Stagnant liquid: Stagnant liquid in the tank and the pipeline

## 4.4. Contents of the PRTR chemicals when the target material is a mixture

The amount of PRTR chemicals contained in the mixture or natural products is obtained from the test data sheet or MSDS of the supplier. If the value is indicated in a range, the maximum value should be used.

For example, if the PRTR chemical in the mixture is indicated as 0.5 – 1.5%, the maximum value of 1.5% should be adapted and the product should be covered under the PRTR law. Do not decide that the product shall not be subject to PRTR requirements, adapting 0.5%.

The composition of petroleum products like kerosene and mineral terpene differs from product to product depending on the crude oil used, and method and condition of refining. The composition should be confirmed by the test data sheet or MSDS of the supplier.

## 4.5. PRTR Chemicals related to the Automobile Chemicals Manufacturing Industry

The main PRTR Chemicals contained in the products or raw materials of the engine antifreeze coolant, the brake fluid and the polish wax for automobile (including coating agents and waxes for car washing machines) are shown in Table 1.

Table 1 PRTR Chemicals related to Automobile Chemicals

| Cabinet Order No. | Name of substance | CAS No. | Chemical formula | Main use |
|---|---|---|---|---|
| 43 | Ethylene glycol | 107-21-1 | $C_2H_6O_2$ | Engine antifreeze coolant |
| 311 | Manganese and its compounds | | Unspecified | Engine antifreeze coolant |
| 346 | Molybdenum and its compounds (applicable substance: sodium molybdate CAS No. 7631-95-0) | | $MoO_{4}2Na$ | Engine antifreeze coolant |
| 354 | Tributyl phosphate/Tri-n-butyl phosphate | 126-73-8 | $C_{12}H_{27}O_4P$ | Engine antifreeze coolant |
| 29 | Bisphenol A | 80-05-7 | $C_{15}H_{16}O_2$ | Brake fluid |
| 304 | Boron and its compounds | | Unspecified | Brake fluid |
| 24 | Alkyl benzene sulfonic acid and its salt (straight line type) | | Unspecified | Wax |
| 45 | 2-methoxyethanol/ethylene glycol mono methyl ether | 109-86-4 | $C_3H_8O_2$ | Wax |
| 63 | Xylene (substance that can exist in petroleum products) | 1330-20-7 | $C_8H_{10}$ | Wax |
| 224 | 1, 3, 5-trimethyl benzene (the same as above) | 108-67-8 | $C_9H_{12}$ | Wax |
| 227 | Toluene (the same as above) | 108-88-3 | $C_7H_8$ | Wax |
| 251 | Bis (hydrogenated beef tallow) dimethyl ammonium chloride | 61789-80-8 | Unspecified | Wax |
| 299 | Benzene (substance that can exist in petroleum products) | 71-43-2 | $C_6H_6$ | Wax |
| 40 | Ethyl benzene | 100-41-4 | $C_8H_{10}$ | Wax |

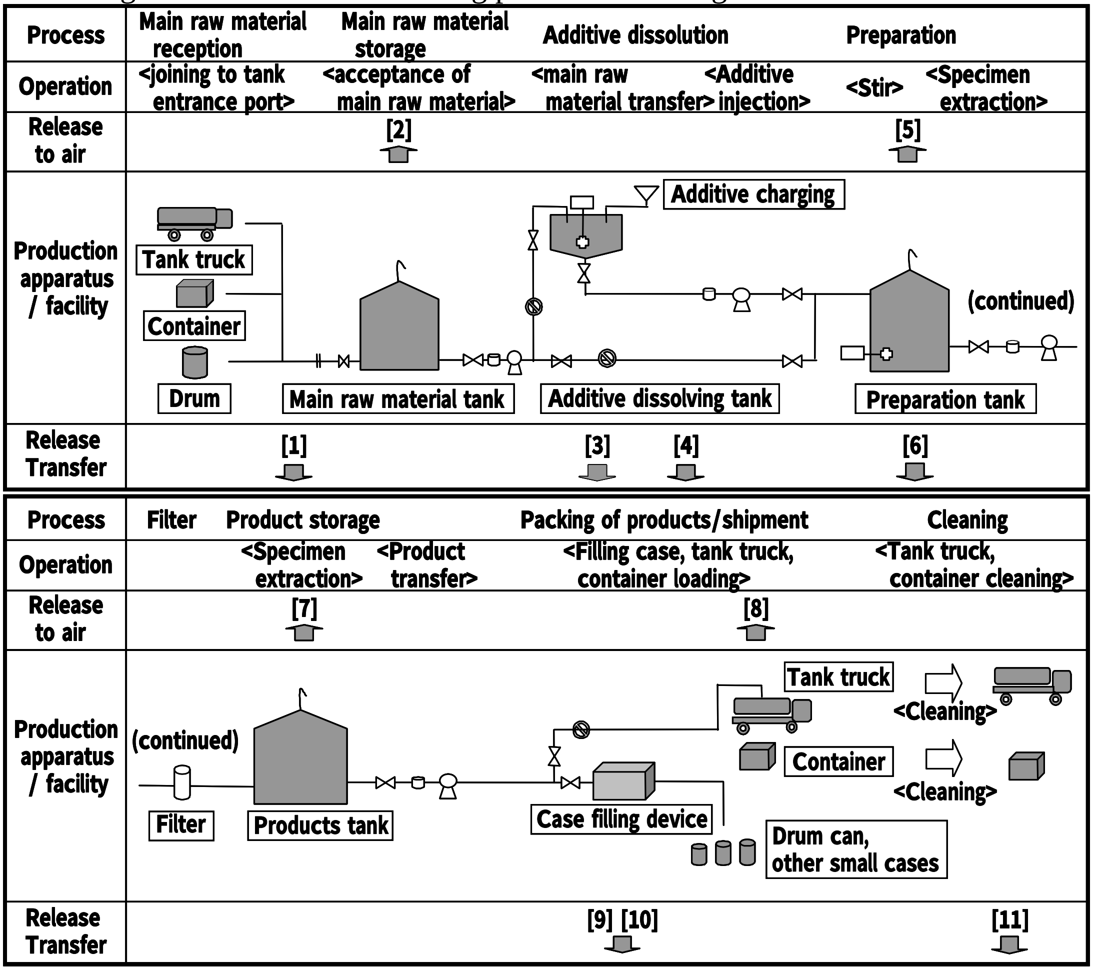
# 5. Calculation methods of releases and transfers

## 5.1. Engine antifreeze coolant

### 5.1.1. Outline of the model manufacturing process

The model manufacturing processes for engine antifreeze coolant and the points of releases and transfers are shown below in Figure 1. (Numbers [1] through [11] affixed to the release and transfer points in Figure 1 correspond to the heading numbers of sections 5.1.4 and 5.1.6.)

Figure 1 Model manufacturing process of the engine antifreeze coolant



Notes: The engine antifreeze coolant and the outline of its manufacturing process

The engine antifreeze coolant (JIS K2234) has been used to prevent freezing of the cooling system of the engine under the low temperature condition in winter time with dilution by appropriate amount of water. Recently, according to the development of high performance engine the coolant with capacities not only of cooling but also of protection against rust and corrosion to various kinds of metal parts in the cooling system, sold as Long Life Coolant, becomes very popular. The main component of long life coolant is ethylene glycol added with many kinds of additives like antirust compounds and antioxidants.

The main manufacturing facilities are stock facilities for raw materials and additives, compounding equipments for mixing additives, facilities to stock products (tanks, warehouses), filling equipments and facilities for shipping. Since long life coolant fall under The Fire Service Law as Class 4 dangerous chemicals of category 3 petroleum products, the facilities should be qualified for The Fire Service Law.

5.1.2. Standard composition

The model composition of the engine antifreeze coolant determined by JACA. (This model composition is quoted from "the standard for preparing MSDS" by JACA.) is shown in Table 2.

Table 2 Model composition of engine antifreeze coolant

| Chemical substance | CAS No | Ratio (weight %) |
|---|---|---|
| Ethylene glycol | 107-21-1 | 89 |
| Benzotriazole | 95-14-7 | 0.5 |
| Tolyltriazole | 29385-43-1 | 0.5 |
| Sodium benzoate | 532-32-1 | 3 |
| Sodium molybdate | 7631-95-0 | 0.1 |
| Triethanolamine | 102-71-6 | 3.2 |
| Phosphoric acid | 7664-38-2 | 1 |
| Antifoaming agent (silicone) |  | 0.005 |
| Dyestuff |  | 0.005 |
| Water | 7732-18-5 | 2.69 |

5.1.3. Main PRTR chemicals and their physical properties (refer to the Manual)

Table 3 Physical properties of PRTR chemicals

| Chemical substance | Ethylene glycol (EG) | Sodium molybdate |
|---|---|---|
| Number specified in Cabinet Order | 43 | 346<br>(Molybdenum and its compound) |
| CAS No. | 107-21-1 | 7631-95-0 |
| Composition formula | $C_2H_6O_2$ | $Na_2MoO_4 \cdot 2H_2O$ |
| Molecular weight | 62.1 | 241.95 |
| Melting point (°C) | -13 | *** |
| Boiling point (°C) | 197.6 | *** |
| Vapor pressure (mmHg) | 0.06 (@20°C) | *** |
| Water solubility | Miscible | *** |
| Octanol-water partition coefficient (Log Pow) | -1.36 | *** |
| Density | 1.1088 (@20°C) | 3.28<br>(DB Tomes Plus/Dolphin MSDS) |
| Conversion factor | *** | Mo = 0.397 |

5.1.4. Method for estimating releases and transfers of engine antifreeze coolant in the model manufacturing process

(Numbers [1] through [11] affixed to the release and transfer points correspond to the numbers in sections 5.1.1 Figure 1 and 5.1.6.)

[1] Releases and transfers of ethylene glycol (hereinafter abbreviated as "EG") at the time of acceptance of a primary raw material

(1) EG <Tank truck acceptance>

･Leakage from the tank truck discharge port, hose joint portion and tank reception port: EG 40g/time （= 0.04kg/time）

Annual amount of EG released

= 0.04 kg/time x acceptance times of tank trucks per year

(2) EG <container acceptance>

･Leakage from the container discharge port, hose joint portion and tank reception port: EG 40g/time (= 0.04kg/time)

Annual amount of EG released
= 0.04kg/time × acceptance times of containers per year

(3) EG<drum can acceptance>

- Leakage at the time of transfer from the drum can to the main raw material tank: EG 40g/time (= 0.04kg/time)
  Annual amount of EG released
  = 0.04kg/time × drum acceptance times per year* (note)

* (note): Irrespective of the number of drums accepted, whether, for example, 10 or 100 drums are accepted, the operation continuously performed is considered as one acceptance time.

[2] Releases and transfers of EG from the main raw material tank

- Release from air vent following the acceptance from a tank truck, container, and drum: Annual amount of EG released = refer to the Manual
- Release from the air vent by breathing of the tank:
  Annual amount released = refer to the Manual

[3] Releases and transfers of EG and Mo by the cleaning operation at the time of changing the product of the additive dissolving tank

(In carrying out the calculation, refer to the calculation examples in section 5.1.5 [4]. Only the approaches to the method of calculation are indicated below.)

- Residual solution at the tank bottom portion: washed in common, recovered in a container and disposed of as industrial waste
  Annual amount of EG transferred (kg/y)
  = (volume of tank residual solution + common cleaning solution)
  × residual solution density × (concentration of EG or Mo)
  × operation times
  (When the amount of tank residual solution is unknown, 0.1vol% of the prepared amount may be used.)
- Tank bottom residual solution: washed with water, wastewater treatment is performed and released to sewerage or water bodies.
  Annual amount of EG released or transferred (kg/y)
  = tank residual solution volume × residual solution density
  × ( concentration of EG or Mo) × water washing times
  (when the average tank residual volume is unknown, 0.1vol% of the prepared stock capacity)
- Unrecoverable containers: wiped off with waste cloth and disposed of as industrial waste
  Released EG amount (kg/y)
  = 0.095g/sheet × sheets of waste cloth
  × drum acceptance times per year

[4] Releases and transfers of sodium molybdate at the time of charging the additive

- Residue in the bag of 20kg of sodium molybdate: 2g/bag
  (= 0.002kg/bag)
  Annual amount of Mo released (kg/y)

= 0.002 kg/bag × Mo conversion factor
× number of bags used per year

[5] Releases of EG to air from the preparation tank

・Release from the air vent following the transfer from the additive dissolving tank:
Annual amount of EG released = refer to the Manual

・Release from the air vent by breathing of the preparation tank:
Annual amount of EG released = refer to the Manual

[6] Releases and transfers of EG and Mo at the time of changing the product of the preparation tank
(when the tank residual amount is unknown, 0.1vol% of the charge stock amount)

・Residual solution at the tank bottom: washed in common, and recovered by a container and disposed of as industrial waste.
Annual amount of EG transferred (kg/y)
= amount of tank residual solution (charge stock amount (kL)
× 0.1%/100) × residual solution density × EG blending amount%/100
× product changing times
Annual amount of Mo transferred (kg/y)
= amount of tank residual solution (charge stock amount (kL)
× 0.1%/100) × residual solution density
× sodium molybdate blending amount%/100 × Mo conversion factor
× use changing times

・Tank bottom residual solution: washed with water, and after wastewater treatment is performed, released to sewerage or water bodies
Annual amount of EG released or transferred (kg/y): refer to the above
Annual amount of Mo released or transferred (kg/y): refer to the above

[7] Release of EG from product tank

・Release from the air vent following the transfer from the preparation tank:
Annual amount of EG released = refer to the Manual

・Release from the air vent by breathing of the tank:
Annual amount of EG released = refer to the Manual

[8] Release of EG following the loading into the tank truck and container from the product tank

・Release from a manhole etc. following the transfer from the product tank <air>
Annual amount of EG released = refer to the Manual

[9] Releases and transfers of EG, and Mo caused by the operation of changing the product of the packing line, filling machine, and shipment line

・The fraction solution is recovered by a container and is disposed of as industrial waste
Annual amount of EG transferred (kg/y)
= fraction solution amount L/times × fraction solution density
× EG compounding amount% /100

× fraction discarding operation times
Annual amount of Mo transferred (kg/y)
= fraction solution amount L/times
× fraction solution density
× sodium molybdate compounding amount%/100
× Mo conversion factor × fraction discarding operation times

[10] Leakage of EG and Mo from the shipment line loading port and tank truck hose joint portion

･Leakage from the shipment line loading port and tank truck hose joint portion: EG 0.04kg/time
Annual amount of EG released and transferred (kg/y)
= 0.04kg/time × EG compounding amount%/100
× tank truck loading times per year
Annual amount of Mo released and transferred (kg/y)
= 0.04kg/time × sodium molybdate compounding amount%/100
× Mo conversion factor × tank truck loading times per year

[11] Releases and transfers of EG and Mo by the cleaning operation of the tank trucks and containers

･When the inside of tank truck and container are washed with water: The cleaning water is released to sewerage or water bodies after waste water treatment is performed.

(Notes: The residual amounts of tank truck are various according to the structure of pipelines and the pumps. The average value is supposed to be in the range of 0.5 – 10L (kg). If the average value of the company–owned trucks is unknown, the value 10L should be used.)

Annual amount of EG released or transferred (kg/y)
= tank truck residual solution amount × residual solution density
× EG compounding amount%/100 × cleaning times
Annual amount of Mo released or transferred (kg/y)
= tank truck residual solution amount × residual solution density
× sodium molybdate compounding amount%/100
× Mo conversion factor × cleaning times
<Container residual solution amount: if unknown, 0.5L/unit>
Annual amount of EG released or transferred (kg/y)
= container residual solution amount × residual solution density
× EG compounding amount%/100 × cleaning times
Annual amount of Mo released or transferred (kg/y)
= container residual solution amount × residual solution density
× sodium molybdate compounding amount%/100
× Mo conversion factor × cleaning times

### 5.1.5. Calculation and reporting of releases and transfers of Ethylene Glycol (EG) and Molybdenum (Mo)

The releases and transfers obtained in section 5.1.4 are totaled according to the media such as air, water, land, waste, etc., and each release and transfer ratio by percentage is calculated. The total release and transfer obtained by “mass balance” is proportionally distributed for checking and the results are reported using designated forms. The methods for calculating the amounts of EG and Mo released and transferred based on the total releases and transfers are described below.

Table 4 Method for proportionally allocating the total releases and transfers obtained from mass balance of EG to each release and transfer point

| | Total releases and transfers (kg/y) | Releases/transfers ratio (%) | EG releases and transfers to be reported (kg) |
|---|---|---|---|
| **1. Release to air** | a | a/AAA x 100 | Total amount of release and transfer kg x (a/AAA x 100)% ÷100 |
| **2. Releases and transfers:** | | | |
| **2-1 to water bodies (release)** | b-1 | b-1/AAA x 100 | Total amount of release and transfer kg x (b-1/AAA x 100)% ÷100 |
| **2-2 to sewerage (transfer)** | b-2 | b-2/AAA x 100 | Total amount of release and transfer kg x (b-2/AAA x 100)% ÷100 |
| **3. Release to land** | c | c/AAA x 100 | Total amount of release and transfer kg x (c/AAA x 100)% ÷100 |
| **4. Transfer as waste** | d | d/AAA x 100 | Total amount of release and transfer kg x (d/AAA x 100)% ÷100 |
| **5. Onsite landfills** | e | e/AAA x 100 | Total amount of release and transfer kg x (e/AAA x 100)% ÷100 |
| **Total** | AAA kg/y | 100% | Total amount of release and transfer |

Table 5 Method for proportionally allocating the total release and transfer obtained from mass balance of Mo to each release and transfer point

| | Total releases and transfers (kg/y) | Releases/transfers ratio (%) | Mo releases and transfers to be reported (kg) |
|---|---|---|---|
| **1. Release to air** | f | | 0 |
| **2. Releases and transfers:** | | | |
| **2-1 to water bodies (release)** | g-1 | g-1/BBB x 100 | Total amount of release and transfer kg x (g-1/BBB x 100)% ÷100 |
| **2-2 to sewerage (transfer)** | g-2 | g-2/BBB x 100 | Total amount of release and transfer kg x (g-2/BBB x 100)% ÷100 |
| **3. Release to land** | h | h/BBB x 100 | Total amount of release and transfer kg x (h/BBB x 100)% ÷100 |
| **4. Transfer in waste** | i | i/BBB x 100 | Total amount of release and transfer kg x (i/BBB x 100)% ÷100 |
| **5. Onsite landfills** | j | j/BBB x 100 | Total amount of release and transfer kg x (j/BBB x 100)% ÷100 |
| **Total** | BBB kg/y | 100% | Total amount of release and transfer |

### 5.1.6. Calculation examples of releases and transfers

Estimation example for each release and transfer point in the 5.1.4 (Procedure for estimating releases and transfers in the engine antifreeze coolant model manufacturing process) is shown below. (The numbers [1] through [11] affixed to the below correspond to the numbers in sections 5.1.1 Figure 1 and 5.1.4.)

<Calculation example>

- Annual amount of EG purchased: 4,500KL <acceptance of 450 times per year with 10KL tank truck >
- Annual amount of sodium molybdate used: 5,000kg <acceptance of 250 bags by 20kg bag>
- Annual amount of engine antifreeze coolant manufactured: 5,000KL
- Additive dissolving tank capacity: 5KL <sodium molybdate is dissolved with EG 4KL>
- Manufactured amount in the blending tank: 50KL/lot <manufacturing 100 lots per year >
- Engine antifreeze coolant composition (JACA standard composition):
  Refer to the standard composition in section 5.1.2.

[1] Releases and transfers at the time of acceptance of raw material

- In cases when there are leaking from the tank truck discharge port, hose joint and tank acceptance port at the time of acceptance.

Annual amount of EG released (kg/y)
= 0.04kg/time $\times$ acceptance times of tank truck per year (450 times)
= 0.04kg/time $\times$ 450
= 18.0kg/y

[2] Releases and transfers of EG from primary raw material tank

(1) Release from the air vent following the EG acceptance with the tank truck of 10KL (acceptance of 450 times/year)

Annual amount of EG released (kg/y)
= $A \times [(B \times E) \times D/(C \times 760)]/(22.4 \times 293/273)$ ( refer to the Manual )
= $5.5 \times 10^{-5} \times A \times B \times D \times E/C$
= $5.5 \times 10^{-5} \times 62.1 \times 10 \times 0.06 \times 450/1$
= 0.9 kg/y

<Calculation example>

| | | |
|---|---|---|
| **A Molecular weight** | **g/mol** | **62.1** |
| **B Solution charge amount** | **$m^3$/time** | **10** |
| **C Pressure inside tank** | **$kg/cm^2$** | **1** |
| **D Vapor pressure** | **mmHg/20℃** | **0.06** |
| **E Number of charging times per year** | **times/year** | **450** |
| **Average temperature** | **℃** | **20** |
| **Released amount per year** | **kg/y** | **0.9** |

(2) Release of EG from air vent due to breathing of tank:

Annual amount of EG Released (kg/y)
= $0.3 \times A \times (C/(B - C))^{0.68} \times D^{1.73} \times E^{0.51} \times F^{0.5} \times G \times H$
= $0.3 \times 62.1 \times (0.06/(760 - 0.06))^{0.68} \times 5.80^{1.73} \times 4.5^{0.51} \times 10^{0.5} \times 1.2 \times 0.8$
= 4.86 kg/y

|  |  |  |
|---|---|---|
| A Molecular weight | g/mol | 62.1 |
| B Average atmospheric pressure | mmHg | 760 |
| C Vapor pressure | mmHg | 0.06 |
| D Tank inner diameter (tank capacity 240kl) | m | 5.8 |
| E Average air space height * (tank height : 9m) | m | 4.5 |
| F Average outside air temperature difference | ℃ | 10 |
| G Tank color factor | Silver | 1.2 |
| H Correction factor for tanks of small diameters | Tank diameter (5～9m) | 0.8 |
| Released amount per year | kg/y | 4.86 |

Note*: When the average void height is unknown, it is estimated as half of the tank height.

[3] Releases and transfers of sodium molybdate at the time of charging the additive

- Residue in the bag of 20kg of sodium molybdate: 0.002kg/bag

Annual amount of Mo transferred (kg/y)
= 0.002kg/bag x Mo conversion factor
x the number of bags used per year
= 0.002kg x 0.397 x 250 bags = 0.198kg

[4] Releases or transfers of EG and Mo when changing the product of the additive dissolving tank

- Example of calculation condition: tank residual solution amount: unknown (When the tank residual solution amount is unknown, 0.1% of the charge stock amount should be used.)

<Calculation example>

50kg of sodium molybdate is dissolved with EG 4KL for dissolving additive
Times of additive dissolving tank used: 100 times
Change of product (what is accompanied by release and transfer)
: 50 times

(On the precondition of dissolving only sodium molybdate with EG: Weight ratio of EG 4KL : sodium molybdate 50kg = 99 : 1)

Annual amount of EG released or transferred (kg/y)
= (dissolving EG amount + sodium molybdate amount) x 0.1%/100
x EG weight ratio x use changing times
= (4435kg + 50kg) x 0.1/100 x 99/100 x 50 times
= 222kg/y

Annual amount of Mo released or transferred (kg/y)
= (Amount of EG used for dissolving
+ sodium molybdate compounding amount) x 0.1%/100
x sodium molybdate weight ratio x Mo conversion factor
x use changing times
= (4435kg + 50kg) x 0.1/100 x 1/100 x 0.397 x 50 times
= 0.89kg/y

[5] Release of EG to air from blending tank

Annual amount of EG released (kg/y)
= A **x** [(B **x** E) **x** D/(C **x** 760)]/(22.4 **x** 293/273)
= 5.5 **x** $10^{-5}$ **x** A **x** B **x** D **x** E/C
= 5.5 **x** $10^{-5}$ **x** 62.1 **x** 50 **x** 0.06 **x** 100 /1
= 1.02kg/y

<Calculation example>

| | | |
|---|---|---|
| **A Molecular weight** | **g/mol** | **62.1** |
| **B Average atmospheric pressure** | **mmHg** | **760** |
| **C Vapor pressure** | **mmHg** | **0.06** |
| **D Tank inner diameter (tank capacity 240kl)** | **m** | **5.8** |
| **E Average air space height * (tank height : 9m)** | **m** | **4.5** |
| **F Average outside air temperature difference** | **℃** | **10** |
| **G Tank color factor** | **Silver** | **1.2** |
| **H Correction factor for tanks of small diameters** | **Tank diameter (5～9m)** | **0.8** |
| **Released amount per year** | **kg/y** | **4.86** |

[6] Release/transfer of EG and Mo when changing the product in the blending tank

・Tank bottom residual solution: In the case where the number of product changing times is 50 times and the tank bottom residual solution is unknown. ( Table 2 )
Annual amount of EG released or transferred (kg/y)
(residual solution density = 1.129)
= tank residual solution amount (charge stock amount **x** 0.1%/100)
**x** residual solution density **x** EG compounding amount%/100
**x** use changing times
= 50KL **x** 1.129 **x** 0.1/100 **x** 89/100 **x** 50 times
= 2,512kg/y
Annual amount of Mo released or transferred (kg/y)
= Tank residual solution amount (charge stock amount **x** 0.1%)
**x** residual solution density
**x** sodium molybdate compounding amount%/100
**x** Mo conversion factor **x** use changing times
= (50KL **x** 0.1/100) **x** 1.129 **x** 0.1/100 **x** 0.397 **x** 50 times
= 1.12kg/y

[7] Release to air from the product tank (release following the transfer from the blending tank):

Annual amount of EG released (kg/y)
= A **x** [(B **x** E) **x** D/(C **x** 760)]/(22.4 **x** 293/273)
= 5.5 **x** $10^{-5}$ **x** A **x** B **x** D **x** E/C
= 5.5 **x** $10^{-5}$ **x** 62.1 **x** 50 **x** 0.06 **x** 100/1
= 1.0kg/y

<Calculation example>

| | | |
|---|---|---|
| **A Molecular weight** | **g/mol** | **62.1** |
| **B Solution charge amount** | **$m^3$/a time** | **50** |
| **C Pressure inside tank** | **$kg/cm^2$** | **1** |
| **D Vapor pressure** | **mmHg/20°C** | **0.06** |
| **E Number of charging times per year** | **times/year** | **100** |
| **Average temperature** | **°C** | **20** |
| **Released amount per year** | **kg/y** | **1** |

[8] Release of EG to air following the loading from the product tank to a tank truck and container

- EG release from the tank truck:

  Annual amount of EG released (kg/y)
  $= 5.5 \times A \times B \times C \times D \times E/10^5$
  $= 5.5 \times 10 \times 0.06 \times 62.1 \times 1.45 \times 300/10^5$
  = 0.89kg/y

<Calculation example>

| | | |
|---|---|---|
| **A Molecular weight** | **g/mol** | **62.1** |
| **B Solution charge amount** | **$m^3$/a time** | **50** |
| **C Pressure inside tank** | **$kg/cm^2$** | **1** |
| **D Vapor pressure** | **mmHg/20°C** | **0.06** |
| **E Number of charging times per year** | **times/year** | **100** |
| **Average temperature** | **°C** | **20** |
| **Released amount per year** | **kg/y** | **1** |

- EG release from container: refer to the above-described "Tank truck"

[9] Transfer by the change in the product of the packing line, filling machine and shipment line

- 10L is discarded from the packing line (fraction discarding operation times: 100 times/year), and is recovered by container and disposed as industrial waste:

  Annual amount of EG transferred (kg/y)
  = fraction-discarded solution amount L/time
  × discarded fraction solution density
  × EG compounding amount%/100
  × fraction discarding operation times
  $= 10L \times 1.129 \times 89/100 \times 100$ times
  = 1004.8kg/y

  Annual amount of Mo transferred (kg/y)
  = fraction-discarded solution amount L/time
  × fraction discarded solution density
  × sodium molybdate compounding amount/100
  × Mo conversion factor × fraction discarding operation times
  $= 10L \times 1.129 \times 0.1/100 \times 0.397 \times 100$ times
  = 0.45kg/y

- When 10L is discarded from the filling machine, recovered by container and disposed of as industrial waste: refer to the above-described packing line
- When 10L is discarded from the shipment line, recovered by container and disposed of as industrial waste: refer to the above-described packing line

[10] Leakage from loading port of the shipment line and tank truck hose joint portion

- Leakage from the shipment line loading port and tank truck hose joint portion: engine antifreeze coolants 0.04kg/time
  Annual amount of EG released or transferred (kg/y)
  = engine antifreeze coolants leakage amount g/time
  × EG compounding amount%/100
  × tank truck loading times per year
  = 0.04kg/time × 89/100 × 300 times
  =10.7kg/y
  Annual amount of Mo released or transferred (kg/y)
  = engine antifreeze coolants leakage amount kg/time
  × sodium molybdate compounding amount%/100
  × Mo conversion factor × tank truck loading times per year
  = 0.04 kg/time × 0.1/100 × 0.397 × 300 times
  = 0.005kg/y
- Leakage from the shipment line loading port and container joint portion: refer to the above-described shipment line

[11] Releases and transfers by the cleaning operation of tank truck and container

- When tank truck residual solution amount: 10L/truck, and cleaning times per year: 100 times
  Annual amount of EG released or transferred (kg/y)
  = tank truck residual solution amount × residual solution density
  × EG compound amount%/100 × cleaning times
  = 10L × 1.129 × 89/100 × 100 times
  = 1004.8kg/y
  Annual amount of Mo released or transferred (kg/y)
  = tank truck residual solution amount × residual solution density
  × sodium molybdate compound amount%/100
  × cleaning times amount × Mo conversion factor
  = 10L × 1.129 × 0.1/100 × 100 × 0.397
  = 0.45kg/y
- Container residual solution amount: refer to the above-described tank truck

<Reference> Summary of the examples of calculation of releases and transfers in section 5.1.6 (Table 6)

This summary is only a summation of the result of calculation examples stated above, and may be useful to overview the tendency of releases and transfers as a reference.

Table 6 Summary of the examples of calculation of releases and transfers

| Points of releases and transfers | Points of releases and transfers and the conditions of operations | EG Release・Transfer/Year (kg/y) | Mo Release・Transfer/Year (kg/y) | Classification as release or transfer |
|---|---|---|---|---|
| [1] | <Accept 450 times per year by 10kL tank truck><br>In cases when there are leaking from the tank truck discharge port, hose joint and tank acceptance port at the time of acceptance | 18 | 0 | 1.disposed of as industrial waste: transfer<br>2. washed with water and released to sewerage: transfer |
| [2] | <Accept 450 times per year by 10kL tank truck><br>Release from air vent of main raw material tank following the acceptance from a 10kL tank truck | 0.9 | 0 | Release<br>(air) |
| | <240kL tank><br>Release from the air vent by breathing of the tank | 4.86 | 0 | Release<br>(air) |
| [3] | <100 times Dissolution of 50kg sodium molybdate (250 bags), 50 times of product change ><br>Releases and transfers of sodium molybdate at the addition of the additive: Residue of sodium molybdate in the 20kg bags | *** | 0.198 | Transfer<br>(disposed of as industrial waste) |
| [4] | <Residual amount of the tank is unknown. 50kg of sodium molybdate was dissolved in 4kL of EG. Additive dissolution tank was used 100 times. Product change (with release and transfer): 50 times><br>Releases and transfers of EG and Mo by the product change of additive resolution tank | 222 | 0.89 | 1. Disposed of as industrial waste: transfer<br>2. Released to the sewerage after washing with water: transfer |
| [5] | <100 times of production by 50kL tank per year><br>Release to air from the preparation tank | 1.0 | 0 | Release<br>(air) |
| [6] | <Residual solution of the tank bottom: the amount of solution is unknown, 50 times of product change><br>Releases and transfers from the preparation tank by the operation of product change | 2,512 | 1.12 | 1. Disposed of as industrial waste: transfer<br>2. Released to the sewerage after washing with water: transfer |
| [7] | <100 times of production by 50kL tank per year><br>Release to air of the production tank by the transfer from the preparation tank | 1.0 | 0 | Release<br>(air) |
| [8] | <300 times of charging to the 10kL tank truck per year><br>Release to air from tank truck by charging from the product tank | 0.9 | 0 | Release<br>(air) |

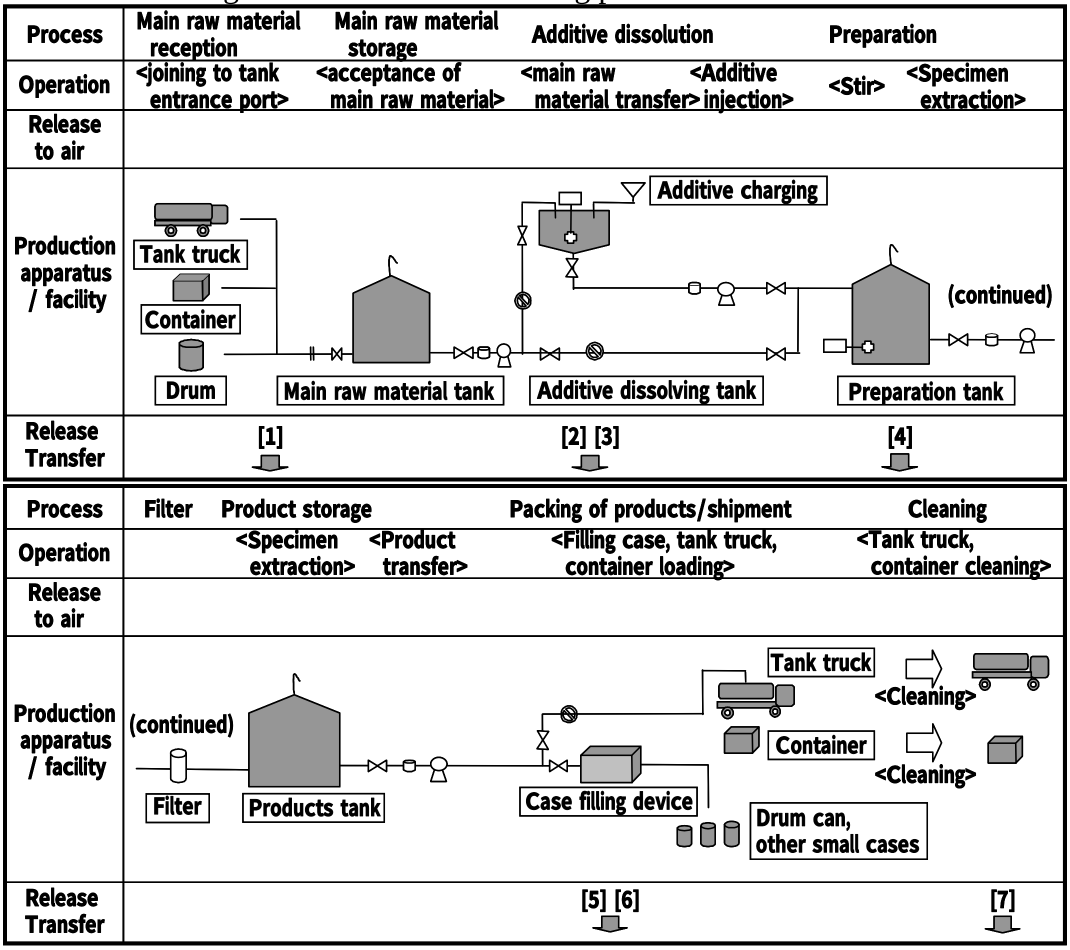
| Points of releases and transfers | Points of releases and transfers and the conditions of operations | EG Release・Transfer/Year (kg/y) | Mo Release・Transfer/Year (kg/y) | Classification as release or transfer |
|---|---|---|---|---|
| [9] | <100 times of 10L fraction omitting from packaging line per year><br>Releases and transfers from the product change operation of packaging line | 1004.8 | 0.45 | Disposed of as industrial waste:<br>Transfer |
| | <100 times of 10L fraction omitting from filling machine per year><br>Releases and transfers from the product change of the filling machine | 1004.8 | 0.45 | Disposed of as industrial waste:<br>Transfer |
| | <100 times of 10L fraction omitting from the shipment line per year><br>Releases and transfers from the product change operation of shipment line | 1004.8 | 0.45 | Disposed of as industrial waste:<br>Transfer |
| [10] | <100 times of charging to the tank truck><br>Leakage from shipment loading port and tank truck hose joint portion | 10.7 | 0.005 | 1. Recovered and disposed as industrial waste: transfer<br>2. Released to the sewerage after washing with water: transfer |
| [11] | <100 times of cleaning of tank truck: the residual solution is 10L><br>Releases and transfers from the cleaning operation of tank truck and container | 1004.8 | 0.45 | 1. Recovered and disposed of as industrial waste: transfer<br>2. Released to the sewerage after washing with water: transfer |
| | **Total weight** | **6,781.0** | **4.01** | |

## 5.2. Brake fluid

### 5.2.1. Outline of the model manufacturing process

The model manufacturing processes for brake fluid and the points of releases and transfers are shown below in Figure 2. (Numbers [1] through [7] affixed to the release and transfer points in Figure 2 correspond to the heading numbers of sections 5.2.4 and 5.2.6.)

Figure 2 Model manufacturing process of brake fluid



Notes: Outline of the manufacturing process of brake fluid

Brake fluid for automobile (JIS K2233) is the liquid to transmit the pressure to each wheel when the driver presses the brake pedal to stop or to reduce the speed of the automobile. Brake fluid is designated to the important part to keep security, and is required a severe reliability. Good performances of the pressure transmission, of the protecting metal parts of the braking system against corrosion and of the stability to rubber parts are required to the brake fluid.

Brake fluid contains glycolethers as a main ingredient added with anti-corrosive additives, anti-oxidants and anti-aging stabilizer for rubbers. The main facilities are the stock facilities for main raw materials and additives, equipments for blending additives, stock facilities for products (tanks, warehouses) and equipments for filling and shipment. The moistureproofing of the whole process is important.

Since brake fluid fall under The Fire Service Law as a Class 4 dangerous chemicals of category 3 petroleum product, the facilities should be qualified for The Fire Service Law.

### 5.2.2. Standard composition

The model composition of the brake fluid determined by JACA is shown in Table 7. (This model composition is quoted from the “Standard for Preparing MSDS” by JACA.)

Table 7 Model composition of brake fluid

| Chemical substance | CAS No | Ratio (weight %) |
|---|---|---|
| Boric acid ester | 71243-41-9 | 35 |
| Glycol ether |  | 53 |
| Polyglycol |  | 10 |
| Bisphenol A | 80-05-7 | 1 |
| Antioxidant |  | 0.4 |
| Anticorrosive |  | 0.6 |

### 5.2.3. Main PRTR chemicals and their physical properties

Table 8 Physical properties of PRTR chemicals

| Chemical substance | Boric acid ester | Bisphenol A |
|---|---|---|
| Number specified in Cabinet Order | 304 (Boron and its compound) | 29 |
| CAS No. | 71243-41-9 | 80-05-7 |
| Composition formula | $(CH_3(OC_2H_4)_3O)_3B$ | $C_{15}H_{16}O_2$ |
| Molecular weight | 500.47 | 228.3 |
| Melting point (°C) | <40°C | 150-155°C |
| Boiling point (°C) | >150°C | 220°C (4mmHg) |
| Vapor pressure (mmHg) | *** | $4x10^{-8}$ mmHg (25°C) |
| Water solubility | *** | 120mg/L (25°C) |
| Octanol-water partition coefficient (Log Pow) | *** | 3.32 |
| Density | 1.04 | 1.195 (25°C) |
| Conversion factor | 0.0216 | *** |

(Notes: Releases to air of boric acid ester and bisphenol A could be regarded as zero.)

### 5.2.4. Method for estimating releases and transfers

(Numbers [1] through [7] affixed to the release and transfer points correspond to the numbers in sections 5.2.1 Figure2 and 5.2.6.)

(1) Releases / transfers at the acceptance of the main raw materials

Boric acid ester <from tank truck>

- Leakage from the tank truck discharge port, hose joint portion and tank reception port: 40g/time (= 0.04kg/time)

Annual amount of boron released / transferred

= 0.04 kg/time × (B content (%)/100) × acceptance times per year

(Notes: The boron is expressed as B in the following equations.)

Boric acid ester <from container>

- Leakage from the container discharge port, hose joint portion and tank reception port: 40g/time (= 0.04kg/time)

Annual amount of boron released / transferred

= 0.04 kg/time x (B content (%)/100) x acceptance times per year

Boric acid ester: <from drum cans>

- Leakage at the time of transfer from the drum can to the main raw material tank: 40g/time (= 0.04kg/time)

Annual amount of boron released / transferred
= 0.04 kg/time x (B content (%)/100) x acceptance times per year

(2) Transfers at the dissolution of additives

- Residue in the bag of 20kg of bisphenol A: 2g/bag (= 0.002kg/bag)

Annual amount of bisphenol A transferred (kg/y)
= 0.002 kg/bag x number of bags used per year

(3) Transfers at the operation of the product change of the dissolving tank of additives

- Residual solution at the tank bottom + recovered common cleaning solution: Recovered in a container and is disposed of as industrial waste.

Annual amount of boron or bisphenol A transferred (kg/y)
= average amount of tank residual solution (kL)
x density of residual solution x content of [B(%) or BPA(%)]/100
x operation times per year

(Notes: Bisphenol A is expressed as BPA in the equations. When the amount of tank residual solution is unknown, 0.1vol% of the prepared amount may be used.)

(4) Transfers at the time of changing the product in the preparation tank

- Residual solution at the tank bottom + recovered common cleaning solution: Recover in a container and dispose as industrial waste.

Annual amount of boron or bisphenol A transferred (kg/y)
= average amount of tank residual solution(kL)
x density of residual solution x content of [B(%) or BPA(%)]/100
x operation times per year

(Notes: When the amount of tank residual solution is unknown, 0.1vol% of the prepared amount may be used.)

(5) Transfers caused by the operation of the product change of the packing line, filling machine and shipment line

- When fraction discarded: Recovered by a container and disposed of as industrial waste

Annual amount of boron or bisphenol A transferred (kg/y)
= average amount of fraction solution (kL)
x density of the solution x content of [B(%) or BPA(%)]/100
x operation times per year

(6) Releases / transfers at the shipment of products

- Leakage from the hose joint portion of the shipment line loading port to tank trucks and containers:

Annual amount of boron or bisphenol A transferred (kg/y)
= 0.04kg/times x content of [B(%) or BPA(%)]/100

× shipment times per year

(7) Transfers by the cleaning operation of the tank trucks and containers

(Notes: The residual amounts in tank truck are various according to the structure of pipelines and the pumps. The average value is supposed to be in the range of 0.5 – 10L(kg). If the average value of the company owned truck is unknown, the value 10L should be used.)

- Transfer from tank trucks

Annual amount of boron or bisphenol A transferred (kg/y)
= tank truck residual solution(kg)/time
× content of [B(%) or BPA(%)]/100 × cleaning times per year

- Containers:

Average amount of the residual solution = 0.5 kg/time
Annual amount of boron or bisphenol A transferred (kg/y)
= container residual solution (kg)/time
× content of [B (%) or BPA(%)]/100 × cleaning times per year

### 5.2.5. Calculation and reporting of releases and transfers of Boron (B) and Bisphenol A (BPA)

(1) Calculate total releases and transfers by the mass balance

[total releases and transfers]
= [amount accepted of raw materials in the reporting year × content
+ stock at previous year × content (product and raw material)]
- [amount shipped as products in the reporting year × content
+ stock at the reporting year (product and raw material)]

(2)-1 Transfer as industrial waste only, without releases to the land and on-site landfills

Since releases to air are regarded as zero, the total releases and transfers are regarded as equal to transfers as waste.

[total releases and transfers] = [transfers as waste]

(2)-2 In case there are releases to land and on-site landfills:

The ratio of each point of release and transfer in Table 9 below is calculated by the totaled amount of release to land, landfill and, transfer as waste.

(3) Method for proportionally allocating the total releases and transfers obtained from mass balance

Table 9 Method for proportionally allocating the total releases and transfers of Boron obtained from mass balance to each release and transfer point

| | Total releases and transfers (kg/y) | Releases/transfers ratio (%) | Releases and transfers to be reported (kg) |
|---|---|---|---|
| Release to land | a | a/AAA x 100 | Total amount of release and transfer kg x (a/AAA x 100)% ÷100 |
| Transfer as waste | b | b/AAA x 100 | Total amount of release and transfer kg x (b/AAA x 100)% ÷100 |
| On-site landfills | c | c/AAA x 100 | Total amount of release and transfer kg x (c/AAA x 100)% ÷100 |
| Total | AAA | 100 | Total amount of release and transfer |

Table 10 Method for proportionally allocating the total releases and transfers of bisphenol A obtained from mass balance to each release and transfer point

| | Total releases and transfers (kg/y) | Releases/transfers ratio (%) | Releases and transfers to be reported (kg) |
|---|---|---|---|
| Release to land | d | d/BBB x 100 | Total amount of release and transfer kg x (d/BBB x 100)% ÷100 |
| Transfer as waste | e | e/BBB x 100 | Total amount of release and transfer kg x (e/BBB x 100)% ÷100 |
| On-site landfills | f | f/BBB x 100 | Total amount of release and transfer kg x (f/BBB x 100)% ÷100 |
| Total | BBB | 100 | Total amount of release and transfer |

### 5.2.6. Calculation examples of releases and transfers

(1) The total amount of releases and transfers under the conditions shown in the tables below

a. Brake fluid (calculation example)

| | |
|---|---|
| Amount of products shipped (kL) | 10kL tank truck x 100<br>18L can x 50,200 |
| Amount of products shipped (kg) | 1,999,784 (kg) |
| Indicated volume of 18L can | 18L (18.9 kg) |
| Filling up amount of 18L can | 18.92 kg |
| Product stock amount of the previous year | 4,000 kg |
| Product stock amount of the reporting year | 3,200 kg |
| Density | 1.05 |
| Content of boric acid ester | 10% |
| Content of boron | 0.15% |
| Content of bisphenol A | 1% |

b. Mixture of boric acid ester (calculation example)

| | |
|---|---|
| Purchased amount of boric acid ester | 200,000 kg |
| Boric acid ester stock amount of the previous year | 1,000 kg |
| Boric acid ester stock amount of the reporting year | 1,000 kg |
| B content in the boric acid ester | 1.5% |

c. Bisphenol A (calculation example)

| | |
|---|---|
| **Purchased amount of bisphenol A** | **20,000 kg** |
| **Bisphenol A stock amount of the previous year** | **20 kg** |
| **Bisphenol A stock amount of the reporting year** | **20 kg** |

Total releases and transfers of boron (kg/y)
= [(200000 x 1.5/100) + (4000 x 0.15/100) + (1000 x 1.5/100)]
- [(1999784 x 0.15/100) + (3200 x 0.15/100) + (1000 x 1.5/100)]
= 1.52

Total releases and transfers of bisphenol A (kg/y)
= [20000 + (4000 x 1/100) + 20]
- [(1999784 x 1/100) + (3200 x 1/100) + 20]
= 10.16

(2)-1 Transfer as industrial waste only, without releases to the land and on-site landfills

[total releases and transfers] = [transfers as waste]

Transfers as waste of boron = 1.52 (kg/y)
Transfers as waste of bisphenol A = 10.16 (kg/y)

(2)-2 In cases where released to land and on-site landfills

◆ Calculate the releases and transfers from the each points ([1] to [7]) of section 5.2.4

[1] Accept a raw material (boric acid ester : B = 1.5%) by 10kL tank truck 20 times a year: Release to land of the leakage from the joint of tank at the time of acceptance:

The amount released to land of boron (kg/y)
= 0.04kg/time/y x 1.5%/100 x 20times = 0.012kg/y

[2] Transfer as waste of bisphenol A from the production of 50t (1% content of bisphenol A) by 40 times per year

The amount used of bisphenol A:
50,000kg x 1%/100 = 500kg <20kg bag x 25>
Residual amount left in 20kg bags:
0.002kg/bag x 25bags = 0.05kg
The amount of transfer of bisphenol A (kg/y)
= 0.05kg/time x 40times/y = 2kg/y

[3] Transfer as waste of bisphenol A by 10 times of the product change of the additives dissolving tank (2t)、 after dissolving 500kg of bisphenol A in 1500kg of solvent.

The content of bisphenol A in solution: =500kg/2000kg x 100 = 25%
Residual solution in the tank: = 2000kg x 0.1%/100 = 2kg
The amount of transfer of bisphenol A (kg/y)
= 2kg x 25%/100 x 10times/y = 5kg/y

[4] Transfers as waste by 10 times of product change of the preparation tank (50t) after the production of the brake fluid

Residual solution in the tank: = 50t x 0.1%/100 = 50kg

The amount of transfer of boron (kg/y)
= 50kg/time x 10times/y x 0.15%/100 = 0.75kg/y
The amount of transfer of bisphenol A (kg/y)
= 50kg/time x 10times/y x 1%/100 = 5kg/y

[5] Transfers caused by the operation (20 times per year) of the product change of the packing line and filling machine with recovery of the fraction discarded (20L )each time

The amount of recovery of brake fluid per year
= 20L x 1.05g/cm3 x 20times/y = 420kg/y
The amount of transfer of boron (kg/y)
= 420kg/y x 0.15%/100 = 0.63kg/y
The amount of transfer of bisphenol A (kg/y)
= 420kg/y x 1%/100 = 4.2kg/y

[6] Releases to land from the leakage from the tank truck by 100 times of product loading

The amount of release of bisphenol A (kg/y)
= 0.04kg/time x 100times/y x 1%/100 = 0.04kg/y
The amount of release of boron (kg/y)
= 0.04kg/time x 100times/y x 0.15%/100 = 0.006kg/y

[7] Transfers as waste from the tank truck by the cleaning operation of 20 times per year (The average value of the residual solution in the tank truck is supposed to be in the range of 0.5 - 10L (kg)/truck, however, the value of 0.5kg/truck is adopted here.)

Residual amount of tank truck: 0.5kg/truck
The amount of transfer of bisphenol A (kg/y)
= 0.5kg/time x 1%/100 x 20times/y = 0.1kg/y
The amount of transfer of boron (kg/y)
= 0.5kg/time x 0.15%/100 x 20times/y = 0.015kg/y

◆ Calculate the reporting values of releases and transfers from the ratio of each release and transfer

Table 11 Reporting values of releases and transfers of boron

| | Total amount per year (kg/y) | Ratio of releases and transfers (%) | Reporting value of releases and transfers (kg/y) |
|---|---|---|---|
| 1. Release to land | 0.02 | 1.4 | 0.02 |
| 2. Transfer as waste | 1.39 | 98.6 | 1.5 |
| 3. On-site landfill | 0 | 0 | 0 |
| Total | 1.41 | 100 | 1.52 |

Table 12 Reporting values of releases and transfers of bisphenol A

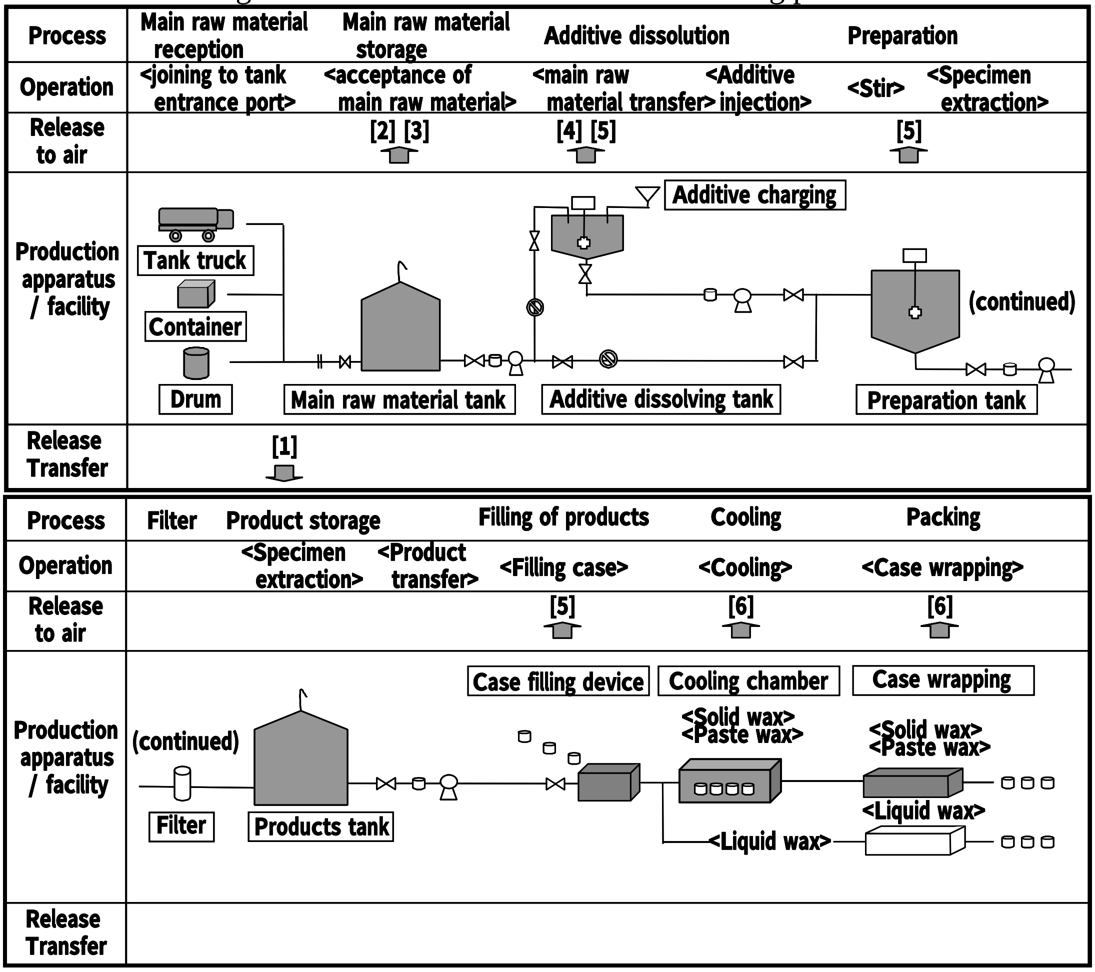
| | Total amount per year (kg/y) | Ratio of releases and transfers (%) | Reporting value of releases and transfers (kg/y) |
|---|---|---|---|
| 1. Release to land | 0.04 | 0.24 | 0.02 |
| 2. Transfer as waste | 16.3 | 99.76 | 10.14 |
| 3. On-site landfill | 0 | 0 | 0 |
| Total | 16.34 | 100 | 10.16 |

## 5.3. Wax

### 5.3.1. Outline of the model manufacturing processes

The model manufacturing processes for wax and the points of releases and transfers are shown below in Figure 3. (Numbers [1] through [6] affixed to the release and transfer points in Figure 3 correspond to the heading numbers of sections 5.3.4 and 5.3.6.)

Figure 3 Outline of the model manufacturing process



Notes: The outline of manufacturing process of wax polish

The wax polish (JIS K2236) for polishing the coated surface of automobiles has many kinds of products. Typical examples are polish waxes, polish coating agents and the wax for the automobile washing machines, having the form of solid, paste and liquid. There are also the forms of products like an aerosol bomb or a spray.

The main components of the wax polish are waxes, silicones and solvents added with polishers and perfumes. The main manufacturing facilities are the stock facilities for raw materials and additives, blending equipments for additives, stock facilities for products and equipments for filling and refrigeration. (The aerosol products are consigned to the loader company.)

### 5.3.2. Standard composition

The standard compositions of the wax polish determined by JACA are shown in Tables 13 to 16. (This model composition is quoted from the “ Standard for Preparing MSDS “ by JACA.)

Table 13 The model composition of solid wax

| | Content (weight%) | Percentage of volatile content (kerosene, mineral terpene) (weight %) |
|---|---|---|
| Diatom earth | 4 | |
| Carnauba wax | 10 | |
| Paraffin wax | 6 | |
| Hoechst wax | 7 | |
| Kerosene | 33 | [33/(33+30)] x 100 = 52.4 |
| Silicone | 10 | |
| Mineral terpene | 30 | [30/(33+30)] x 100 = 47.6 |

Table 14 The model composition of paste wax

| | Content (weight%) | Percentage of volatile content (kerosene, water) (weight %) |
|---|---|---|
| Carnauba wax | 4 | |
| Paraffin wax | 5 | |
| Silicone | 16 | |
| Kerosene | 36 | 59 |
| Diatom earth | 8 | |
| Nonionic surfactant | 2 | |
| Carboxymethylcellulose | 2 | |
| Water | 25 | 41 |

Table 15 The model composition of liquid wax

| | Content (weight%) | Percentage of volatile content(kerosene, mineral terpene, water) (weight %) |
|---|---|---|
| Hoechst wax | 2 | |
| Paraffin wax | 6 | |
| Silicone | 1.5 | |
| Kerosene | 10 | 12.4 |
| Diatom earth | 10 | |
| Mineral terpene | 16.5 | 20.5 |
| Water | 54 | 67.1 |

Table 16 The model composition of the wax for automobile washing machines

| | Content (weight%) | |
|---|---|---|
| **Carnauba wax** | **5** | |
| **Paraffin wax** | **2** | |
| **Liquid paraffin** | **4** | |
| **Cationic surfactant** | **7** | **Calculate as bis(hydrogenated tallow) dimethylammonium chloride** |
| **Nonionic surfactant** | **2** | |
| **Ethylene glycol** | **10** | |
| **Water** | **70** | |

### 5.3.3. Main PRTR chemicals and their physical properties

The main PRTR chemicals are shown in Table 17. Where except for ethylene glycol and bis(hydorgenenated tallow)dimethylammonium chloride, the chemical substances are possibly contained in kerosene and mineral terpene. In Table 18, examples of physical properties of kerosene and mineral terpene are shown.

In the listed PRTR chemicals, when the content of benzene is equal to 0.1% or more and 1% for toluene, xylene and ethylbenzene, the product fall under the PRTR law. The composition of the petroleum products like kerosene and mineral terpene is not uniform depending on the kind of the crude oil used, by the process of refinery and the condition of the refinement. The composition should be confirmed by the MSDS or the test data from the producer. The content of xylene in kerosene in Table 19 is shown in the range of 0.5 – 2.0%, however, the maximum value 2.0 should be adopted and kerosene should be treated as PRTR subject product.

Table 17 PRTR chemicals and their physical properties

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Chemical substance** | **Benzene** | **Toluene** | **Xylene** | **Ethylebenzene** |
| | **Possibly contained in kerosene and mineral terpene** | | | |
| **Number specified in Cabinet Order** | **299** | **227** | **63** | **40** |
| **CAS No.** | **71-43-2** | **108-88-3** | **1330-20-7** | **100-41-4** |
| **Composition formula** | $C_6H_6$ | $C_7H_8$ | $C_8H_{10}$ | $C_8H_{10}$ |
| **Molecular weight** | **78.1** | **92.1** | **106.2** | **106.2** |
| **Melting point (°C)** | **5.5** | **-95** | ******* | **-95** |
| **Boiling point (°C)** | **80.1** | **111** | **137-140** | **136.2** |
| **Vapor pressure (mmHg)** | **100 (@26.1°C)** | **36.7 (@30°C)** | **7.99 (@25°C)** | **10 (@25.9°C)** |
| **Water solubility @25°C** | **1.8 g/L** | **0.54-0.58 g/L** | **130 mg/L** | **0.14 g/L** |
| **Octanol-water partition coefficient (Log Pow)** | **2.13** | **2.69** | **3.12-3.20** | **3.15** |
| **Density** | **0.8787 (@15°C)** | **0.8661 (@20°C)** | **0.864 (@20°C)** | **0.867 (@20°C)** |

Table 18 Continued

| | 5 | 6 |
|---|---|---|
| **Chemical substance** | **Bis(hydorgenenated tallow)dimethylammonium chloride** | **Ethylene glycol** |
| **Number specified in Cabinet Order** | **251** | **43** |
| **CAS No.** | **61789-80-8** | **107-21-1** |
| **Composition formula** | **Mixture: example**<br>$(C_{18}H_{37})_2N(CH_3)_2Cl$<br>$(C_{16}H_{33})_2N(CH_3)_2Cl$<br>$(C_{14}H_{29})_2N(CH_3)_2Cl$ | $C_2H_6O_2$ |
| **Molecular weight** | **Not available** | **62.1** |
| **Melting point (°C)** | **61 (diluted with solvent: market product)** | **-13** |
| **Boiling point (°C)** | **NA** | **197.6** |
| **Vapor pressure (mmHg)** | **NA** | **0.06 (@20°C)** |
| **Water solubility @25°C** | **NA** | **Miscible** |
| **Octanol-water partition coefficient (Log Pow)** | **NA** | **-1.36** |
| **Density** | **Mixture: example calculated 0.92** | **1.1088 (@20°C)** |

Table 19 Physical properties of kerosene and mineral terpene

| | Kerosene | Mineral terpene |
|---|---|---|
| **Density (g/cm$^3$)** | **0.79 (@15°C)** | **0.79 (@4°C)** |
| **Vapor pressure (mmHg)** | **NA** | **NA** |
| **Content of xylene (%)** | **0.5-2.0** | **2.5** |

### 5.3.4. Method for estimating releases and transfers

Here, estimation is made on the assumption that “xylene” is the only PRTR chemical contained in kerosene and mineral terpene.

[1] Releases and transfers at the time of acceptance of kerosene and mineral terpene:

(1) Tank truck acceptance

･Leakage from the tank truck discharge port, hose joint portion and tank acceptance port: 40g/time (= 0.04kg/time)

Annual amount of xylene released (kg/y)
= 0.04kg/time X xylene content weight%/100
X acceptance times per year

Note 1: The amount of xylene released is calculated based on the above-described estimation formula at each time of acceptance of kerosene and mineral terpene, respectively

Note 2: If any other PRTR chemical exist, estimation is made using the above-described estimation formula.

(2) Drum can acceptance

･Leakage at the time of transfer from the drum can to primary raw material tank: refer to the above-described tank truck acceptance

[2] Releases / transfers at the time of acceptance of ethylene glycol:
Refer to the sections 5.1.4 [1] and 5.1.6 [1] concerning engine antifreeze coolants.

[3] Releases and transfers from the primary raw material tank

(1) Ethylene glycol:

- Release from the air vent following acceptance from tank truck, drum etc.: Refer to the sections 5.1.4 [2] and 5.1.6 [2] concerning engine antifreeze coolants.
- Release from the air vent by breathing of the primary raw material tank: as above

(2) Kerosene, mineral terpene:

- Release from the air vent by acceptance into the primary raw material tank and breathing of the tank: There is no estimation formula available to the public at present. Accordingly, the released amount to air is considered to be included in the total released amount based on mass balance, and the released amount to air is regarded as 0.

[4] Release at the time of blending of bis (hydrogenated tallow)dimethyl ammonium chloride

- Release at the time of charge to the additive dissolving tank: refer to the sections 5.1.4 [4] and 5.1.6 [4] concerning engine antifreeze coolants

[5] The amount released in the blending process and filling process

Because the temperatures of each component in the blending process and of product in the filling process are still high, volatile components are released outside the system. Accordingly, the amount released to air is calculated by the amount decreased, that is (the charge stock amount minus the amount of product) multiplied by the proportion of each covered substance contained in the compounded volatile components.

(1) The amount decreased (kg/y)
= [ charge stock amount (kg) - (filled weight (kg)
× (the number of units produced) - waste solution (kg)]

(2) Amount of xylene released from kerosene
= the amount decreased (kg/y) × kerosene content %/100
× xylene content ratio in kerosene %/100

(3) Amount of xylene released from mineral terpene
= the amount decreased (kg/y) × mineral terpene content %/100
× xylene content in mineral terpene %/100

[6] Amount released in the cooling/packing process

Because the temperatures of products are still high, the volatile components are released outside the system while they are transferred to the cooling process and a cap is applied to the container in the packing process. Accordingly, the amount released of the volatile components is calculated by the amount decreased per unit, that is the amount subtracting the product average weight before packing from the average filling weight (the amount with the estimation of loss of volatile components), multiplied by the number of manufactured units.

(1) Amount of volatile components released (kg/y)
= [average filling weight (kg) - average product weight before packing (kg)]
× the number of manufactured units per year

(2) Amount of xylene released
· Amount of xylene contained in kerosene
= released amount (kg)
× kerosene ratio in the volatile component %/100
× xylene content %/100
· Amount of xylene contained in mineral terpene
= released amount (kg/y)
× mineral terpene ratio in the volatile component %/100
× xylene content %/100

Note 1: released amount to water bodies and land is supposed to be 0.
Note 2: transferred amount is 0.

### 5.3.5.Method for summing up releases and transfers

The sum total is obtained for each PRTR chemical obtained in the aforementioned paragraph 5.3.4 [1] through [5], and the releases and transfers should be estimated.

(1) Amount of xylene transferred = the aforementioned section 5.3.4 [1]
Note 1: The transfer amount is 0 when the recovered solution is reused
Note 2: When the recovered solution is disposed of as industrial waste, the amount of the PRTR chemical transferred is calculated by multiplying the recovered solution amount by the ratio of the PRTR chemicals containing components and the content ratio of the PRTR chemical in the components

(2) Ethylene glycol = the aforementioned paragraph 5.3.4 [2]
Note 1: When the recovered part is reused: the transferred amount is 0
Note 2: When it is disposed of as industrial waste: it is calculated as the transferred amount

(3) Bis (hydrogenated tallow) dimethyl ammonium chloride: refer to the aforementioned paragraph 5.3.4 [3]
Note 1: When the recovered part is reused: the transferred amount is 0
Note 2: When it is disposed of as industrial waste: it is calculated as the transferred amount

(4) Amount of xylene released (to air) = the aforementioned 5.3.4 [4] + [5]
Note 1: When the recovered solution is reused, the transferred amount is 0
Note 2: When the recovered solution is disposed of as industrial waste, the amount of xylene transferred is calculated by multiplying the recovered solution amount by the ratio of the xylene containing components and the content of xylene in the components

### 5.3.6. Examples of estimating releases and transfers

Methods for estimating releases and transfers are described for production lots of solid, paste and liquid wax which are manufactured by different processes, and a lot of wax for car washing machine which have different composition.

### 5.3.6-1 Solid wax

When raw material of 720kg of the above-described compounding composition is charged in the blending tank of 1t, 2813 products (filled weight per product: 242.0g = 0.242kg) with indicated weight of 240g (0.24kg) each are obtained, and waste solution of 13.8kg is recovered.

[1] Amount released in the blending and filling process

(1) Amount of volatile components released (kg)

= charge stock amount kg - (filled weight kg
× the number of manufactured units) - recovered solution kg
= 720kg - (0.242 × 2813) - 13.8
= 25.45kg

(2) Amount of xylene released

When kerosene contains 2.0% of xylene, and mineral terpene 2.5% of xylene and the other PRTR designated chemical substance less than 1.0%.

· Amount of xylene contained in kerosene
= Amount of volatile components released kg
× kerosene ratio in the volatile component %/100 × xylene content
= 25.45 × (52.4/100) × (2.0/100)
= 0.267kg

· Amount of xylene contained in mineral terpene
= Amount of volatile components released kg
× mineral terpene ratio in the volatile component weight%/100
× xylene content
= 25.45 × (47.6/100) × (2.5/100)
= 0.303kg

[2] Amount released in the cooling/packing process

(1) Amount of volatile components released (kg)

= (average filled weight kg - weight before packing kg)
× the number of manufactured units
= (0.242 - 0.240) × 2813
= 5.63kg,

where the average filled weight: 0.242kg, the average weight of product before packing: 0.240kg

(2) Amount of xylene released

· Amount of xylene contained in kerosene
= Amount of volatile components released kg
× kerosene ratio in the volatile component %/100 × xylene content
= 5.63 × (52.4/100) × (2.0/100)
= 0.059kg

· Amount of xylene contained in mineral terpene
= Amount of volatile components released
× kerosene ratio in the volatile component % × xylene content
= 5.63 × (47.6/100) × (2.5/100)

= 0.067kg

[3] Amount of xylene released in the blending, filling, cooling and packing process

The total sum is obtained for each PRTR designated chemical substance in each process and the released amount is calculated.

Amount of xylene released (to air )

= 0.267 + 0.303 + 0.059 + 0.067 = 0.696 kg

### 5.3.6-2 Paste wax

When raw material of 1800kg of the above-described compounding composition is charged in the preparation tank of 2t, 8250 products (filled weight per product: 0.204kg) with indicated weight of 0.2kg each are obtained, and waste solution of 100.0kg is recovered.

[1] Releases at the preparation and the filling operation

(1) Releases of volatile component

= charge amount – (filled amount x number of products)
– recovered solution

= 1800 – (0.204 x 8250) – 100 = 17.0kg

(2) Releases of xylene

2.0% of xylene is contained in kerosene, and less than 1% of other PRTR chemicals are contained.

· Amount of xylene contained in kerosene
= Amount of volatile components released kg
x kerosene ratio in the volatile component %/100 x xylene content
= 17.0 x (59.0/100) x (2.0/100) = 0.2006kg

[2] Amount released in the cooling/packing process

(1) Amount of volatile components released (kg)
= (average filled weight kg - weight before packing kg)
x the number of manufactured units
= (0.204 - 0.2005) x 8250
= 28.875kg

average filled weight: 0.204kg,
average weight of product before packing: 0.2005kg

(2) Amount of xylene contained in kerosene released
= Amount of volatile components released kg
x kerosene ratio in the volatile component %/100 x xylene content
= 28.875 x (59.0/100) x (2.0/100) = 0.3407kg

[3] Amount of xylene released in the blending, filling, cooling and packing process

From the released amount obtained for each PRTR designated chemical substance in each process, the total released amount is calculated.

Amount of xylene released
= 0.2006 + 0.3407 = 0.541 kg

### 5.3.6-3 Liquid wax

When raw material of 1800kg of the above-described compounding composition is charged in the preparation tank of 2t, 5900 products (filled weight per product: 301.0g) with indicated weight of 300g each are obtained, and waste solution of 10.0kg is recovered.

[1] Releases of volatile component at the preparation and the filling operation

(1) Releases of volatile component

= charge amount – (filled amount × number of products)
- recovered solution
= 1800 – (301.0 × 5900/1000) – 10.0 = 14.1kg

(2) Releases of xylene contained in kerosene

2.0% of xylene is contained in kerosene, and less than 1% of other PRTR chemicals are contained

= Amount of volatile components released kg
× kerosene ratio in the volatile component %/100 × xylene content
= 14.1 × (12.4/100) × (2.0/100) = 0.035kg

[2] Amount of xylene released in the blending and filling operation

From the released amount obtained for each PRTR designated chemical substance in each process, the total released amount is calculated.

Amount of xylene released (to air)
= 0.035kg

### 5.3.6-4 Liquid wax for car washing machine

When 1000kg of raw material of the above-described composition is charged in the blending tank of 1000kg, and 55 products (filled weight per product: 18.1kg) of the product indication weight of 18kg each are obtained,

(1) Amount transferred at the time of blending and filling

= raw material charge stock amount kg
- (filled amount kg × number of products)
= 1000 - (18.1 × 55) = 1000 - 995.5
= 4.5kg (calculate as product wastage)

(2) Calculating amounts released and transferred

・Bis(hydrogenated tallow)dimethylammonium chloride amount in 4.5kg of product wastage

4.5kg × 4.0/100 = 0.18kg

・Ethylene glycol amount in 4.5kg of product wastage

4.5kg × 1.0/100 = 0.045kg

## 6. Simplified calculation method by the mass balance

### 6.1. Engine antifreeze coolant

A simplified calculation method by mass balance is given below. For checking the value obtained by the method in section 5.1, the simplified calculation method by the mass balance which uses the average operation factor and the estimation equation of the industry is effective. Care must be taken, however, the higher value might be obtained by the simplified calculation than that of by section 5.1, because the maximum values are adopted for each operation. When the data of each process or the actual conditions are not clear, the simplified calculation method is one choice. Basically, it is advisable to adopt the calculation method of 5.1 above mentioned, with the data by actual measurement based on the actual operation conditions.

a. Confirm the name and the content of PRTR chemicals by the MSDS of the chemical products used in the composition table

b. The calculation of the amount of loss (R) is performed by the equation below. Either the average yield of the industry or the company's average yield can be used.

Amount of loss = charge amount – (charge amount x yield) = R

c. Distribution factor of the amount of loss

The distribution of the amount of loss (R) is calculated by the distribution factor below.

d. Releases to the air and the land are regarded as zero.

Distribution factor of engine antifreeze coolant

| | |
|---|---|
| **Preparation loss** | **R x 0.02279** |
| **Filling loss** | **R x 0.81984** |
| **Test sample loss** | **R x 0.01215** |
| **Stock sample loss** | **R x 0.01215** |
| **Waste** | **R x 0.09919** |
| **Waste cloth and others** | **R x 0.03388** |
| **Total of distribution factor** | **1.0000** |

[An example of the production]

Charge amount 5000kg
Average yield 98%
PRTR chemicals
Ethylene glycol 90%
$Na_2MoO_4 \cdot H_2O$ 0.5% (Conversion factor 0.397 )
R = 5000 – (5000 x 0.98) = 100kg

| | | |
|---|---|---|
| **Preparation loss** | **2.2790** | **Recovered and disposed of as waste: Transfer**<br>**Release to sewerage: Transfer**<br>**Release to water bodies: Release** |
| **Filling loss** | **81.9840** | **Transfer** |
| **Test sample loss** | **1.2150** | **Disposed of as waste: Transfer** |
| **Stock sample loss** | **1.2150** | |
| **Waste** | **9.9190** | **Transfer** |
| **Waste cloth and others** | **3.3880** | **Transfer** |
| **Total loss** | **100** | |

EG = 100.0 x 90/100 = 90.0kg

Mo = 100.0 x 0.5/100 x 0.397 = 0.1985kg

## 6.2. Brake fluid

The relation between the calculation method in section 5.2 and the simplified calculation method by the mass balance below is the same as in section 6.1. Basically, it is advisable to calculate with the data by actual measurement based on the actual operation conditions. The simplified calculation methods are shown below.

a. Confirm the name and the content of PRTR chemicals by the MSDS of the chemical products used in the composition table

b. The calculation of the amount of loss (R) is performed by the equation below. Either the average yield of the industry or the company's average yield can be used.

Amount of loss = charge amount – (charge amount x yield) = R

c. Distribution factor of the amount of loss

The distribution of the amount of loss (R) is calculated by the distribution factor below.

d. Releases to the air and the land are regarded as zero.

Distribution factor of brake fluid

| | |
|---|---|
| Preparation loss | R x 0.02279 |
| Filling loss | R x 0.81984 |
| Test sample loss | R x 0.01215 |
| Stock sample loss | R x 0.01215 |
| Waste | R x 0.09919 |
| Waste cloth and others | R x 0.03388 |
| Total of distribution factor | 1.0000 |

[An example of the production]

Charge amount 5000kg
Average yield 98%

PRTR chemicals

Boron and its compounds $(CH_3(OC_2H_4)_3O)_3B$ 35%
Conversion factor 0.0216
Bisphenol A 0.4%
R = 5000 – (5000 x 0.98) = 100kg

| | |
|---|---|
| Preparation loss | 2.2790 |
| Filling loss | 81.9840 |
| Test sample loss | 1.2150 |
| Stock sample loss | 1.2150 |
| Waste | 9.9190 |
| Waste cloth and others | 3.3880 |
| Total loss | 100 |

(Notes: As to the release or the transfer, refer to the paragraph of engine antifreeze coolant above.)

B: 100.0 x 35/100 x 0.0216 = 0.756kg
Bisphenol A: 100 x 0.4/100 = 0.4kg

### 6.3. Wax, Coating agent and wax for car washing machine

The relation between the calculation method in section 5.3 and the simplified calculation method by the mass balance below is the same as in section 6.1. Basically, it is advisable to calculate with the data by actual measurement based on the actual operation conditions. The simplified calculation methods are shown below.

a. Confirm the name and the content of PRTR chemicals by the MSDS of the chemical products ,especially organic solvent like kerosene and terpene used in the composition table
b. The calculation of the amount of loss (R) is performed by the equation below. Either the average yield of the industry or the company's average yield can be used.
   Amount of loss = charge amount – (charge amount x yield) = R
c. Distribution factor of the amount of loss
   The distribution of the amount of loss (R) is calculated by the distribution factor below.
d. Release to the land is regarded as zero.

Waxes and coating agents

| | Solid | Paste | Liquid |
|---|---|---|---|
| **Preparation loss** | R x 0.01770 | R x 0.01296 | R x 0.06516 |
| **Filling loss** | R x 0.79740 | R x 0.58315 | R x 0.59952 |
| **Cooling room loss** | R x 0.03230 | R x 0.23614 | ---- |
| **Test sample loss** | R x 0.01180 | R x 0.00864 | R x 0.01422 |
| **Stock sample loss** | R x 0.01180 | R x 0.00864 | R x 0.01422 |
| **Waste** | R x 0.09650 | R x 0.12671 | R x 0.20853 |
| **Waste cloth and others** | R x 0.03250 | R x 0.02376 | R x 0.09835 |
| **Total of distribution factor** | 1.0000 | 1.0000 | 1.0000 |

(Notes: As to the release or the transfer, refer to the paragraph of engine antifreeze coolant above.)

#### 6.3.1. Calculation example of solid wax

Standard composition of solid wax is given in the table below.

| | Content (weight %) | Volatile content (%) |
|---|---|---|
| **Diatom earth** | 4.0 | |
| **Carnauba wax** | 10.0 | |
| **Paraffin wax** | 6.0 | |
| **Hoechst wax** | 7.0 | |
| **Kerosene** | 33.0 | 52.4 |
| **Silicone** | 10.0 | |
| **Mineral terpene** | 30.0 | 47.6 |

[An example of the production]

Charge amount 1800kg
Average yield 98%
PRTR chemicals
Xylene in the solvents
R (loss) = 1800 – (1800 x 0.98) = 36kg

Total loss is distributed by the distribution factor

| | |
|---|---|
| Preparation loss | 0.63720 |
| Filling loss | 28.70640 |
| Cooling room loss | 1.16280 |
| Test sample loss | 0.42480 |
| Stock sample loss | 0.42480 |
| Waste | 3.47400 |
| Waste cloth and others | 1.17000 |
| Total loss | 36.00000 |

Xylene in kerosene = 36.0 x 52.4/100 x 2/100 = 0.37728
Xylene in mineral terpene = 36.0 x 47.6/100 x 2.5/100 = 0.4284
Total xylene = 0.37728 + 0.4284 = 0.805kg
Release of xylene of one batch of production = 0.805kg
240 batches per year
Total release (to air) of xylene per year = 0.805 x 240 = 193.2kg

### 6.3.2. Calculation example of paste wax

Standard composition of solid wax is given in the table below

| | Content (weight %) | Volatile content (%) |
|---|---|---|
| Carnauba wax | 4.0 | |
| Paraffin wax | 5.0 | |
| Silicone | 16.0 | |
| Kerosene | 36.0 | 59.0 |
| Diatom earth | 8.0 | |
| Nonionic surfactant | 2.0 | |
| Carboxymethylcellulose | 2.0 | |
| Water | 25.0 | 41.0 |

[An example of the production]

Charge amount 1800kg
Average yield 98%

PRTR chemicals

Xylene in the solvent
R (loss) = 1800 – (1800 x 0.98) = 36kg

Total loss is distributed by the distribution factor

| | Volatile matter | Xylene in kerosene |
|---|---|---|
| Preparation loss | 0.46656 | 0.00551 |
| Filling loss | 20.99340 | 0.24772 |
| Cooling room loss | 8.50104 | 0.10031 |
| Test sample loss | 0.31104 | 0.00367 |
| Stock sample loss | 0.31104 | 0.00367 |
| Waste | 4.56156 | 0.05383 |
| Waste cloth and others | 0.85536 | 0.01009 |
| Total loss | 36.00000 | 0.42480 |

Xylene in kerosene: 36.0 x 59.0/100 x 2/100 = 0.4248kg

250 times of production per year: 0.4248 x 250 = 106.2kg

### 6.3.3. Calculation example of the liquid wax

Standard composition of solid wax is given in the table below

| | Content (%) | Volatile content (%) |
|---|---|---|
| **Hoechst wax** | **2.0** | |
| **Paraffin wax** | **6.0** | |
| **Silicone** | **1.5** | |
| **Kerosene** | **10.0** | **12.4** |
| **Diatom earth** | **10.0** | |
| **Mineral terpene** | **16.5** | **20.5** |
| **Water** | **54.0** | **67.1** |

[An example of the production]

| | |
|---|---|
| Charge amount | 1800kg |
| Average yield | 98% |
| Density | 0.792 (at 15℃) |

PRTR chemicals

Xylene in the solvents

R (loss) = 1800 – (1800 x 0.98) = 36kg

Total loss is distributed by the distribution factor

| | | |
|---|---|---|
| **Preparation loss** | **R×0.06516** | **2.34576** |
| **Filling loss** | **R×0.059952** | **21.58272** |
| **Test sample loss** | **R×0.01422** | **0.51192** |
| **Stock sample loss** | **R×0.01422** | **0.51192** |
| **Wastes** | **R×0.20853** | **7.50708** |
| **Wastes (cloth) and others** | **R×0.9835** | **3.54060** |
| **Total loss** | | **36.00000** |

Xylene in kerosene: 36.0 x 12.4/100 x 2/100 = 0.08928kg

230 times of production per year: 0.08928 x 230 = 20.5kg

When the solid wax, the paste wax and the liquid wax are all produced, total xylene released is:

193.2kg + 106.2kg + 20.5kg = 319.9kg

Needless to say, if the other PRTR chemicals are used for the products except xylene, the calculation should be performed in the same way.