25.Forging Industry

I Procedures for Calculating Quantities of Designated Chemical Substances Handled and Transferred in the Forging Industry

1.1 Overall Flow of Reporting

The overall flow for completing the Notification Form is shown below (Figure 1). Please follow the steps described in sections 2.2 and 2.3 for more specific procedures.

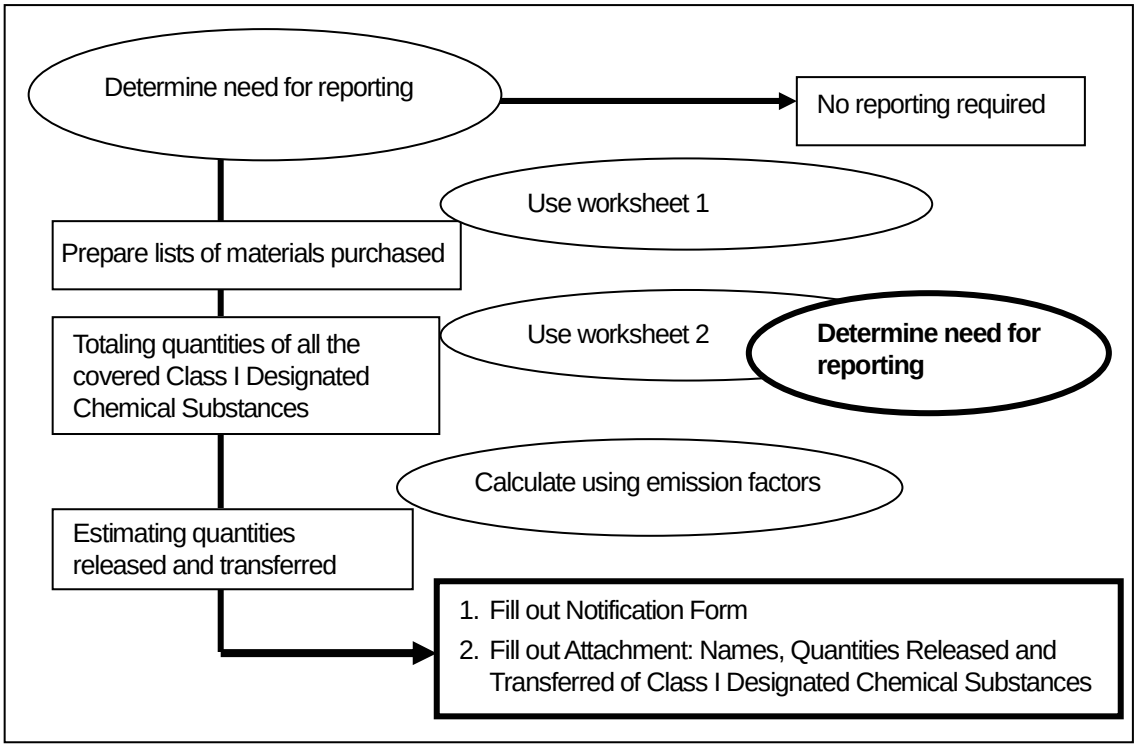


Figure 1 Flow for Estimating Quantities of Designated Chemical Substances Handled and Transferred in the Forging Industry, and Completing Notification Form

1.2 Determining PRTR Reporting Businesses

Figure 2 depicts the procedures used for the determination of PRTR reporting businesses. Most forging businesses are required to report under PRTR system. The quantities released and transferred shall be estimated by following the procedures shown in Figure 3. Specifically, the reporting work shall be done using the following 5 items as checkpoints.

1) Is your business included in the covered industry categories under the PRTR system?

All manufacturing industries have been designated as being subject to PRTR reporting, thus the forging industry is subject to PRTR reporting.

2) Does your business employ 21 or more regular employees?

3) Does your business use raw materials that contain any substances subject to the PRTR?

List the raw materials used during the manufacturing processes in your factories. In the event that some raw materials may contain unknown compounds, obtain the MSDS and confirm the identity of such compounds.

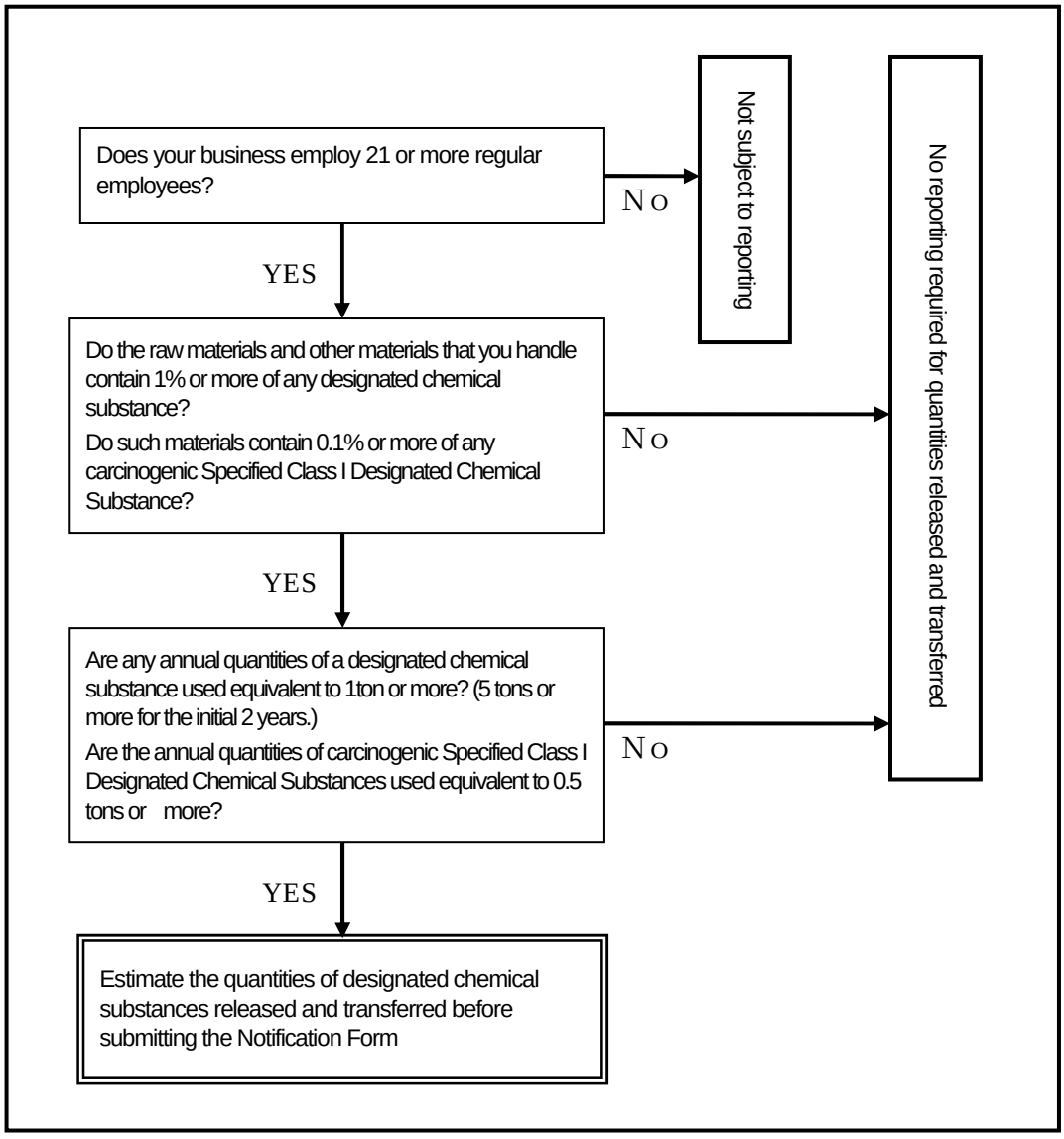
4) Do the raw materials contain 1% (0.1% for carcinogenic substances) or more of any designated chemical substances?

In the event that any materials contain the specified quantities, or more, of a designated chemical substance, then the names of each material and the names of all such designated chemical substances, must be listed.

5) Are the annual quantities of any designated chemical substance used, equal to or greater than 1 ton ? (5 tons for the initial 2 years, 0.5 tons for carcinogens even for the initial 2 years)

Calculate the annual quantity used for each designated chemical substance. In the event that several raw materials contain the same designated chemical substances, all of the quantities used must be totaled.

Figure 2 Procedures for Determining Reporting Businesses



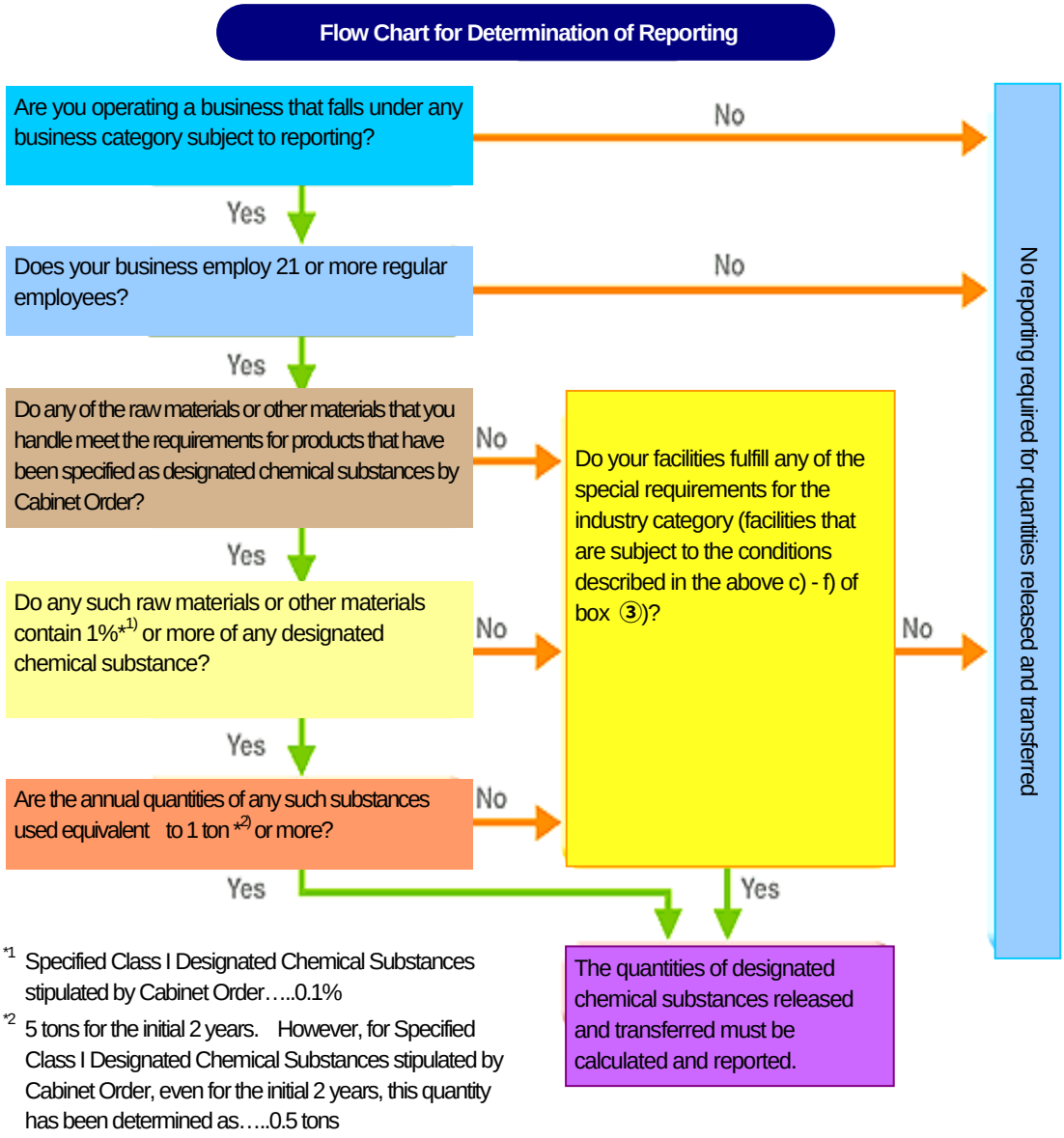


Figure 3 Flow for the Determination of Quantities Released and Transferred

1.3 Confirming the Usage and Calculating the Quantities of Class I Designated Chemical Substances

1.3.1 Confirming the Usage of Class I Designated Chemical Substances Subject to Reporting

Follow the procedures shown in Figure 2, to determine whether your facility uses any designated chemical substances that must be reported.

1.3.2 Calculating Total Quantities Handled

The total quantities of all Class I Designated Chemical Substances handled must be calculated. First of all, use worksheet 1 to calculate the quantities handled.

Precautions Prior to Calculating Total Quantities Handled

1) Select the materials utilized in each process by referring to the "List of Materials Used in the Forging Industry".

2) On worksheet 1, list all raw materials that contain 1% or more of any designated chemical substance, from among all of the raw materials that your plant has purchased. Enter the names of the designated chemical substances and their percentage content.

   Note 1: Refer to the MSDS of each material purchased, for the name and content of each designated chemical substance. (If this information is unknown, contact the manufacturer.)

   Note 2: Any "purchased materials that contain 1% or less of any designated chemical substance (0.1% or less for carcinogenic Specified Class I Designated Chemical Substances)" shall not be subject to investigation.

3) Enter the annual results for the materials purchased, as described in worksheet 1, then calculate the annual quantities of designated chemical substances handled, which are contained within these purchased materials.

1.3.3 Determination of Need for Reporting

According to the results of the aggregated quantities handled, as described in section 1.3.2, above, if 1 ton or more of any designated chemical substances was used (0.1% or more for carcinogenic substances), the facility must report to the local government. Therefore, for the covered Class I Designated Chemical Substances that are handled at each facility, identify the names, quantities and reporting obligation by filling out Worksheet 2.

When carrying out the above work, ensure that the following precautions are taken;

Precautions for Determining Whether Reporting is Required or Not (Notification)

1) On worksheet 2, list each designated chemical substance used in each process or operation, using the results of the calculations performed in worksheet 1. Then, calculate the total quantities of each designated chemical substance handled at your facility (plant).

2) Any of the aforementioned designated chemical substances that are handled in annual quantities of 1 ton/year or more (5 tons/year or more for the initial 2 years) are subject to reporting.

Table 1Worksheets 1 and 2

1. Class I Designated Chemical Substances Subject to Reporting (Worksheet 1)

Worksheet 1 should be used when your facility manufacture 1 ton/year or more of designated chemical substances (including byproducts).

Worksheet 1 Table for Calculating Quantities of Designated Chemical Substances Handled

	Raw Materials and Other Materials							
	② Names of Raw Materials and Other Materials	Calculating Annual Quantities Handled				Designated Chemical Substances		
		Annual Quantity Purchased Kg/year	Inventory at End of Year Kg/year	Inventory at Beginning of Year Kg/year	④ Annual Quantity Handled Kg/year	③ Name of Designated Chemical Substance	④ Content %	⑤ Annual Quantity Handled Kg/year
1								
2								
3								
4								

2. Confirming Need for Reporting (Worksheet 2)

Using the following Worksheet, fill out information on the Class I Designated Chemical Substances handled in your plant and determine whether or not reporting is required.

Worksheet 2 Table for Calculating Quantities of Designated Chemical Substances Handled, by Type

	CAS No.	Name of Designated Chemical Substance	Annual Quantity Handled Kg/year	Total Kg/year	Need of Reporting
1					
2					
3					
4					

1.3.4 Estimation Procedures for Quantities Released and Transferred

The quantities of designated chemical substances released from release points to the atmosphere and to the bodies of water (and land) must be estimated, for each manufacturing process. The quantity of designated chemical substances transferred in waste must also be estimated. The methods for these estimations include the following;

1) Estimation method based on materials balance
2) Estimation method based on emission factors
3) Estimation method based on physical properties

4) Estimation method based on actual measured values

In accordance with the basic concepts behind the estimation of the quantities of designated chemical substances released and transferred in the forging industry, the "Estimation method based on emission factors", as listed in 2), above, shall be utilized based on the "Flow Chart" shown in Figure 4, and the "Flow Chart of the Manufacturing Process for Steel and Nonferrous Forgings" in Figure 5, to be provided later in this manual. Table 2 presents the emission factors for the Class I Designated Chemical Substances handled in the forging industry.

However, in the event that the specific chemical substances do not match the emission factors listed in Table 2, depending upon the facilities, the most appropriate experiential values (emission factors for released quantities, obtained from previously measured values and other data) should be used, in order to achieve the most accurate results.

Using the emission factors shown in Table 2, develop the estimates for the quantities released and transferred, in accordance with the formula below:

(Quantities released and transferred) = (annual quantities of designated chemical substances handled) × (emission factors)

Enter the quantities of designated chemical substances released and transferred obtained from the above estimation, into the report.

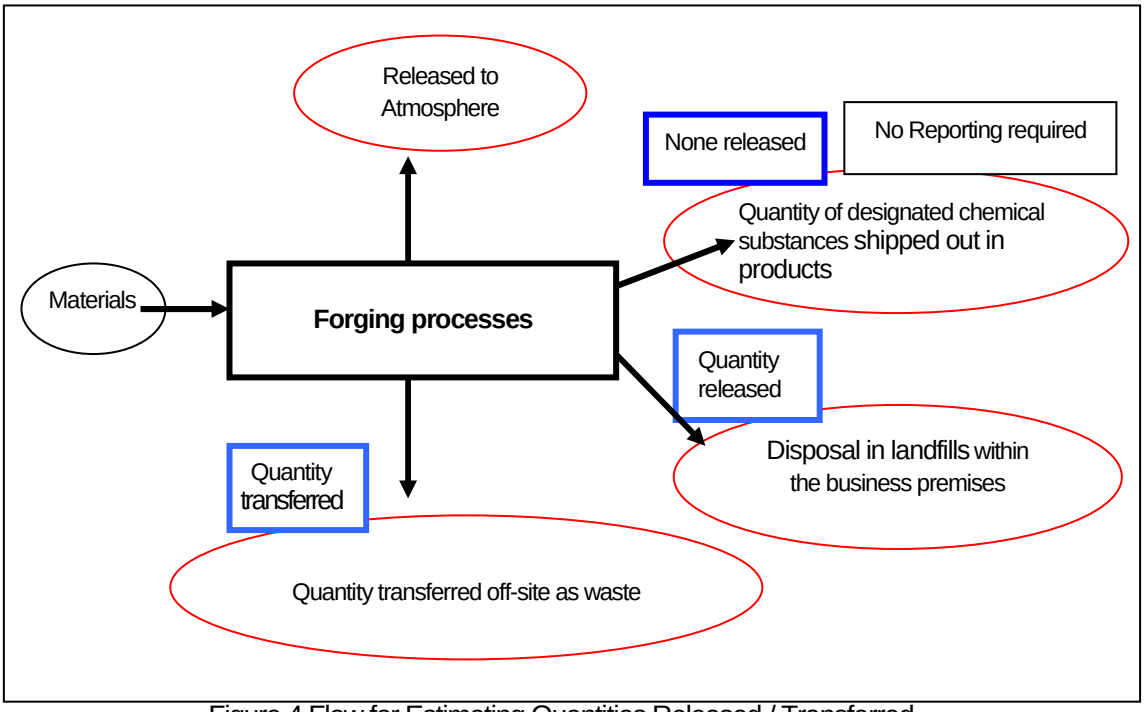


Figure 4 Flow for Estimating Quantities Released / Transferred

1.4 Forging Processes and Emission Factors

Figure 5 indicates the typical forging processes. Beginning with the materials and continuing through to shipping and inspection, the processes enclosed within ○ (oval shapes) are subject to identification of quantities of released and transferred. Let us identify the designated chemical substances used in each process. Figure 6 depicts the substances for which the quantities released and transferred should be identified, as potential chemical substances subject to PRTR reporting, for each forging process. Develop the estimates for the actual quantities released and transferred in accordance with these figures and with the emission factors indicated in Table 2.

Example: Methods and Procedures for Estimating Quantities Released and Transferred Under the PRTR System

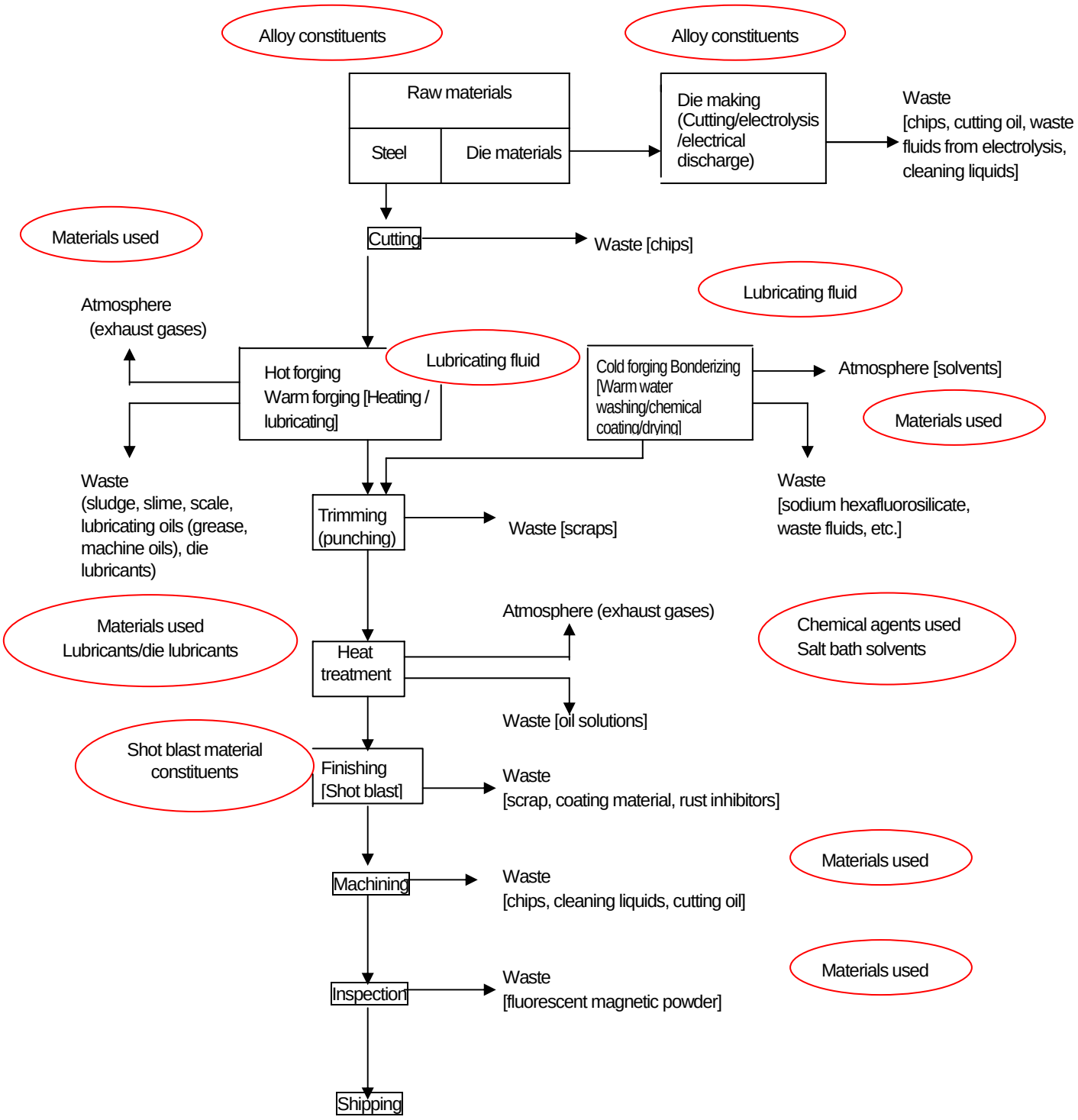
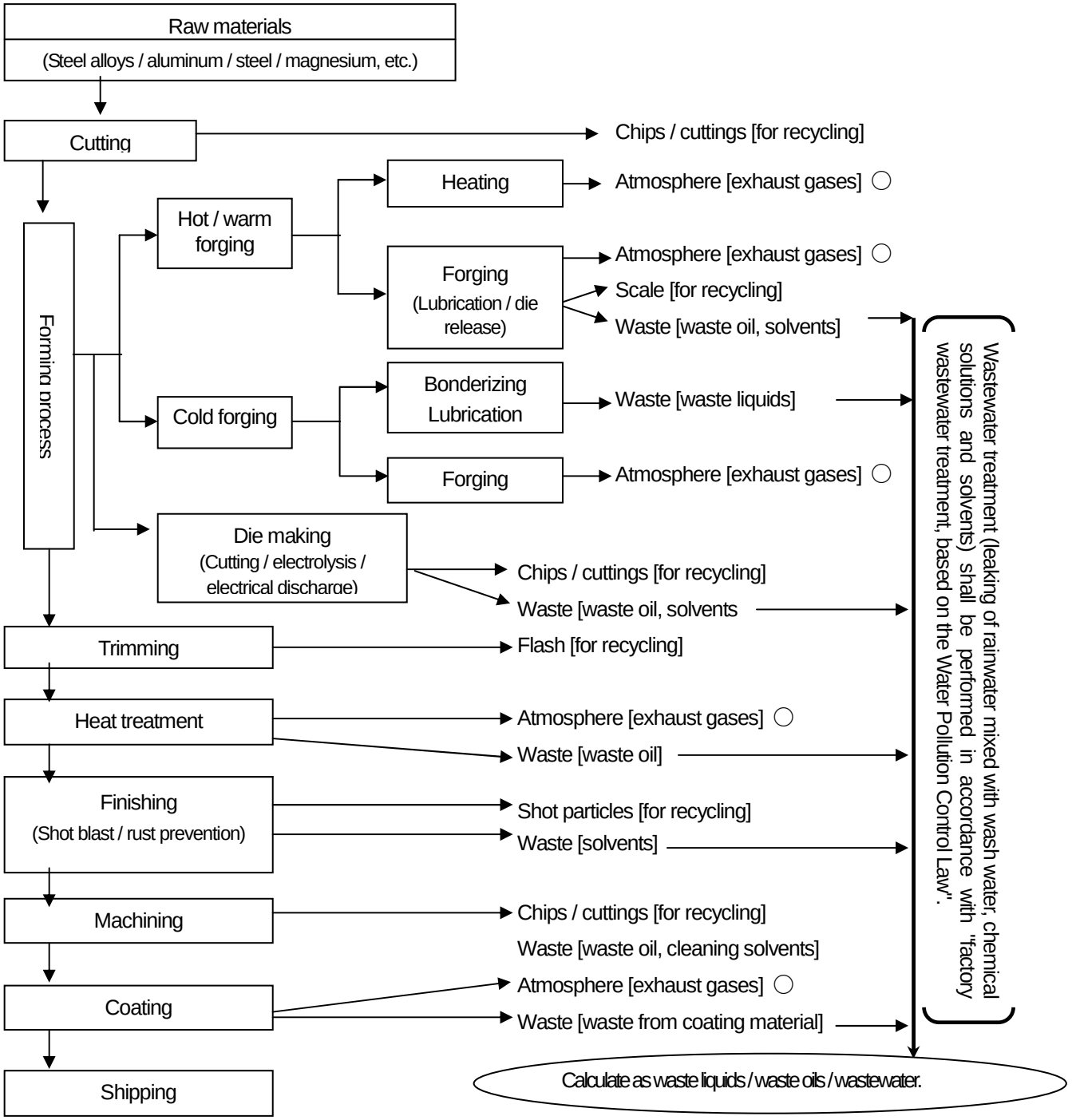


Figure 5 Flow Chart for the Manufacturing Processes for Steel and Nonferrous Forgings

Figure 6 Example Methods and Procedures for Estimating Quantities Released and Transferred Under the PRTR System

Flow Chart for Manufacturing Processes Used in the Forging Industry



Note: As a result of examinations conducted by the Manual Drafting Committee, pertaining to the solvents used during the die lubrication process and the washing process, the MSDS indicates that no Class I Designated Chemical Substances are contained in these solvents. However, it has been determined that some solvents used in the cold bonderizing process, the heat treatment process and the coating process, may contain Class I Designated Chemical Substances. Therefore, the MSDS must be used in order to accurately verify the actual content of such substances.

1.4.1 Concepts Underlying the Use of Emission Factors for Individual Processes in the Forging Industry

Forging industry is subject to reporting of the Class I Designated Chemical Substances specified in the Law for PRTR and Promotion of Chemical Management and required to submit reports to the local governments.

For this reason, the "List of Substances Purchased" must first be drafted. And develop estimates for quantities released and transferred of those designated chemical substances handled. Finally, the Notification Form and Attachment shall be completed and submitted.

The quantities handled, above, can be determined easily using the calculation examples described later within this manual. However, in order to perform the "estimation of quantities transferred and released", it is necessary to obtain the transfer / emission factors for the "designated chemical substances" handled in each forging process. This information is derived from the results of actual measurements performed by businesses, on an individual basis.

Therefore, the Manual Drafting Committee has contracted with the Society of Chemical Engineering, in Japan, to conduct a case study to measure the actual quantities of designated chemical substances released to the atmosphere during each of the forging processes (refer to attached Table 1). The emission factors for respective chemical substances have been obtained from the study results.

Furthermore, with reference to case studies cited in the manuals from other business categories and the results of these actual measurements, the concepts underlying the "designated chemical substances" handled during each of the forging processes and their transfer/emission factors, are described below.

1) Materials (Raw Materials)

The substances subject to reporting include the following: manganese - including ferrous and nonferrous compounds (Mn, 311), chromium (Cr, 68), cobalt (Co, 100), molybdenum (Mo, 346), lead (Pb, 230), nickel (Ni, 231) and barium (Ba, 243). The "maximum values of the specified values" must be used for these constituent elements. Calculate the quantities of designated chemical substances handled at each business premise, by referring to the examples described in section II.

2) Cutting

The cuttings and chips produced when cutting the raw materials used in forging processes, such as ferrous and nonferrous alloys (including die materials) may contain designated chemical substances (chromium, nickel, lead and molybdenum, etc.). Final waste treatment companies usually dispose of these cuttings and chips as scrap waste. Scrap waste that will

be recycled is not considered to be subject to reporting. However, if these materials are, without charge, taken for eventual disposal by waste treatment companies then the quantities transferred in such wastes shall be subject to reporting.

With respect to secondary materials (such as cutting oils, etc.), refer to the MSDS when these materials are purchased, in order to ensure that they are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

3) Heating Process (1200°C)

① Air Releases of Designated Chemical Substances in Materials

The quantities of chemical constituents (chromium, nickel, lead, molybdenum, molybdenum disulfide, boron nitride, silicon, etc.) contained in raw materials, such as ferrous and nonferrous alloys, which are released and transferred during heating, are subject to reporting. These emission factors have been determined from the results of specific measurements. (Refer to Table 2)

② Air Releases of Designated Chemical Substances Released During Combustion

The quantities of chemical constituents (benzene, toluene, xylene, ethylene benzene, etc.) contained in petroleum fuels (kerosene, gas oil, heavy oil "A" and heavy oil "C"), which are released or transferred during combustion are subject to reporting. These emission factors have been determined from the results of specific measurements. However, refer to the MSDS when these materials are purchased, in order to ensure that they are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

4) Hot / Warm Forming Process

① Transfers of Designated Chemical Substances Contained in Materials

The quantities of chemical constituents (chromium, nickel, lead, molybdenum, molybdenum disulfide, boron nitride, silicon, etc.) contained in raw materials that are to be heated, such as ferrous and nonferrous alloys, which are released or transferred during the forming process, are subject to reporting. As only minute quantities of these chemical constituents were released during actual measurements, these chemical substances are not subject to reporting. Furthermore, certain designated chemical substances are contained in byproducts, such as the scale produced during forging and the flash produced after forging. These substances are subject to reporting. However, most forging companies pay waste treatment companies to treat and recycle both scale and flash. Therefore, no transfers of designated chemical substances are actually considered to have occurred. For this reason, the quantities released and transferred have

been determined as "zero".

② Secondary Materials, such as Lubricants

The chemical constituents contained in the lubricants used for forming machines and compressors (machine oil, grease, etc.) are not subject to reporting, as it has been determined through MSDS inspection that these chemical constituents do not comprise any designated chemical substances. However, for any lubricants that are used repeatedly at each business premise, it is recommended that the chemical constituents be verified as safe through MSDS inspection.

5) Cold Bonderizing Treatment / Forming

① Transfer of Designated Chemical Substances Contained in Materials

The quantities of chemical constituents (chromium, nickel, lead, molybdenum, molybdenum disulfide, boron nitride, silicon, etc.) contained in raw materials to be heated, such as ferrous and nonferrous alloys, that are released to the atmosphere or transferred due to the heat and pressure applied during the cold forming process, are subject to reporting. It has been determined that only minute quantities of these chemical substances are actually released, therefore, they shall not be subject to reporting.

② Secondary Materials, such as Lubricants

The waste fluids from the chemical compounds (lead stearate, lead phosphate, lead oxide, zinc oxide, etc.) contained in solutions from raw materials that have received bonderizing pretreatment before cold forming, are subject to reporting. It has been recognized from the results of actual measurements (see Table 2) that these chemicals compounds released to the air during bonderizing are negligible in quantity. And all of the transferred quantities are transferred via adhesion to the product. Therefore, the bonderizing residues from facility cleaning and from clean up of the bonderizing baths, shall be subject to reporting. However, with respect to secondary materials, refer to the MSDS when these materials are purchased, in order to ensure that they are not subject to reporting under the Law for PRTR and Promotion of Chemical Management6) Die Processing

6) Transfers of Designated Chemical Substances Contained in Materials

① The cuttings and die chips that are produced during cutting operations may contain designated chemical substances (chromium, nickel, lead, molybdenum,cobalt, etc.). At present, final waste treatment companies dispose of these cuttings and chips as

scrap waste. Therefore, these chemical substances are not subject to reporting. However, if these materials are, without charge, taken for eventual disposal by waste treatment companies then the quantities transferred in such wastes shall be subject to reporting.

② Secondary Materials, such as Electrolytic Process Liquids

Theuantities of chemical compounds (chromium, nickel, lead, lybdenum,olybdenum disulfide, etc.) contained in and subsequently released and transferred from discharged process liquids, electrolytic process liquids and raw materials used during the die forming process, are subject to reporting. At present, these treated liquids are reused and the sludge is recovered and disposed of as scrap waste. Therefore, these secondary materials are not subject to reporting. However, if these materials are, without charge, taken for eventual disposal by waste treatment companies then the quantities transferred in such wastes shall be subject to reporting.

7) Trimming

The chemical compounds (chromium, nickel, lead, molybdenum, etc.) contained in waste materials, such as the flash and chips produced during the trimming process after forging, are subject to reporting. However, as final waste treatment companies treat these waste materials as scrap waste, they shall not be subject to reporting. However, if these materials are, without charge, taken for eventual disposal by waste treatment companies then the quantities transferred in such wastes shall be subject to reporting.

8) Heat Treatment

① Transfers of Designated Chemical Substances Contained in Forgings

From the results of actual measurements, it has been confirmed that only minute quantities of the chemical compounds contained in forgings are actually released to the atmosphere, even when such forgings are heated to the high temperatures utilized for heat treatment. Therefore, the quantities of designated chemical substances released and transferred in forgings shall not be subject to reporting.

② Designated Chemical Substances Contained in Secondary Materials

The quantities of chemical constituents (benzene, toluene, xylene, ethylene benzene, etc.) contained in the oils used for conditioning of the ausforging and re-ausforging process, which are released and transferred during the heat treatment process, are subject to reporting. From the results of actual measurements, it has been confirmed that the quantities of designated chemical substances released are extremely minute. Therefore, the quantities of these substances in such secondary materials shall not be subject to reporting.

However, with respect to secondary materials, refer to the MSDS when these materials are purchased, in order to ensure that they are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

9) Finishing

① Transfers of Designated Chemical Substances Contained in Forgings

In the forging process, shot balls are utilized for shot blasting, in order to remove oxides from the surface of forgings. Therefore, any chemical substances contained in these shot balls may be subject to reporting. However, at the present time, final waste treatment companies treat these shot balls as scrap. Therefore, for these cases, any designated chemical substances in forgings shall not be subject to reporting. However, if these materials are, without charge, taken for eventual disposal by waste treatment companies then the quantities transferred in such wastes shall be subject to reporting.

② Designated Chemical Substances Contained in Secondary Materials

The waste fluids, such as the rust preventive oils used in finishing forgings, contain certain quantities of chemical constituents (benzene, toluene, xylene, ethylene benzene, etc.) that can be released and transferred and are therefore subject to reporting. However, through MSDS examination, it has been confirmed that only extremely minute quantities of designated chemical substances are actually released from such secondary materials used during the forging process. Therefore, the quantities of designated chemical substances in these secondary materials shall not be subject to reporting. However, with respect to secondary materials, it is recommended that all business premises refer to the MSDS when these materials are purchased, in order to ensure that such secondary materials are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

10) Machining

① Transfers of Designated Chemical Substances Contained in Forgings

The cuttings and chips produced when cutting forged materials may contain designated chemical constituents (chromium, nickel, lead, molybdenum, etc.). Final waste treatment companies usually dispose of these cuttings and chips as scrap waste. Therefore, the quantities of designated chemical substances transferred to such wastes are not subject to reporting. However, if these materials are, without charge, taken for eventual disposal by waste treatment companies then the quantities transferred to such wastes shall be subject to reporting.

② Designated Chemical Substances Contained in Secondary Materials

From examination of the MSDS, it has been confirmed that only extremely minute quantities of designated chemical substances are present in the cutting oils and other similar oils used as secondary materials (the same substances used in the aforementioned die forming process). Therefore, the quantities of designated chemical substances in these secondary materials shall not be subject to reporting.

However, with respect to secondary materials, it is recommended that all business premises refer to the MSDS when these materials are purchased, in order to ensure that such secondary materials are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

③ Transfers of Designated Chemical Substances Contained in Secondary Materials Used for Surface Washing After Machining

The quantities of chemical constituents (dichloromethane (ethylene chloride), tetrachloroethylene (PERC), trichloroethylene) contained in the secondary materials used for surface washing of forgings after machining, which are released to the atmosphere, are subject to reporting. In order to verify whether the quantities of such chemical substances released are actually subject to reporting, as stipulated by the 1 ton or more of any designated chemical substance was used (0.1% or more for carcinogenic substances), it is necessary to perform calculations based on emission factors, as indicated in Table 2. If such quantities are minimal, then they may not be subject to reporting.

11) Inspection

With respect to the chemical constituent (bis phthalate) contained in the fluorescent magnetic powder used for surface inspections of forgings, an examination of the MSDS has confirmed that such powders do not contain any designated chemical substances. However, if poly (oxyethylene) is present, then 100% of this designated chemical substance will diffuse to the air, therefore making it subject to reporting. Calculations based on emission factors must be performed, as indicated in Table 2, in order to verify whether the quantity of this designated chemical substance released is actually subject to reporting, as stipulated under the Law for PRTR and Promotion of Chemical Management. If such quantities are minimal, then they may not be subject to reporting. In addition, with respect to secondary materials, it is recommended that all business premises refer to the MSDS when these materials are purchased, in order to ensure that such secondary materials are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

12) Coating

The quantities of xylene, ethylene glycol and other substances released and transferred to the atmosphere due to the diffusion and emission of chemical constituents of cation coating agents for forged products (lead, xylene, zinc, nickel, manganese, etc.), are subject to reporting. Examples of the estimations used for these quantities released and transferred are shown for reference in section "II". Furthermore, with respect to secondary materials, it is recommended that all business premises refer to the MSDS when these materials are purchased, in order to ensure that such secondary materials are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

The concepts underlying the estimation for quantities of Class I Designated Chemical Substances released and their emission factors, during each of the forging processes, have been described above. Also refer to Table 2 for the emission factors concerning the releases and transfers of Class I Designated Chemical Substances handled during each of the forging processes.

The next section (section II) describes the procedures for performing the actual calculations and reporting.

Table 2 Emission Factors for Class I Designated Chemical Substances During the Forging Operations

These emission factors have been obtained from the results of the measurements in the appended Table

Process	Cabinet Order Number	Emission Factor for Designated Chemical Substance					
		Designated Chemical Substance			Product	Atmosphere	Waste
Cutting	311	Mn	A	Material	100	0	0
			B	Material	96	0	4
	68	Cr	A	Material	100	0	0
			B	Material	96	0	4
	346	Mo	A	Material	100	0	0
			B	Material	96	0	4
	231	Ni	A	Material	100	0	0
			B	Material	96	0	4
	230	Pb	A	Material	100	0	0
			B	Material	96	0	4
	304	B	A	Material	100	0	0
			B	Material	96	0	4
Die making	311	Mn	D	Die material	100	0	0
	68	Cr	D	Die material	100	0	0
	346	Mo	D	Die material	100	0	0
	231	Ni	D	Die material	100	0	0
Lubrication	1	Water-soluble zinc compounds	E	Cold	95.6	0	4.4
	16	2-Aminoethanol	E	Cold	100	0	0
	109	2-(Dibutylamino) ethanol	E	Cold	100	0	0
	160	2-(Di-N-butylamino) ethanol	E	Cold	100	0	0
	283	Hydrogen fluoride and its water-soluble salts	E	Cold	100	0	0
	304	Boron (B) and its compounds	F	Cold / Hot	100	0	0
	307	Polyoxyethylene alkylether	F	Cold / Hot	100	0	0
	309	Polyoxyethylene nonylphenyl ether	F	Cold / Hot	100	0	0
	304	Molybdenum (Mo) and its compounds	F	Cold / Hot	100	0	0
Forging / Trimming	311	Mn	G	Forged material	100	0	0
	68	Cr	G	Forged material	100	0	0
	346	Mo	G	Forged material	100	0	0
	231	Ni	G	Forged material	100	0	0
	230	Pb	G	Forged material	100	0	0
	304	B	G	Forged material	100	0	0
Heat Treatment	108	Inorganic cyanide	H	Quenching material	100	0	0
	243	Barium and its compounds	H	Quenching material	100	0	0
Decarbonizing agent	304	Boron and its compounds	H	Decarbonizing agent	0	0	100
Cleaning	145	Dichloromethane (ethylene chloride)	I	Washing agent	0	100	0
	200	Tetrachloroethylene (PERC)	I	Washing agent	0	100	0
	211	Trichloroethylene	I	Washing agent	0	100	0
Coating	63	Xylene	J	Coating material	90	10	0
	44	Ethylene glycol monoethyl ether	J	Coating material	90	10	0
	69	Chromate compounds	J	Coating material	100	0	0
	230	Lead and its compounds	J	Coating material	100	0	0
Inspection	272	Bis(2-ethylhexyl) phthalate	K	Inspection	100	0	0
	307	Poly (oxyethylene)alkyl ether(alkyl c=12-15)	K	Inspection	0	100	0

Note 1: Classified by cutting method.

A: Shearing B: Sawing

Ⅱ. Typical Example of Methods for Calculating Quantities of Class Ⅰ Designated Chemical Substances Released and Transferred at a Model Forging Plant

2.1 Drafting the Report

The outline of a model forging plant is given below. Figure 7 indicates a flow chart for typical forging process and Figure 8 shows examples of major products manufactured in the process.

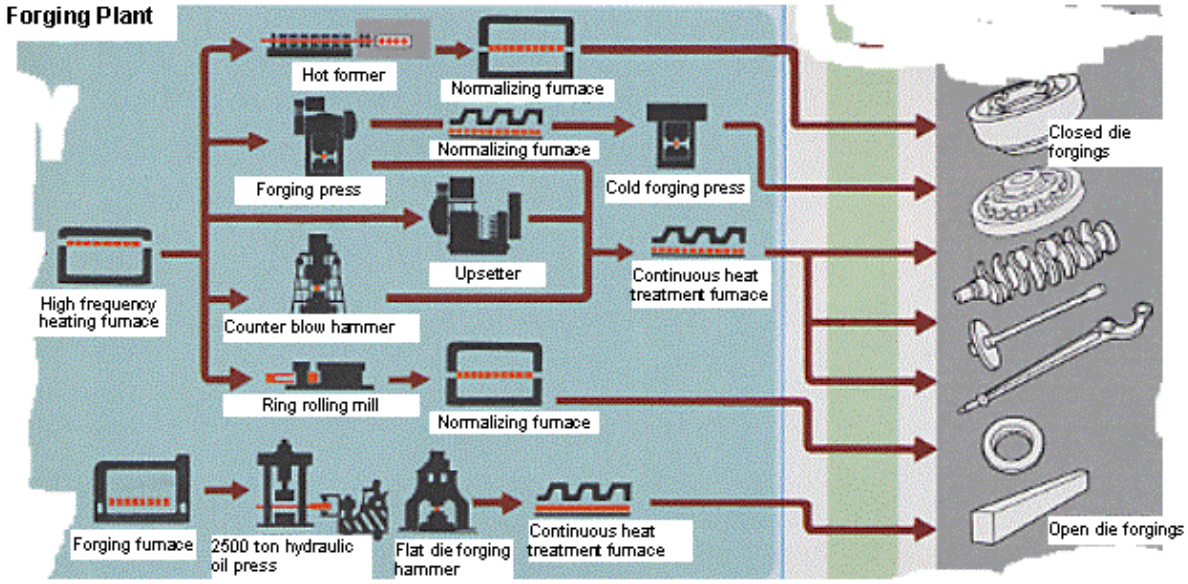


Figure 6 Flow Chart for the Forging Process at a Model Forging Plant

Figure 7 Examples of Major Products Manufactured in a Model Forging Plant

Two types of documents: “Form No.1 (Concerning Article 5 of the Law) Notification Form for Quantities of Class I Designated Chemical Substances Released and Transferred” and Attachment: “Name and Quantities of Class I Designated Chemical Substances Released and Transferred” are required for the reporting for this particular model plant.

Figure 8 depicts the specific procedures to be followed for reporting. In order to fill out the form, it is first necessary to prepare lists of materials purchased and used by the forging plant. Then the quantities of designated chemical substances are calculated. To ensure accurate calculations, it is recommended that worksheet 2 be used, as described on page 6.

Once these calculations have been completed, the quantities of designated chemical substances transferred and released must be estimated. In this example, emission factors have been determined from the results of measurements of actual quantities released and transferred during forging processes in this model plant. These emission factors are listed in Table 2, for reference. Now, reporting and estimations for designated chemical substances released and transferred shall be conducted as follows.

The basic procedure using a model is described in the following section.

2.2 Preparing Notification Forms for a Model Plant

The specific steps to be followed for preparing the reports are described below, for a model forging plant (a forging business with 21 or more employees). This forging plant is assumed to perform operations in the forging processes indicated in Figure 10. The data required for reporting shall be obtained for each of the processes. The reports shall now be drafted by following the procedures below.

2.2.1 Calculations for Quantities Purchased (Calculations for Annual Quantities Handled)

Of all the materials used for forging, any alloy that contains 1% or more of any of the chemical substances designated under the Law for PRTR and Promotion of Chemical Management, shall be subject to calculation. “The results of Measurement for Designated Chemical Substances under PRTR System for each Process in a Forging Plant” is provided as Appendix. The same procedures shall apply for nonferrous metals.

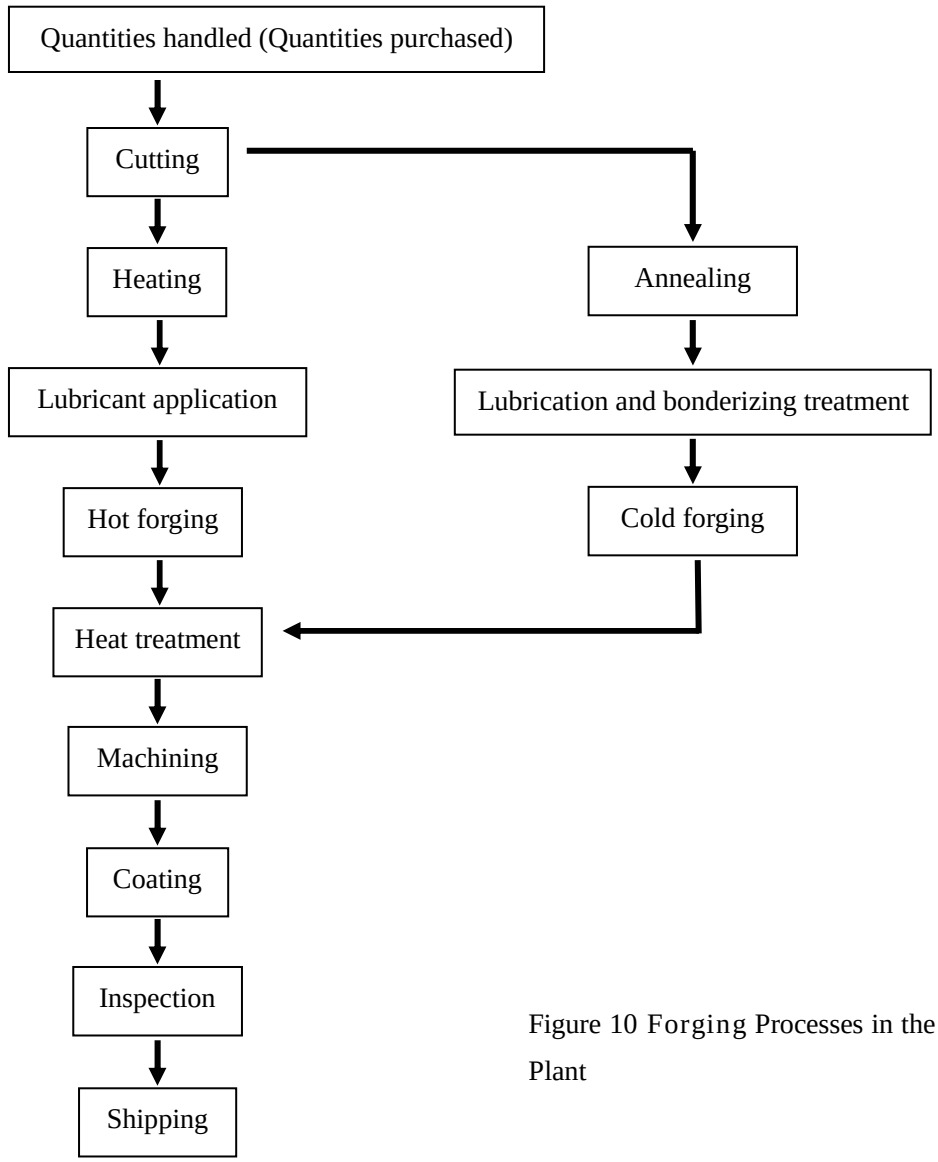


Figure 10 Forging Processes in the Model Plant

1) Calculation of Annual Quantities of Forging Materials Handled

The annual quantities of forging materials handled shall be calculated for each designated chemical substance. In the event that the same designated chemical substance is present as a constituent in more than one type of alloy, then all quantities must be totaled. First, the annual quantities of forging materials handled are obtained by using formula A), below:

A:【Annual quantities of forging materials handled】 = 【Inventory at the beginning of the period】 + 【annual quantities purchased】 — 【Inventory at the end of the period】

2) Calculation of Annual Quantities of Designated Chemical Substances Handled

The maximum standard values shall be utilized, from the list of steel material constituents. (As a matter of principle, the PRTR system attempts to avoid underestimating any potential risks. Therefore, the maximum values are utilized, rather than the mean values.) The quantities of each Class I Designated Chemical Substance handled are obtained by using formula B), below:

B: 【Annual quantities of designated chemical substances handled】 = 【annual quantities of raw materials handled】 × 【designated chemical substance content】

2.2.2 Examples of Specific Calculations for Forging Materials

1) Materials Purchased by the "All Japan Forging Corporation" (arbitrary name):

The All Japan Forging Corporation uses SCr420 chrome steel, SCM435 chrome / molybdenum steel, SNC631H nickel / chrome steel and A2014 aluminum alloy, as shown below. All steel materials have been manufactured using hot forging, with the aluminum alloy being cold forged.

Table 3 Quantities of Materials Purchased and Inventories at Beginning / End of Period

Type of Alloy/ Purchased	Inventory at Beginning of Period (kg)	Annual Quantity Purchased (kg)	Inventory at End of Period (kg)
SCr420	10,000	380,000	8,000
SCM435	5,000	96,000	6,000
SNC631H	6,000	88,000	4,000
A2014	7,000	24,000	3,000

2) Calculation of Annual Quantities of Designated Products and Designated Chemical Substances Handled

This plant is a forging business that uses the forging materials listed in Table 3, above. First, the annual quantities of these materials handled shall be calculated, using worksheet 1. Let us perform the actual calculations for the quantities of designated chemical substances contained in the forging materials, using worksheet 1.

Table 4 depicts the results of these calculations. However, these calculations were performed only for the above forging materials. In reality, the same procedures must be followed for each of the particular materials involved with all of the forging processes.

When these calculations are performed, it is always necessary to consider the

calculation of the quantities of Class I Designated Chemical Substances, for each of the individual forging processes. In this particular example, the constituents of forging materials subject to reporting are: manganese - both ferrous and nonferrous (Mn, 311), chromium (Cr, 68), cobalt (Co, 100), molybdenum (Mo, 346), lead (Pb, 230), nickel (Ni, 231) and barium (Ba, 243). The maximum standard values are utilized for these constituents.

Table 4 Example of the Calculation of Annual Quantities of Designated Chemical Substances Handled, for Forging Materials (Worksheet 1)

Number	Raw Materials and Other Materials								
	Name of Raw Materials and Other Materials	Calculation of Annual Quantity Handled				Class I Designated Chemical Substances			
		Annual Quantity Purchased	Inventory at End of Period	Inventory at Beginning of Period	Annual Quantity Handled		Cabinet Order Number	Content	Annual Quantity Handled
		kg/year	kg/year	kg/year	kg/year	Name of Substance		%	kg/year
1	SCr420	380,000	8,000	10,000	382,000	Cr	68	1.25	4775
2	SCM435	96,000	6,000	5,000	95,000	Cr	68	1.2	1140
3	SNC631	88,000	4,000	6,000	90,000	Cr	68	1.05	945
4	SNC631	88,000	4,000	6,000	90,000	Ni	231	3	2700
5	A2014	24,000	3,000	7,000		Mn	311	1.2	336
6									
7									
8									
9									
10									
11									
12									

Note: With respect to the constituents of each raw material and their content of Class I Designated Chemical Substances, the maximum values have been utilized for alloy chemical constituents.

Now, need for reporting shall be determined by reference to the "List of Total Quantities of Designated Chemical Substances Handled" on worksheet 2. Table 5 indicates the results of these calculations.

Table 5 Total Quantities of Designated Chemical Substances Handled (worksheet 2)

Number	Cabinet Order Number	CAS No.	Designated Chemical Substances	Annual Quantity Handled	Total	Reporting of Quantity Handled
				kg/year	kg/year	
1	68	7440-02-0	Chromium, Cr	4,775		
2				1,140		
3				945	6,860	Required
4	231		Nickel, Ni	2,700	2,700	Required beginning in year 2004
5	311		Manganese, Mn	336	336	Not Required
6						
7						

Precautions for Report Completion:

1) In the event that a designated chemical substance such as Cr is present in different materials as shown in Table 4, enter the corresponding numbers (e.g. 1, 2, and 3) for Cr in Table 4 when filling out Table 5.

2) This plant has used a total annual quantity of Cr equivalent to 6,860 kg. Therefore, reporting is required because this quantity exceeds the 5t/year reporting threshold for designated chemical substances handled, as stipulated under the Law for PRTR and Promotion of Chemical Management.

3) This plant has used a total annual quantity of Ni equivalent to 2,700 kg. Therefore, reporting is not required because this quantity is less than the 5 tons/year reporting threshold for designated chemical substances handled, as stipulated under the Law for PRTR and Promotion of Chemical Management. However, reporting shall be required for this quantity, beginning from the year 2004.

2.2.3 Estimating Quantities Transferred and Released During Forging Processes

Now that all of the calculations for the materials purchased have been completed, it has been determined that reporting is required. The next step is the estimation of quantities of designated chemical substances released and transferred during the actual processes involved with forging. Refer to Figure 10 for the specific processes. The calculations for each process are now performed below.

When performing calculations, it is necessary to take the following precautions:

(1) The quantities of forging materials must be used, as previously calculated. The quantities of secondary materials handled, including cutting oils and lubricants, must be calculated for each process.

(2) The quantities of designated chemical substances released during each process, can be obtained by reference to Table 2.

(3) In the event that designated chemical substances are disposed of in the form of solid wastes, then the quantities of such disposals are determined to be transfers of designated chemical substances. If such disposals have been consigned to a waste disposal company, then the quantities of such wastes disposed of must also be estimated, as these are deemed to be "transfers". However, if a waste treatment company is paid to take away and recycle the wastes, then this form of disposal shall not be deemed as a "transfer".

(4) The quantities of designated chemical substances released need only be

estimated when such substances are released to either the atmosphere or to wastewater.

1) Cutting Process

○ As waste treatment companies are paid to take away and recycle the cuttings and chips produced during the cutting process, the quantities of designated chemical substances contained in these materials and transferred, are deemed to be zero ("0" used for the calculation).

○ As most of the secondary materials utilized, such as cutting oils, do not contain any designated chemical substances, the quantities of designated chemical substances contained in these materials and transferred and released, are deemed to be zero ("0" used for the calculation). However, it is recommended that the MSDS be examined to ensure that such materials are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

2) Heating Process

○ From the results of measurements (Appendix), it has been confirmed that only minute quantities of designated chemical substances contained in the raw materials have been released to the atmosphere, even after being heated to approximately 1200 ℃ (hot forging). Therefore, it has been determined that reporting of the quantities of designated chemical substances released is not required ("0" used for the estimation.)

○ From the results of measurements (Appendix) of heavy oils and gases used for heating the furnaces, it has been confirmed that only minute quantities of designated chemical substances contained in these materials have been released. Therefore, it has been determined that reporting of the quantities of designated chemical substances transferred and released is not required.

3) Forging Process

○ During the die trimming process, the designated chemical substances contained in raw materials can be transferred in wastes, such as flash and oxidized scale. However, waste treatment companies are paid to dispose of both flash and scale. Therefore, the quantities of designated chemical substances transferred are deemed to be zero ("0" used for the estimation).

○ Designated Chemical Substances Derived from Secondary Materials

With respect to die release agents, neither graphite (black-colored) die release agent nor chemical (white-colored) die release agent contain any substantial

quantities of designated chemical substances. Actual measurements (Appendix) have shown that any such quantities of designated chemical substances released are extremely minute. Therefore, the quantities of designated chemical substances released and transferred are deemed to be zero ("0" used for the calculation). However, it is recommended that the MSDS be examined to ensure that such materials are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

○ Bonderizing During Cold Forging

As described in details of the measurement results shown in [case3] of Appendix, the chemical agents used for bonderizing contain both zinc nitrate and tribasic zinc phosphate. In general, these chemical agents contain 20% zinc nitrate (by weight) and 30% tribasic zinc phosphate (by weight). However, since tribasic zinc phosphate is not water soluble, it is not a substance designated under the Law for PRTR and Promotion of Chemical Management, thus only zinc nitrate is subject to reporting. As well, the content conversion factor for elemental zinc is equivalent to 22% of the total mass of zinc nitrate. Therefore, the annual quantities of designated chemical substances handled are calculated based on an annual usage of 30,000 kg of chemical agents and on the cold forging process used within this plant for A2014 materials.

○ The quantity of zinc nitrate ($ZnNO_3$) in the material handled is 30,000kg×0.2 (content) = 6,000 kg/year. Therefore, it is necessary to report the annual quantity handled. Next, the estimations for the quantities transferred and released are as follows: 6,000 kg/year (quantity handled)×0.22 (content conversion factor for elemental zinc) = 1,320 kg/year. Table 6 indicates the designated chemical substances contained in the bonderizing agents. Figure 11 depicts the processes of release and transfer of bonderizing agents. Table 7 shows the results of estimation for the quantities of designated chemical substance transferred and released. All of this information can be used as reference data.

Table 6 Designated Chemical Substances Contained in Bonderizing Agents / Cleaning Agents

Bonderizing Agent / Cleaning Agent					
Name of Product	Specified Designated Chemical Substance	Designated Chemical Substance	Content	Zinc Content Conversion Factor	Quantity Purchased
Accelerator AC-131	–	–	–	–	–
Paloob LUB-235	–	–	–	–	–
Palbond PB181XR	○	Zinc nitrate	20%	0.220	A = 30,000

〃	－	Tribasic zinc phosphate	30%	0.508	kg / year
Degreasing agent FC4358	－	－	－	－	－
Neutralizer PL-21	－	－	－	－	－
Dilute sulfuric acid (30%)	－	－	－	－	－

* Tribasic zinc phosphate shall not be subject to reporting, as it is not water-soluble. (Source: page 215 of Ministry of the Environment Manual)
* Report is not required for the quantities of designated chemical substances that are shipped out in products.

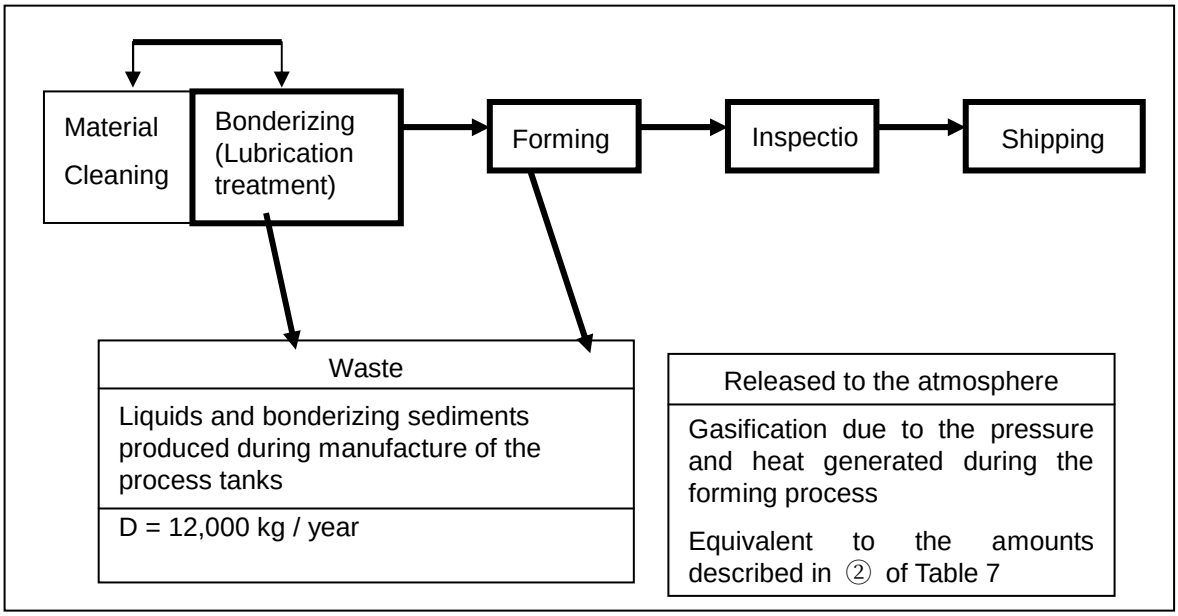


Figure 11　Process of Release and Transfer for Bonderizing Treatment　Agents

Table 7　Quantities of Designated Chemical Substances Transferred and Released During Bonderizing

	Basis for Calculation	Quantity (kg / year)	
I. Quantity Handled	= A×content (20%)×zinc conversion factor (0.22)	1,320	①
II. Quantity Released			
1. Released to atmosphere	= (A－D)×(4.4%)×0.0000073 measurement factor	0	②
2. Released to water bodies	= 0　Zinc content		
3. Released to land	= 0		
4. Disposal in landfills	= 0		
III. Quantity Transferred			
1. Transferred to sewage	= 0		

2. Transferred off-site	= 0×4.4%　Zinc content	528	③

Note: The above zinc content conversion factor is based on the MSDS submitted by the manufacturer.

The numbers enclosed in "◯" marks (circles) represent the specific processes in which these releases and transfers occur.

◯ Lubricating oils, such as machine oils and greases (i.e., products that are not designated under the Law for PRTR and Promotion of Chemical Management), contain only minute quantities of designated chemical substances. Therefore, the quantities of designated chemical substances contained in these materials and transferred and released, are deemed to be zero ("0" used for the calculation). However, it is recommended that the MSDS be examined to ensure that such materials are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

4) Heat Treatment Process

◯ Transfers and Releases of Designated Chemical Substances Contained in Forgings

As shown in the results of measurements (Appendix), even when forgings are heated to the high temperatures utilized for heat treatment, no designated chemical substances are released to the atmosphere. Therefore, the quantities of designated chemical substances contained in these materials, both transferred and released, are deemed to be zero ("0" used for the calculation).

◯ Designated Chemical Substances Contained in Secondary Materials

Fuel oils, such as heavy oils, gas and kerosene contain only minute quantities of designated chemical substances. The oils used for quenching are also not subject to reporting under the Law for PRTR and Promotion of Chemical Management. From the results of actual measurements (Appendix) it has been determined that no emission and transfer factors for designated chemical substances are present, therefore, these factors are deemed to be "zero".

However, it is recommended that the MSDS be examined to ensure that such materials are not subject to reporting under the Law for PRTR and Promotion of Chemical Management.

5) Machining

◯ The chips produced from machining are either reprocessed, or waste treatment companies are paid to dispose of them. Therefore, these chips shall not be subject to reporting.

◯ As cutting oils contain only minimal quantities of designated chemical substances,

they shall not be subject to reporting. Although cutting tools contain some designated chemical substances, such as cobalt (Co), the quantities of such substances contained in tools are extremely minute. Therefore, designated chemical substances contained in cutting tools shall not be subject to reporting.

6) Coating

The coating materials used in the coating processes contain a variety of designated chemical substances. Therefore, the constituents of the particular coating materials used must be confirmed through examination of the MSDS.

In this process, all 5 types of coating materials used contain designated chemical substances. These chemical substances shall be examined in detail. First of all, the designated chemical substances contained in the coating materials used for cation coating, as well as the annual quantities of such materials purchased, are shown in Table 8.

Table 8 Designated Chemical Substances Contained in Coating Materials for Cation Coating and Annual Quantities Purchased

Name of Product	Specified Designated Chemical Substance	Designated Chemical Substance	Content	Quantity Purchased kg/year
Power Top U-5AE F1 Black	○	Basic lead silicate	4%	A = 4,500
Power Top U-5AE F2 Black	○	Xylene	5%	B = 15,000
	○	Ethylene glycol monoethyl ether	10%	
Power Top Additive S Black	–	–	–	–
Power Top Additive A Black	–	–	–	–
Surf Cleaner 53 Black	○	Zinc (Zn)	8%	C = 2,400
	○	Nickel (Ni)	2%	
	○	Manganese (Mn)	2%	

* No Reporting required for the quantities of designated chemical substances that are shipped out in products.

Figure 12 depicts the coating process and the processes by which designated chemical substances are released and transferred from coating materials. These designated chemical substances are transferred via adhesion to the product, released to the atmosphere and transferred as waste.

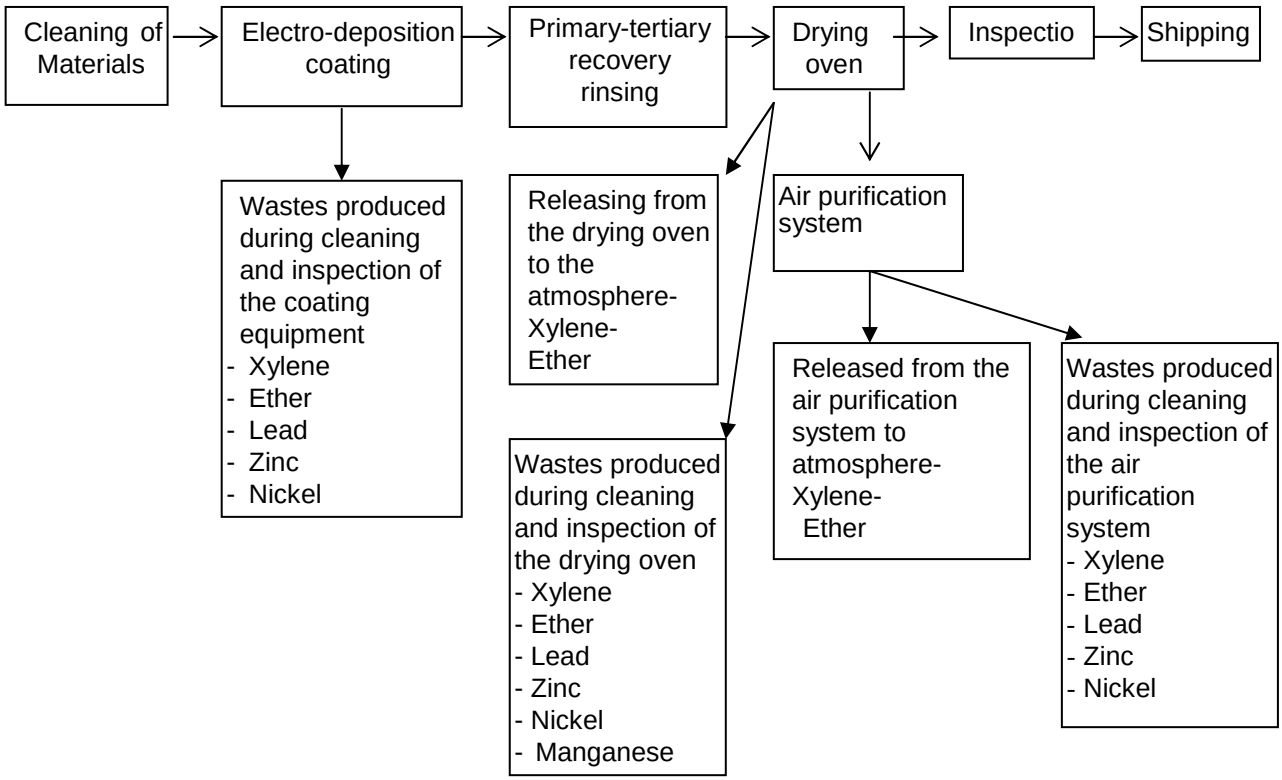


Figure 12 Coating Process and Processes that Release and Transfer Designated Chemical Substances from Coating Materials

Next, the quantities of designated chemical substances transferred and released during the coating process, shall be estimated. Table 9 shows the methods used to perform these estimations.

Table 9 Quantities of Designated Chemical Substances Handled, Released and Transferred During the Coating Processes

	Basis for Calculation	Quantity (kg/year)
I. Quantity Handled	Basic lead silicate = A × content 0.04 × lead content conversion factor 0.486	I ① 87.5
	Xylene = B×content 0.05	I ② 750.0
	Ethylene glycol monoethyl ether = B×content 0.10	I ③ 1,500.0
	Zinc (Zn) = B×content 0.08	I ④ 192.0
	Nickel (Ni) = B×content 0.02	I ⑤ 48.0
	Manganese (Mn) = B×content 0.02	I ⑥ 48.0
II.Quantity Released	Xylene	
1. Release to Atmosphere	Drying oven = I②×0.03 (emission factor)	II ② 22.5
	Air purifying system = I②×0.07 (emission factor)	II ② 52.5
	*The above emission factors are based on data gathered by the coating industry.	Total 75.0
	Ethylene glycol monoethyl ether	
	Drying oven = I ②×0.03 (emission factor)	II ③ 45.0
	Air purifying system = I ②×0.07 (emission factor)	II ③ 105.0
	*The above emission factors are based on data gathered by the coating industry.	Total 150.0
2. Release to Bodies of Water	= 0	
3. Release to Land	= 0	
4. Disposal in Landfills	= 0	
III. Quantity Transferred		
1. Transfers to POTWs	= 0	
2. Transfers Off-site	Basic lead silicate = I①–Percentage of waste shipped out (I①×0.9)	III ① 8.8
	Xylene = I②–Percentage of waste shipped out (I②×0.1)	III ② 675.0
	Ethylene glycol monoethyl ether = I③–Percentage of waste shipped out (I③×0.1)	III ③ 1,350.0
	Zinc (Zn) = I④–Percentage of waste shipped out (I④×0.7)	III ④ 57.6
	Nickel (Ni) = I⑤–Percentage of waste shipped out (I⑤×0.7)	III ⑤ 14.4
	Manganese (Mn) = I⑥–Percentage of waste shipped out (I⑥×0.7)	III ⑥ 14.4
	* The above emission factors are based on data gathered by the coating industry.	

Note: The values for both content and content conversion factors, above, have been obtained from MSDS data. The emission factors and transfer factors, above, have been determined based upon actual data gathered by the coating industry. Please note that the quantities of designated chemical substances transferred in wastes shipped out, will vary for each business premise.

The amounts of designated chemical substances handled, released and transferred in the coating process are summarized below. Making estimations of the quantities handled, released and transferred are described as follows.

1. Quantity Handled

Basic lead silicate 87.5 kg/year

Xylene	750.0 kg/year
Ethylene glycol mono ethyl ether	1,500.0 kg/year
	Reporting required
Zinc (Zn)	192.0 kg/year
Nickel (Ni)	48.0 kg/year
Manganese (Mn)	48.0 kg/year

2. Quantity Released

Xylene	75.0 kg/year
Ethylene glycol mono ethyl ether	150.0 kg/year
	Reporting required

3. Quantity Transferred

Transfers Off-site

Lead	8.8 kg/year
Xylene	675.0 kg/year
Ethylene glycol mono ethyl ether	1,350.0 kg/year
	Reporting required
Zinc(Zn)	57.6 kg/year
Nickel (Ni)	14.4 kg/year
Manganese (Mn)	14.4 kg/yearr

All the forging processes have now been examined. As a result, it has been determined that processes of bonderizing and coating were subject to reporting.

Please perform the calculations using the worksheets 1 and 2 in accordance with the procedures described.

Appendix 1 Data on PRTR Chemical Substances Released in Each Process at a Forging Plant

[Case 1] Measurement results of exhaust gases generated during forming at hot forging line

1) Location of measurement: Aichi Steel Corporation, 6000-tonne press line

2) Date of measurement: December 4, 2002

3) Method of analysis:
Analysis of metallic content of exhaust gases, sampled according to JIS K 0083 / ICP spectroscopic analysis method

4) Record of analysis

	Measurement data	Amount generated per ton of formed product
Measurement time	14:14〜15:24	—
Measurement interval	1.2h	—
Absorbed gas volume V (L)	1019.2	—
Gas meter temperature (°C)	19.9	—
Dry gas volume Vn (Ln)	948.1	—
Ni analysis value a (μg/total volume)	**0.8**	**0.0001mg/ton**
Ni concentration (mg/m^{3}N)	0.001	—
Cr analysis value a (μg/total volume)	**4**	**0.0005 mg/ton**
Cr concentration (mg/m^{3}N)	0.004	—
Mo analysis value a (μg/total volume)	**39**	**0.0049 mg/ton**
Mo concentration (mg/m^{3}N)	0.041	—
Zn analysis value a (μg/total volume)	**31**	**0.0039 mg/ton**
Zn concentration (mg/m^{3}N)	0.033	—
Measurement time	14:14〜15:00	—
Measurement interval	0.77h	—
Absorbed gas volume V (L)	544	—
Gas meter temperature (°C)	19.2	—
Dry gas volume Vn (Ln)	507.2	—
B analysis value a (μg/total volume)	**0.9**	**0.00018 mg/ton**
B concentration (mg/m^{3}N)	0.002	—
Measurement time	15:37〜16:30	—
Measurement interval	0.38h	—
Absorbed gas volume V (L)	553.6	—
Gas meter temperature (°C)	20	—
Dry gas volume Vn (Ln)	514.8	—
Si analysis value a (μg/total volume)	**36**	**0.0145 mg/ton**
Si concentration (mg/m^{3}N)	0.038	—

Conversion method for calculating the annual quantity released to the atmosphere:

1) Based on the above measurement results, use the following formula to calculate the

annual quantity released to the atmosphere.

Example: Zn (Zinc) 0.0039 mg/ton×20,000 tons/year = 78 mg=0.078 g/year

[Case 2] Measurement results of exhaust gases generated during heating in a heat treatment furnace

1) Location of measurement: Aichi Steel Corporation, No. 2 Quenching and Tempering Furnace

2) Date of measurement: December 5, 2002

3) Method of analysis:
Analysis of metallic content of exhaust gases, sampled according to JIS K 0083 / ICP spectroscopic analysis method

4) Record of analysis

	Measurement data	Amount generated per ton of formed product
Measurement time	12:00～14:20	—
Measurement interval	2.3h	—
Absorbed gas volume V (L)	1916.8	—
Gas meter temperature (°C)	18.3	—
Dry gas volume Vn (Ln)	1799.9	—
Ni analysis value a (μg/total volume)	**0.9**	**0.0002 mg/ton**
Ni concentration (mg/m^3N)	0.001	—
Cr analysis value a (μg/total volume)	**5.9**	**0.0010 mg/ton**
Cr concentration (mg/m^3N)	0.003	—
Mo analysis value a (μg/total volume)	**36**	**0.0061 mg/ton**
Mo concentration (mg/m^3N)	0.02	—
Zn analysis value a (μg/total volume)	**12**	**0.0020 mg/ton**
Zn concentration (mg/m^3N)	0.007	—

Conversion method for calculating the annual quantity released to the atmosphere:

Based on the above measurement results, use the following formula to calculate the annual quantity released to the atmosphere.

Example: Zn (Zinc) 0.0020 mg/ton×20,000 tons/year = 40 mg = 0.040 g/year

[Case 3] Measurement results of exhaust gases generated during forming of bond processing agent

1) Location of measurement: Aichi Steel Corporation, Cold Forming (extrusion) ERI 300-T line

2) Date of measurement: December 4, 2002

3) Method of analysis: Analysis of metallic content using a high-volume sampler ／ICP spectroscopic analysis method

4) Record of analysis

	Measurement data	Amount generated per ton of formed product
Measurement time	10:36～11:46	—
Measurement interval	1.2h	—
Absorbed gas volume V (L)	72.8	—
Temperature (°C)	19	—
Gas volume V at 20 (m^3)	72.9	—
Ni analysis value a (μg/total volume)	**0.017**	**0.00742 mg/ton**
Ni concentration (mg/m^3N)	0.00023	
Zn analysis value a (μg/total volume)	**5.34**	**2.331 mg/ton**
Zn concentration (mg/m^3N)	0.073	
Measurement time	10:36～11:46	—
Measurement interval	1.2h	—
Absorbed gas volume V (L)	72.8	—
Temperature (°C)	19	—
Gas volume V at 20 (m^3)	72.9	—
P analysis value a (μg/total volume)	**3.17**	**1.383mg/ton**
P concentration (mg/m^3N)	0.043	—

Conversion method for calculating the annual quantity released to the atmosphere

Based on the above measurement results, use the following formula to calculate the annual quantity released to the atmosphere.

Example: Zn (Zinc) 2.331mg/ton×2,400 ton/year = 5.594 mg = 5.6g/year