PRTR Estimation Manual

11. Aluminum Alloy Manufacturing Industry

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Japan Aluminum Alloy Refiners Association

Contents

1. Criteria for Estimating Releases and Transfers of Chemical Substances

1.1 Class I Designated Chemical Substances

The Class I Designated Chemical Substances specified by the Cabinet Order are as follows.

Classification	Number of Substances
Pesticides/Pharmaceuticals	123
Ozone-depleting substances	21
Inorganic substances, metal and its compounds	24
Others	186
Total	354

NOTE: Cabinet Order No. 138: Cabinet Order for the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management

The substances related to the industry are as follows:

Cabinet Order No.	Name of substance
68	Chromium and trivalent chromium compounds (Cr, Cr_2O_3, etc.)
179	Dioxin (Specific Class I Designated Chemical Substances)
231	Nickel
294	Beryllium and its compounds (Specific Class I Designated Chemical Substances: Be, BeO, etc.)
311	Manganese and its compounds (Mn, MnO_2, etc.)

*Each firm should confirm any other substances in addition to the above (Sb, B, etc) if necessary.

1.2 The judgment criteria of the facility required to report

[1] The number of employees

Full-time employees shall be 21 or more.

[2] The annual amount handled of Designated Chemical Substances

1 T/year or more (5 T/year or more in 2001FY, 2002FY)

Note however, the annual amount of Specific Class I Designated Chemical Substances shall be 0.5 T/ year or more.

[3] Specific requirements facilities

The facility shall be equipped with specific requirements

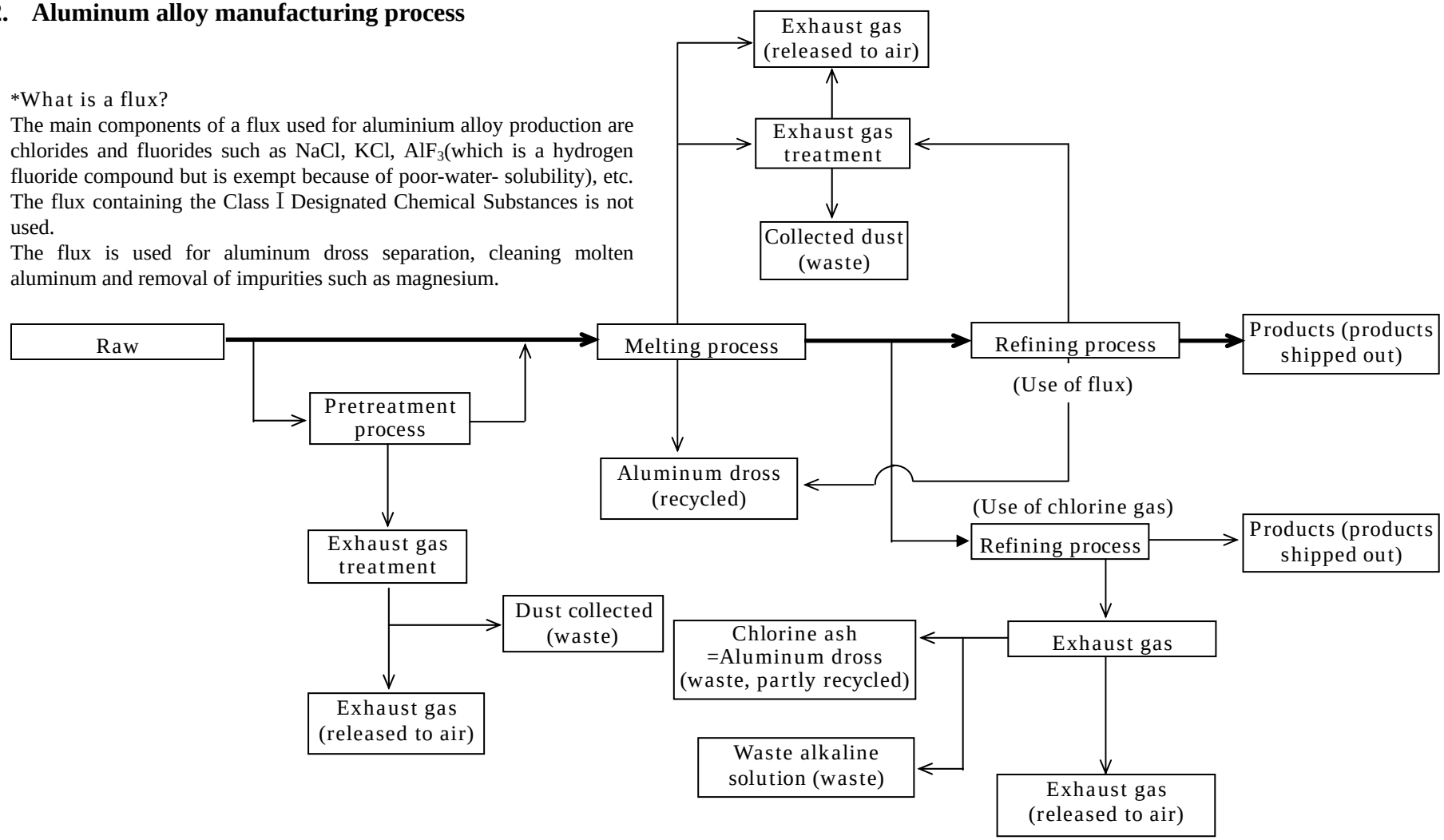
[4] Form of products, etc.

The product shall contain 1% or more of Class I Designated Chemical Substances (0.1% or more of Specified Class I Designated Chemical Substances) and be applicable to none of the following.

- Products which are always solid and are not powder or granulate in the handling process by the facility.
- Products handled in the enclosed state.
- Products used mainly for general consumers.
- Recycled resources

2. Aluminum alloy manufacturing process

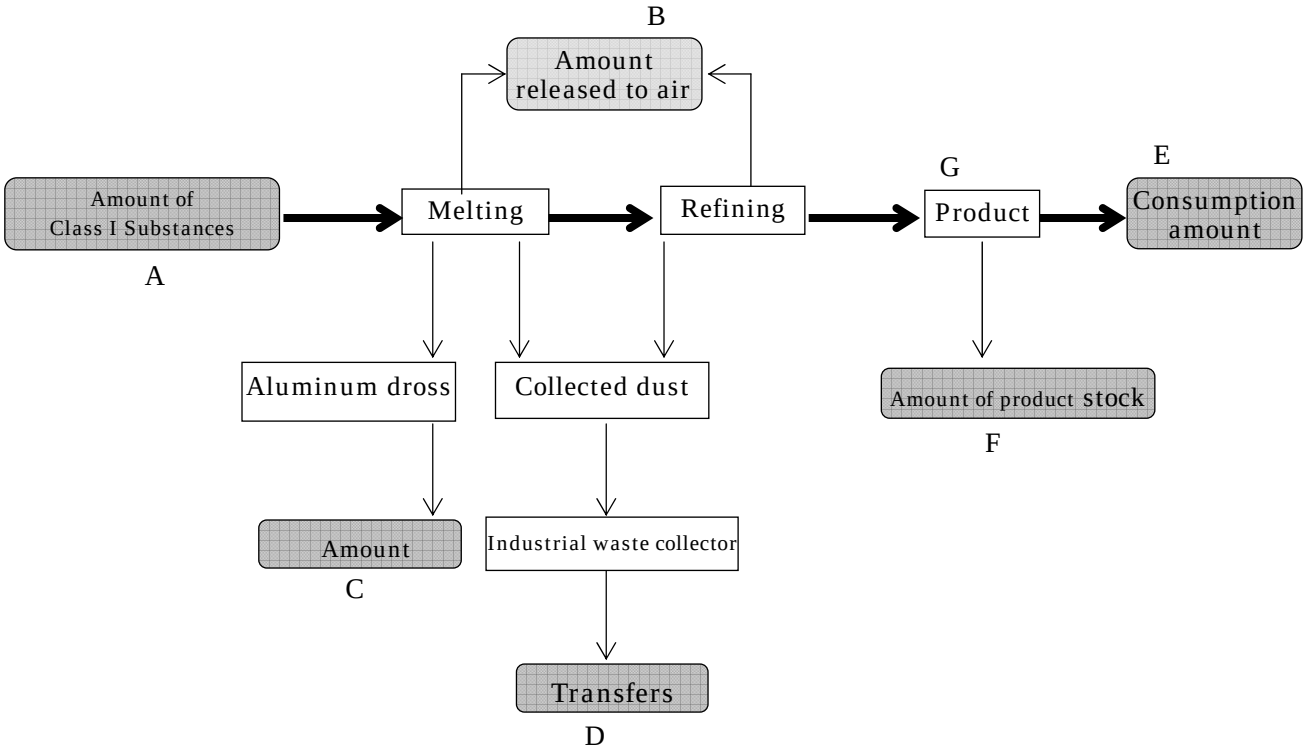
*What is a flux?
The main components of a flux used for aluminium alloy production are chlorides and fluorides such as NaCl, KCl, AlF_3(which is a hydrogen fluoride compound but is exempt because of poor-water- solubility), etc. The flux containing the Class Ⅰ Designated Chemical Substances is not used.
The flux is used for aluminum dross separation, cleaning molten aluminum and removal of impurities such as magnesium.



NOTES: Recycling

- Valuable shipped-out materials (recycled) are not required to report.
- Transfers of non-valuable shipped-out materials should be added up and reported as waste transfers.

2.1 Example 1 (Mn)



NOTES: Amount recycled (C)

- Valuable shipped-out materials (recycled) are not required to report.
- Transfers of non-valuable taking-out materials should be added up and reported as "waste transfers."

2.1.1 Estimation techniques of releases and transfers of the Designated Chemical Substance, Mn, in the aluminum alloy ingot manufacturing

(i) Amount handled A (the annual amount used)

Name of raw material (Content of the substance)	Annual amount used	Amount of the substance used
Al-10% Mn （Mn 10%）	65.0 T/year	Mn 6,500kg/year
Metallic Mn （Mn 100%）	0.50 T/year	Mn 500kg/year *1
3000S （Mn 0.8%）	(Calculation not required)	*1.T/year or more (5 T/year or more in 2001FY, 2002FY)
BM （Mn less than 1.0%）		
Scrap （Mn ？）		
Amount handled A		7,000 kg/year

(Plus the amount from any other than the raw materials)

(ii) Releases, etc. (B, C and D)

Estimate using Emission Factors (*2: See the separate table).

Type	Raw materials used	ⓐ Emission Factors*2 (g/Mn1kg)	ⓑ Amount of the substance used (kg/year)	ⓐxⓑ Releases/Transfers (kg/year)	(Total)
Release to air	Al-Mn	0.00	Mn 6,500	0.00	(0.00 kg/year = B)
	Metallic Mn	0.00	Mn 500	0.00	
Dust transferred	Al-Mn	0.03	Mn 6,500	0.20	(0.22 kg/year = D)
	Metallic Mn	0.03	Mn 500	0.02	
Recycled dross	Al-Mn	15	Mn 6,500	97.5	(105kg/year = C)
	Metallic Mn	15	Mn 500	7.5	
Total (B+C+D)	-	-	-	105.22 = 105 kg/year	

(iii) Product g (the annual amount of the substance contained in the products manufactured)

The target shall be only the products containing the target raw materials, Al-10% Mn and metallic Mn.

Product code	(Content of the substance)	Annual amount of Production	Content of the substance (total content)
AC4A.1 *3	(Mn 0.50%)	600 T/year	Mn 3,000 kg/year
AC4B.1	(Mn 0.40%)	1,000 T/year	Mn 4,000 kg/year
AD3.1	(Mn 0.45%)	400 T/year	Mn 1,800 kg/year
3004	(Mn 1.1%)	100 T/year	Mn 1,100 kg/year
Total (including Mn in any other raw materials used)		2,100 T/ year	9,900 kg/year (= g)

(*3: Indicated by the JIS code, not by the customer's code)

→ The result, A < g, is not available as it is. (g includes Mn in any other raw materials)

(iv) Consumption E and the amount of product stock F

(1) The amount of products G = E + F

Mass balance limited to the amount of target raw materials handled is

$A = B + C + D + G$.

$\therefore\ G = A - (B + C + D)$

$= 7{,}000 - 105 = 6{,}895$ kg/year = E + F

(2) Estimation of E and F

[1] The contents of the substance contained in the stock of products (f)*4 is the below.

Product code		Product stock (△ shows decreased stock)	Content of the substance	
AC4A.1	(Mn0.50%)	10T	Mn	50kg
AC4B.1	(Mn0.40%)	△ 20T	Mn	△ 80
AD3.1	(Mn0.45%)	30T	Mn	135
3004	(Mn1.1%)	△ 5T	Mn	△ 55
Total		15T	Mn	50kg(=f)

(*4 Increase and decrease in the amount at the beginning and end of the fiscal year)

[2] With the results up to here, estimate E and F proportionally

	Total content of Mn		Amount of Mn in the target raw materials handled
e	9,900 – 50 = 9,850 kg/year		E
f	50 (4 – (2) – item [1])		F
g	9,900 kg/year (by item iii)	G	6,895 kg/year (4 – item (1))

∴ E = 9,850/9,900 x 6,895 = 6,860.2 6,860 kg/year

F = 50/9,900 x 6,895 = 34.8 35 kg/year

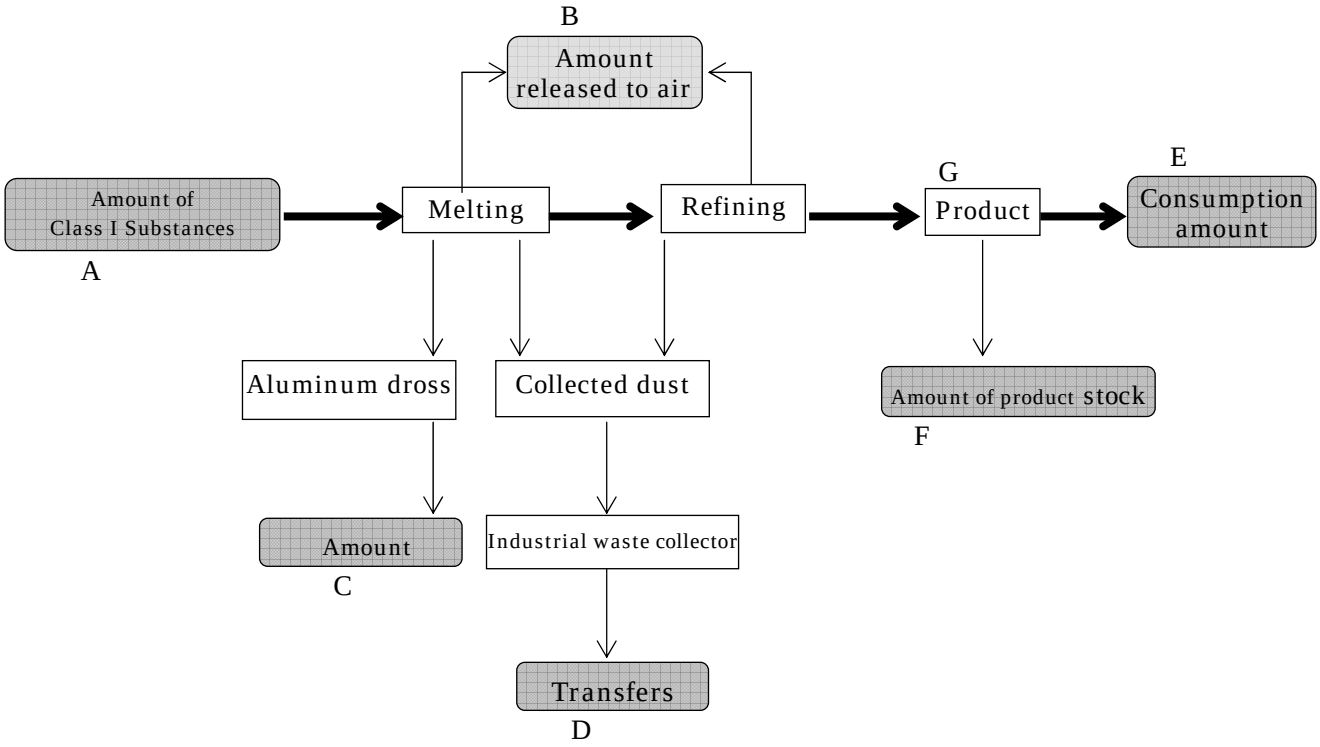
(v) Summary

A: Amount handled	7,000 kg/year	E: Consumption	6,860 kg/year
B: Amount released to the air	0.0 kg/year	F: Amount of product stock	35 kg/year
C: Amount of recycled dross	105 kg/year	G: Amount of Products	6,895 kg/year
D: Amount of dust transferred	0.2 kg/year		

Note 1: B and D shall be reported.

Note 2: B and D are in kg/year, and in significant figure of two digits. (Figures less than 1kg/year are rounded off to first decimal place)

2.2 Example 2 (Be)



NOTES: Amount recycled (C)

- Valuable shipped-out materials (recycled) are not required to report.
- Transfers of non-valuable shipped-out materials should be added up and reported as "waste transfers."

2.2.1 Estimation techniques of releases and transfers of the Designated Chemical Substance, Be, in the aluminum alloy ingot manufacturing

(i) Amount handled A (the amount used this year)

Name of material (Content of the substance)		Annual amount used	Amount of the substance used
Al-2.5% Be	(Be 2.5%)	24.0 T/year	Be 600 kg/year
5000S	(Be 0.004%)	(Calculation not	
Scrap	(Be less than 0.10%)	required)	
Amount handled A			600 kg/year

(ii) Releases, etc. (B, C, and D)

Estimate using Emission Factors (*2: See the separate table).

Type	Raw materials used	Emission Factors*2 (g/Be1kg)	Amount of the substance used (kg/year)	Releases/Transfers (kg/year)
Release to air	Al-Be	0.00	Be 600	0 (= B)
Dust transferred	Al-Be	0.00	Be 600	0 (= D)
Recycled dross	Al-Be	0.00	Be 600	0 (= C)
Total (B+C+D)	-	-	-	0

(iii) Product g (the amount of the substance contained in the products manufactured this year)

The target shall be only the products containing the target raw materials, Al-2.5 % Be.

Product code	(Content of the substance)	Annual amount of production	Content of the substance (total content including Be from other than Al-2.5 % Be)	
AC7A.2	(Be 0.004%)	14,000 T/year	Be	560 kg/year
AD6.1	(Be 0.003%)	3,500 T/year	Be	105 kg/year
Total		17,500 T/ year	Be	665 kg/year (= g)

(iv) Consumption E and the amount of product stock F

(1) Product amount G = E + F

Mass balance limited to the amount of target raw material handled*2 is :

(*2 Al-2.5 % Be)

A = B + C + D + G.

∴ G = A – (B + C + D)

= 600 – 0 = 600 kg/year = E + F

[NOTES] The difference between g = 665 kg/year (item iii) and G = 600 kg/year shows Be in any other raw materials except Al-2.5 % Be.

(2) Estimation of E and F

[1] The contents of the substance in the stock (f*3) of the products is shown below.

Product code		Product stock	Content of the substance	
AC7A.2	(Be0.004%)	△ 20T	Be	△ 0.80 kg
AC6.1	(Be0.003%)	30T	〃	0.90
Total		10T	Be	0.10kg(=f)

(△ shows decreased stock)

(*3 Increase and decrease in the amount at the beginning and end of the fiscal year)

[2] With the results up to here, estimate E and F proportionally

	Total content of Be		Amount of Be in the target raw materials handled
e	665 – 0.10 = 664.9 kg/year		E
f	0.10 (4 – (2) – item [1])		F
g	665 kg/year (item (iii))	G	600 kg/year (4 – item (1))

∴ E = (664.9/665) x 600 = 599.9 600 kg/year

F = (0.10/665) x 600 = 0.090 0.1 kg/year

(v) Summary

A: Amount handled	600 kg/year	E: Consumption	600 kg/year
B: Amount released to the air	0.0 kg/year	F: Amount of product stock	0.1 kg/year
C: Amount of recycled dross	0.0 kg/year	G: Amount of products	600 kg/year
D: Amount of dust transferred	0.0 kg/year		

Note 1: B and D shall be reported.

Note 2: B and D are in kg/year, and in significant figure of two digits or three digits (up to the first decimal place).

2.3 Example 3 (Dioxins)

2.3.1 Estimation techniques of Dioxins released to air

(Estimation example)

- Premise

(1) The results of the measurements of dioxins level released to air stipulated by the law

0.50*ng-TEQ/Nm^3 = 0.50 x 10^{-6} mg-TEQ/Nm^3

* The results of released level measured by each facility once a year are used.

(2) Relevant values during the measurement

Exhaust gas flow:	35,000 Nm^3/h	Sampling time:	4 hours
Amount of molten aluminum alloy which measurement:	8,000 kg	Recovery yield rate:	95 %

(3) The annual production quantity at designated facilities related to the release level describe above

11,000 T/year

(4) The annual operation time at designated facilities related to the release level describe above

20 h/day x 125 day/year + 24 h/day x 125 day/year = 5,500 h/year

- Estimation of released Dioxins

Use either of the following methods.

Calculation 1 By exhaust gas flow

Annual released amount = 0.50 x 10^{-6} mg-TEQ/Nm^3 x 35,000 Nm^3/h x 5,500 h/year

= 96 mg-TEQ/year

Calculation 2 By Emission Factors (unit emission)

Emission Factors = 0.50 x 10^{-6} mg-TEQ/Nm^3 x 35,000 Nm^3/h x 4 h/8 T x 0.95

= 9,210 x 10^{-6} mg-TEQ/product T

Annual released amount = 9,210 x 10^{-6} mg-TEQ/product T x 11,000 T/year

= 101 mg-TEQ/year

3. Separate table

Emission Factors

（The measurement result of November – December in 2000）

Test	Raw materials used	Product code	Emission Factors (g total-M/kgM)				Notes
			Corresponded designated substances	Exhaust gas	Dust	Dross	
A	Metallic Mn pieces	Al-10%Mn	Mn	0	0.03	15	Dross is not generated after the addition of Al-Be.
B	Al-2.5%Be	AC7A.1	Be	0	0	0	
C	Metallic Ni board	AC8A.2	Ni	0	0	3.5	
D	Metallic Cr	Al-5%Cr	Cr	0	0.0006	15	
Notes				Not detected	Appears to depend on the surface condition of each raw material used and its addition method.	Depend on the amount of dross generated and the content of the aluminum alloy in dross.	