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**Conference of the Parties to the
Minamata Convention on Mercury
Third meeting**
Geneva, 25–29 November 2019
Item 5 (f) of the provisional agenda*

Matters for consideration or action by the Conference of the Parties: capacity-building, technical assistance and technology transfer

Compilation of information received from existing regional, subregional and national arrangements on their capacity-building and technical assistance to support Parties in implementing their obligations under the Minamata Convention

Note by the secretariat

As referred to in the note by the secretariat on the matter (UNEP/MC/COP.3/12), a compilation of information received from existing regional, subregional and national arrangements on their capacity-building and technical assistance to support parties in implementing their obligations under the Minamata Convention is set out in the annex to the present note. The submissions and reports are reproduced as received, without formal editing.

* UNEP/MC/COP.3/1.

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Annex

Compilation of information received in relation to decision MC-2/11: Article 14: Capacity-building, technical assistance and technology transfer

I. Information submitted by the Intergovernmental Network on Chemicals and Waste for Latin America and the Caribbean

Secretariat of the Minamata Convention on Mercury
United Nations Environment Programme
Avenue de la Paix 8-14,1211 Geneva 10, Switzerland
MEA-minamatasecretariat@un.org

23-05-2019

Subject: Contribution to follow up on the second meeting of the Conference of the Parties to the Minamata Convention on Mercury, Geneva, Switzerland, 19-23 November 2018 – Capacity building regional arrangements

Dear Ms Silva Repetto:

In accordance with Decision MC-2/11 on capacity building, technical assistance and technology transfer, whereby the Secretariat was requested to collect information from the existing regional, subregional and national arrangements on their capacity-building and technical assistance to support parties in implementing their obligations under the Minamata Convention, I am pleased to inform you about the arrangements conducted within the framework of the Intergovernmental Network on Chemicals and Waste for Latin America and the Caribbean.

The Intergovernmental Network was established in 2016 by the Forum of Ministers of Environment of Latin America and the Caribbean, with the aim of strengthening the environmentally sound management of chemicals and waste, reinforcing sub-regional and regional cooperation and facilitating the exchange of experiences, ensuring cooperation and coordination with agreed international and regional frameworks, as well as improving engagement and communication with other stakeholders.

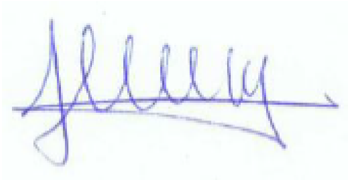
During 2017-2018, the Network organized a range of initial information exchange activities, including 8 webinars on different priority issues on chemicals and waste, which were joined by more than 400 participants from about 35 countries. One of the webinars was focused on mercury trade, with the support of the Minamata Convention Secretariat.

At the XXI meeting of the Forum of Ministers of Environment of Latin America and the Caribbean (Buenos Aires, Argentina, 9-12 October 2018), the *Action plan for regional cooperation on chemicals and waste management 2019-2020 for Latin America and the Caribbean*, was formally adopted through Decision 1 on Chemicals, Marine Litter and Waste Management. The content of the action plan was informed by a comprehensive review of priority issues and cooperation actions for LAC countries.

The Action Plan includes 33 technical cooperation actions within 6 priority topics, including a specific topic on mercury and the Minamata Convention, with a range of priority actions such as the sound management of mercury, use of mercury in ASGM, and control of legal and illegal mercury trade.

We trust that the implementation of this Action Plan, with the support of a range of partners and regional centres, including the support of the Minamata Secretariat, will strengthen the capacity of countries in Latin America and the Caribbean to meet the obligations of the Convention.

Yours sincerely



Alejandra Acosta

Chair of the Steering Committee of the Intergovernmental Network on Chemicals and Waste for Latin America and the Caribbean

Directorate of Chemical Products and Substances

Secretary of Environment and Sustainable Development

Argentina

II. Information submitted by the government of Japan

Information from Japan upon the request from the Minamata Convention Secretariat on capacity building, technical assistance and technology transfer on the Minamata Convention on Mercury

May 2019

At the Diplomatic Conference of the Minamata Convention on Mercury, Japan expressed its intention to support developing countries and promote voices and messages from Minamata, through the actions titled "MOYAI Initiative." As part of this initiative, the MINAS (MOYAI Initiative for Networking, Assessment and Strengthening) is being promoted. MINAS is a program of Ministry of the Environment, Japan that is designed to support developing countries' efforts in mercury management by providing measures including the various activities with close cooperation and collaboration with relevant agencies.

Draft decision MC-2/11 adopted in the second meeting of the Conference of the Parties requested the secretariat of the Minamata Convention to collect the information received from the existing regional, subregional and national arrangements on their capacity-building and technical assistance to support parties in implementing their obligations under the Minamata Convention, and requests the secretariat to report thereon to the Conference of the Parties at its third meeting.

The Minamata Convention requires the implementation of comprehensive mercury control measures throughout the entire lifecycle of mercury, including on import/export, use in products, emission/release to the environment and disposal. Hence, mercury material flow serves as a basic reference to promote mercury management in an appropriate manner and to verify the effects of such measures in the coming years. For this reason, Ministry of the Environment, Japan (MOEJ) published "Mercury Material Flow in Japan (FY2010)" in 2013. After incorporating newly available data, a revised version is now being published as material flow for FY2014 (Annexed to this document).

ANNEX

Overview of Mercury Material Flow in Japan (FY2014)

1. Background and Objective

In October 2013, the Diplomatic Conference on the Minamata Convention was held in Kumamoto City and Minamata city in Japan, and the Minamata Convention on Mercury (hereinafter referred to as "the Convention") was adopted and signed. Japan deposited the instrument of ratification in February 2016, following the enactment of the Act on Preventing Environmental Pollution of Mercury (Act No.42 of 2015; hereinafter referred to as "the Act").

The Convention requires the implementation of comprehensive mercury control measures throughout the entire lifecycle of mercury, including on import/export, use in products, emission/release to the environment and disposal. Hence, mercury material flow serves as a basic reference to promote mercury management in an appropriate manner and to verify the effects of such measures in the coming years. For this reason, Ministry of the Environment, Japan (MOEJ) published "Mercury Material Flow in Japan (FY2010)"[1] in 2013. After incorporating newly available data, a revised version is now being published as material flow for FY2014.

For the purpose of preparing this revised material flow, the target (base) year of the material flow is set to FY2014 due to the following reasons:

- (i) It is desirable to estimate the material flow based on the latest data available, and
- (ii) The mercury (air) emission inventory in Japan was revised using FY2014 as the target year.

This version of the material flow is expected to be used for confirming the progress of domestic measures and for examining future efforts to be made as required by the Convention. It is expected that the knowledge and experience obtained through the process of developing the revised material flow will be useful for other countries to develop their own material flows.

[1] MOEJ Press release (21st March, 2013): "Mercury Material Flow and Mercury Emission Inventory in Japan" http://www.env.go.jp/press/16475.html

2. Executive Summary

The overview of mercury material flow in Japan (FY2014) is shown on the next page. The primary results of the flow are (1) a total input of 80 tons came from raw minerals and fuels for domestic use (of which 74 tons is from imported raw minerals and fuels, 4.5 tons from domestic produced raw minerals and fuels, 1.0 tons from imported products, and 0.44 tons from imported mercury), (2) 84 tons exported, (3) 18 tons emitted/released to the environment (17 tons of atmospheric emission, 0.24 tons of release to public waters and 0.34 tons of release to land) ,and, (4) 7.3 tons landfilled for disposal.

It is our intention to continually improve the accuracy of estimation based on the best available data while reviewing the material flow calculation/estimation method as required.

3. Words of Caution when Referring to the Mercury Material Flow

① Limitations of the Mercury Material Flow

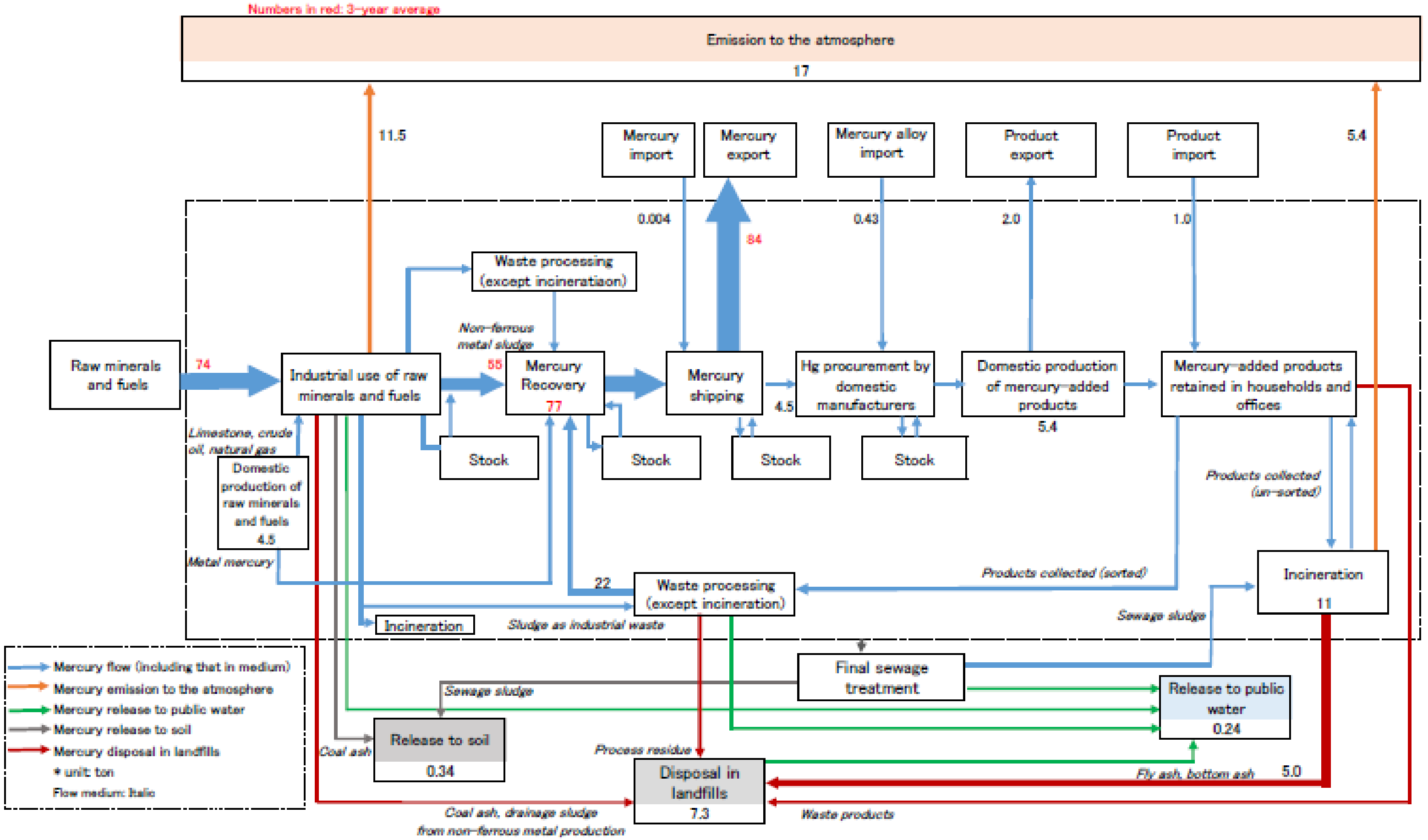
1) The revised material flow is developed using numerical values which are calculated/estimated based on the currently available statistical information, literatures, results of questionnaire/interview surveys with business operators, and thus does not include exhaustive information on the usage, discharge and transfer of mercury. Numerical values for FY2014 are used whenever available. In case such values are not available or fluctuate from one year to another, the numerical values of the nearest year to FY2014 or the average over several years are used for calculation/estimation. The reference year of the data and the respective calculation method used are listed in the Appendix.

2) The quantities of mercury-added products stored in households, workplace, etc. are shown in the material flow simply as market stock as well as stock at each stage. However, their quantities are not indicated as it is difficult to obtain the relevant quantitative values.

② Entry Method of Numerical Values

All the numerical values are corresponding values in metric tons of mercury. The significant figure consists of two digits and each figure is rounded off.

Mercury Material Flow in Japan (FY2014)



Note: This mercury material flow is developed based on best available statistics, literatures, and surveys on the private sectors, and does not indicate accurate and comprehensive mercury flow.
Note: This figure shows the amount of mercury at each stage in FY2014 and does not indicate the movement of individual lifecycle of mercury.
Note: The balance between supply and demand of mercury matches in the long-term, but may not match when looking at data of a single year due to the impact of transport and the use of stock between years.

Mercury Material Flow in Japan (FY2014)

Mercury Material Flow in Japan

(2014 Fiscal Year)

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1. Raw minerals

1.1 Mercury content in imported raw minerals

Table 1.1.1 shows mercury content in imported raw minerals for Fiscal Year (FY, hereinafter) 2016 based on statistical data and data obtained through interviews with business association. To ensure consistency with the mass flow of non-ferrous metal smelting industry, the arithmetic mean between FY2013 and FY2015 is used for the amount of non-ferrous metal ore import. The total amount of mercury in imported raw minerals is estimated as 74 t-Hg.

Table 1.1.1 Mercury content in imported raw minerals (FY2014)

Imported raw minerals		Imported amount	Unit	Hg concentration	Hg content	
					(kg-Hg)	(t-Hg)
Coal	Anthracite	5,105	10^3 t	0.0390 (g/t)	7,454	7.5
	Bituminous coal	170,555				
	Other coals	12,032				
	Briquette, oval briquette, etc.	80				
	Lignite	19				
	Peat	114				
	Coke, etc.	3,218				
Crude oil	Crude oil (refining use)	188,149	ML	2.6 (mg/kL)	489	0.49
Naphtha		18,506	10^3 t	0.001 (g/t)	19	0.019
Iron ore (incl. concentrate)	Iron ore (uncondensed)	124,170	10^3 t	0.0329 (g/t)	4,496	4.5
	Iron ore (condensed)	12,614				
	Burned iron sulphide	0.050				
Non-ferrous metal ore (incl. concentrate)	Copper, lead, zinc concentrate, gold ore	5,710	10^3 t	—	—	62
				Total	—	74

[Source]
Amount of coal, oil, naphtha and iron ore import: Trade Statistics of Japan (Ministry of Finance, Japan)
Mercury concentration in coal: Interview with Federation of Electric Power Companies of Japan (FY2016)
Mercury concentration in crude oil: Country-wise weighted average of crude oil import (Petroleum Association of Japan, 2009-2010)
Hg concentration in naphtha: S&P Global Platts,"Methodology and specifications guide; Asia Pacific & Middle East Refined Oil Products (Last update: May 2015)"
Hg concentration in iron ore: Arithmetic mean of ore lumps used in blast furnaces in Japan (National Institute for Environmental Studies Report, 2010)
Amount of import and Hg concentration in non-ferrous metal ore: Interview with Japan Mining Industry Association (FY2016); arithmetic mean of FY2013-FY2015 is used for the amount of import and hg content in non-ferrous metal ore, to ensure the consistency with the mercury flow in non-ferrous metal smelting facilities.

1.2 Mercury content in domestically produced raw minerals

Table 1.2.1 shows the estimation results of mercury content in domestically produced raw minerals in reference to the Current Survey of Production by Ministry of Economy, Trade and Industry (METI). Total amount of mercury contained in domestically produced raw minerals is estimated as 4.5 t-Hg.

Table 1.2.1 Mercury content in domestically produced raw minerals (CY2014)

Raw mineral	Raw mineral production		Mercury concentration	Mercury content	
	Amount	Unit		(kg-Hg)	(t-Hg)
Limestone	148,088	10^3t	0.022 ppm	3,258	3.3
Crude oil	644	ML	N/A	182	0.18
Natural gas	2,822,463	10^3m^{3}N	N/A	1,067	1.1
			Total	4,507	4.5

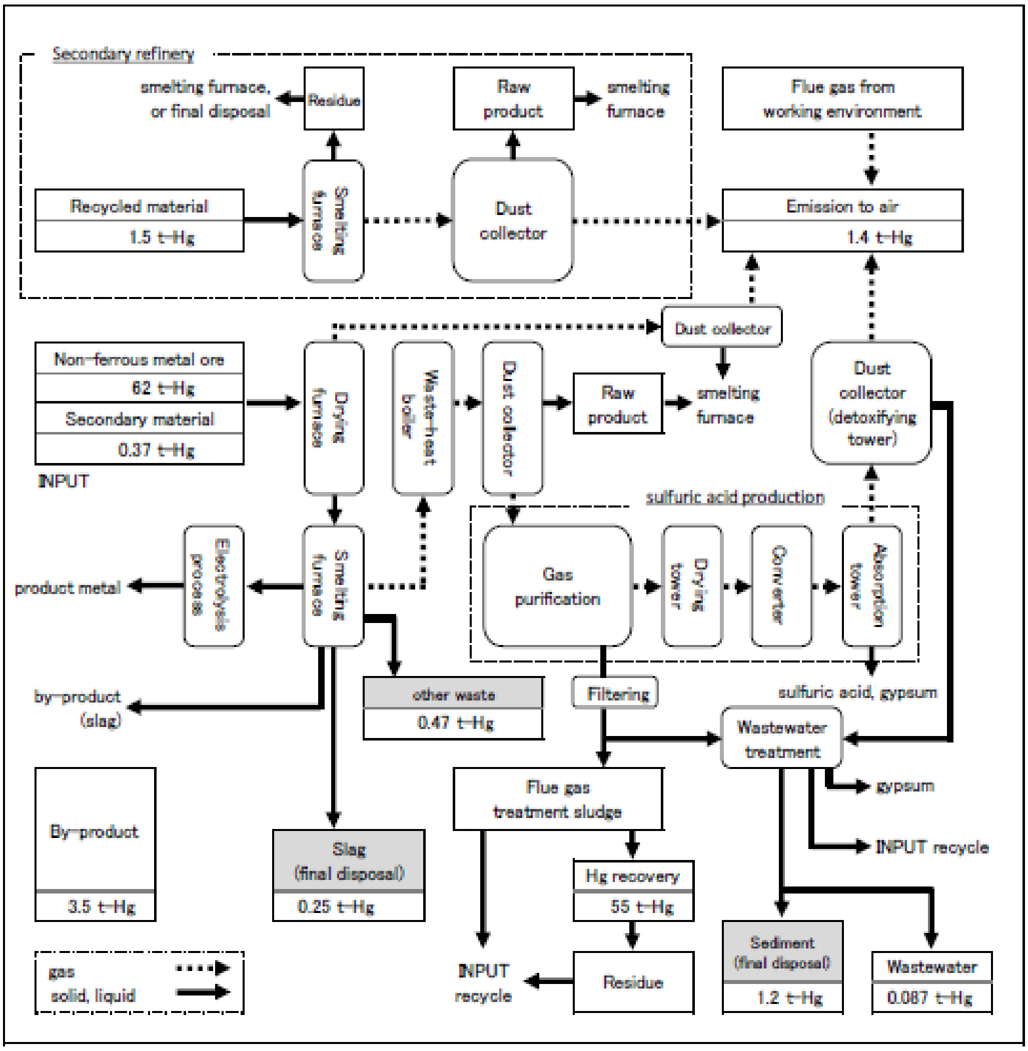
[Source]
Production of raw minerals: Yearbook of current production statistics, Ministry of Economic, Trade and Industry, CY2014
Mercury concentration in limestone: Implementation of measures for mercury emission based on the Minamata Convention on Mercury (First Proposal), Reference document "Mercury emission inventory (FY2014)" http://www.env.go.jp/press/102627.html
Mercury concentration in oil and gas: Interview with three domestic business entities, FY2016. The figure in the table is considered as minimum value in the material flow, since it is the actual value obtained at the interview, and does not cover the entire domestic situation.

1.3 Processing/industrial use of raw minerals and waste incineration

This section describes the mercury flow associated with processing/industrial use of raw minerals and waste incineration by each industry. The shaded items are to be subject to final disposal.

(1) Non-ferrous metal smelting facility

Figure 1.3.1 shows the mercury flow for non-ferrous metal smelting facilities. For data on mercury recovery from sludge generated, as a large fluctuation of data value is seen for data between FY2013 and FY2015, the average of data values from this three year period was utilized.



Flow: Based on interview with Japan Mining Industry Association

Values in the flow: Interview with Japan Mining Industry Association, FY2016 (average data between FY2013 and FY2015)

Figure 1.3.1 Mercury flow in non-ferrous metal smelting facilities (FY2014)

1) Emission

Table 1.3.1 shows the estimation results of atmospheric mercury emission from non-ferrous metal smelting facilities in "Mercury Emission Inventory (FY2014)".

Table 1.3.1 Mercury emission from non-ferrous metal smelting facilities (FY2014)

Non-ferrous metal	Production [Note1] (t)	Overall emission factor (g-Hg/ton)	Emission (t-Hg)
Reproduced lead (secondary)	39,103	0.033 [Note2]	0.0013
Reproduced zinc (secondary)	27,847	0.0034 [Note3]	0.000095
Copper, electrical lead, gold, electrolytic zinc or distilled zinc, recovered zinc	-	-	1.35
		Total	1.4

Note 1: Current Survey of Supply and Demand of Non-ferrous Metals FY2014 (Natural Resources and Fuel Department)

Note 2: Arithmetic mean of overall emission factor obtained at two facilities in 2015. Overall emission factors were calculated based on the data obtained through five measurements with following formula.

Overall emission factor = Average Hg in flue gas x Average gas flow (dry) / Amount of metal production per hour

Note 3: Overall emission factor was calculated based on the data obtained through five measurements at one facility on reproduced zinc (secondary).

2) Input of non-ferrous metal ore/material

Table 1.3.2 shows the mercury content in non-ferrous metal ore/material used for the non-ferrous metal smelting processes. Three-year average between FY2013 and FY2015 is used in the material flow.

Table 1.3.2 Non-ferrous metal smelting: Mercury content in material

Material	Mercury content (t-Hg)			
	FY2013	FY2014	FY2015	Average
Non-ferrous metal ore	64	59	63	62
Recycled material	1.7	1.6	1.2	1.5
Secondary material	0.4	0.5	0.2	0.4

Source: Interview with Japan Mining Industry Association in FY2016

Table 1.3.3 (Reference) Non-ferrous metal smelting: Import of non-ferrous metal ore

	FY2013	FY2014	FY2015	Average
Import of non-ferrous metal ore (10^3 t)	5,710	5,780	5,650	5,710

Note: According to Japan Mining Industry Association, several types (10 types at maximum) of raw material ore are purchased every year by each refinery, and the mercury content varies depending on the types of ore.

3) Transfer to waste

Table 1.3.4 shows mercury transferred to waste from the non-ferrous metal smelting process. Three-year

average from FY2013 to FY2015 is used in the material flow.

Table 1.3.4 Non-ferrous metal smelting: Mercury transfer to waste

Medium	Mercury content (t-Hg)			
	FY2013	FY2014	FY2015	Average
Waste water treatment sediment	0.96	2.22	0.27	1.2
Slag	0.24	0.26	0.26	0.25
Other waste	1.3	0.05	0.05	0.5
Waste water	0.1	0.08	0.08	0.09

Source: Interview with Japan Mining Industry Association, FY2016

4) By-product production

Table 1.3.5 shows the mercury content in by-products (sulfuric acid/gypsum) generated from the process of non-ferrous metal smelting. Three-year average between FY2013 and FY2015 is used in the material flow.

Table 1.3.5 Mercury content in by-product

By-product	Mercury content (t-Hg)			
	FY2013	FY2014	FY2015	Average
Sulfuric acid, gypsum	3.4	4.2	2.8	3.5

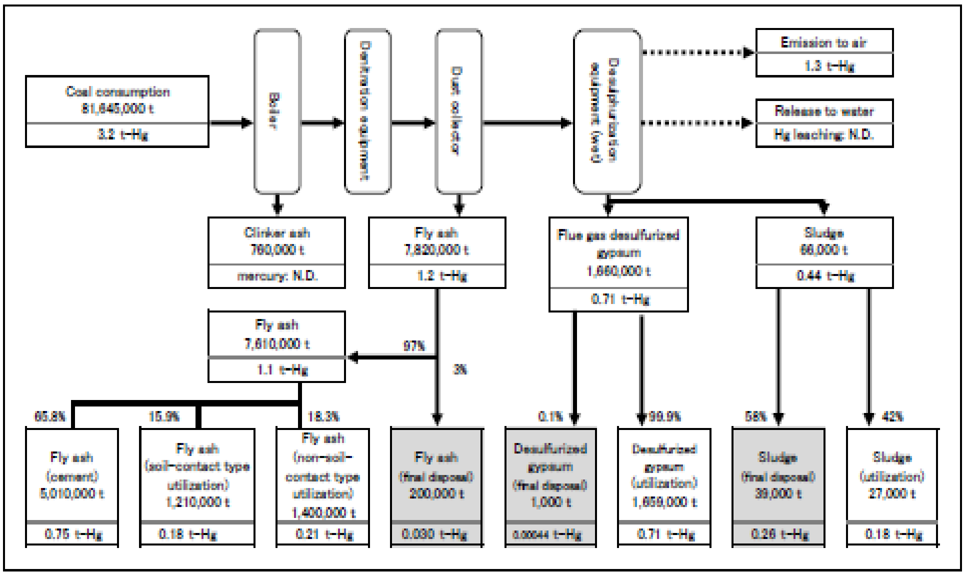
Source: Interview with Japan Mining Industry Association, FY2016

5) Mercury recovery from sludge generated through the flue gas treatment

Mercury recovery from sludge generated from the flue gas treatment process of non-ferrous metal smelting is contracted out to waste treatment companies. The total amount of recovered mercury is estimated as 55 t.

(2) Coal-fired power plant

The mercury flow in coal-fired power plants is shown in Figure 1.3.2.



Flow: Based on interview with Federation of Electric Power Companies

Values in the flow: Data extrapolated to the whole of Japan based on information obtained from interview with the Federation of Electric Power Companies in FY2016, using the results of the Survey of Electric Power Statistics conducted by the Agency of Natural Resources and Energy.

Figure 1.3.2 Mercury flow in coal-fired power plants (FY2014)

1) Emission

Table 1.3.6 shows the result of estimation of mercury emission to air from coal-fired power plants in "Mercury Emission Inventory (FY2014)".

Table 1.3.6 Mercury emission from coal-fired power plants (FY2014)

Energy generation (100,000,000 kWh)	Overall emission factor (μg/kWh)	Emission (t-Hg)
2,845	4.43	1.3

[Source]

Energy generation: "Annual Report on Energy in FY2014 (Energy White Paper 2015)" (Data of FY2013 was the latest at the time of the development of inventory).

Overall emission factor: The values measured at 17 units in 11 power plants out of 38 power plants (coverage 29%) were used, retrieved from Survey report on trace substance emission actual situation of coal-fired power plants (W02002) issued by Central Research Institute of Electric Power Industry.

Note: Mercury emission was calculated by multiplying the domestic energy generation by the overall emission factor based on the domestic actual measurement data.

2) Coal consumption

Table 1.3.7 shows the amount of domestic coal consumption in FY2014 and the mercury content therein in

reference to the Survey of Electric Power Statistics by the Agency of Natural Resources and Energy. The result of the Survey of Electric Power Statistics (3.2 t-Hg) is applied in the material flow because this survey covers a wide range of data. It needs to be noted that the amount of residue generated from coal-fired power plants throughout Japan is estimated using the ratio of the coal consumption data provided by Federation of Electric Power Companies and the value obtained from the Survey of Electric Power Statistics.

Table 1.3.7 Coal-fired power generation: Coal consumption in electric power industries (FY2014)

Source	Data coverage Note1	Coal consumption (1,000 t)	Hg content Note2	
			(kg-Hg)	(t-Hg)
Survey of Electric Power Statistics by the Agency of Natural Resources and Energy	10 General Electricity Utilities	59,559	-	-
	Wholesale Electricity Utilities + Specified Electricity Utilities + Specified-scale Electricity Utilities	22,085	-	-
	Total	81,645	3,184	3.2
Federation of Electric Power Companies	10 General Electricity Utilities and other utilities	80,230	3,129	3.1

Source: Survey of Electric Power Statistics by the Agency of Natural Resources and Energy and Interview with Federation of Electric Power Companies in FY2016.

Note 1: The ratio of coal consumption for Federation of Electric Power Companies data (80,230) and Survey of Electric Power Statistics data (81,645) is 100 to 102. This ratio is used for the estimation of the amount of residue generation in coal ash, flue gas desulfurized gypsum, and sludge obtained through the interview with Federation of Electric Power Companies in FY2016.

Note 2: Mercury concentration in coal applied is 0.0390 g/ton (Interview with Federation of Electric Power Companies, FY2016).

3) Utilization/final disposal of coal ash

Table 1.3.8 and Table 1.3.9 summarize the amount of generation, utilization and final disposal of coal ash (fly ash, clinker) in coal-fired power plants as per data obtained from interviews with Federation of Electric Power Companies in FY2016. It needs to be noted that the ratio of coal consumption shown in 2) was used to extrapolate the value for the whole of Japan.

Table 1.3.8 Coal-fired power generation: Generation, utilization and final disposal of fly ash (FY2014)

Fly ash		Federation of Electric Power Companies data (10,000 t)	Nationwide data (estimation) (10,000 t)	Mercury content Note1	
				(kg-Hg)	(t-Hg)
Generation		768	782	1,164	1.2
	Utilization	748	761	1,134	1.1
	Final disposal	20	20	30	0.030

Source: Interview with Federation of Electric Power Companies in FY2016. Note that the ratio of coal consumption as per

Federation of Electric Power Companies data (80,230) and Survey of Electric Power Statistics data (81,645) (100:102) is used for nationwide estimation.

Note 1: Mercury concentration in precipitator ash applied is 0.149 mg/kg (Interview with Federation of Electric Power Companies in FY2016).

Table 1.3.9 Coal-fired power generation: Generation, utilization and final disposal of clinker (FY2014)

Clinker		Federation of Electric Power Companies data (10,000 t)	Nationwide data (estimation) (10,000 t)	Mercury content Note1	
				(kg-Hg)	(t-Hg)
Generation		75	76	N.D.	N.D.
	Utilization	72	73	N.D.	N.D.
	Final disposal	3	3	N.D.	N.D.

Source: Interview with Federation of Electric Power Companies in FY2016. Be noted that the ratio of coal consumption for Federation of Electric Power Companies data and Survey of Electric Power Statistics data, 80,230:81,645 (100:102), is used for nationwide estimation.

Note 1: Mercury concentration in clinker is N.D. (Interview with Federation of Electric Power Companies in FY2016)

Table 1.3.10 shows the utilization of coal ash in the electric power industry as per the "Coal Ash Nationwide Survey Report (FY2014)". Using the composition rates of utilization by purpose of use in Table 1.3.10, the estimation result for mercury transfer accompanied with utilization of fly ash is summarized in Table 1.3.11.

Table 1.3.10 Utilization of coal ash (FY2014)

Category	Purpose of use Note1	Electric industry	
		Utilization (10^3 t)	Rate (%)
Cement production	Cement material	6,031	64.14
	Cement admixture	78	0.83
	Concrete admixture	77	0.82
	Subtotal	6,186	65.79
Engineering	Soil improvement material	359	3.82
	Construction material Note 2	419	4.46
	Electric construction material	78	0.83
	Soil stabilizer	146	1.55
	Asphalt filler	6	0.06
	Coal mine filling	413	4.39
	Subtotal	1,421	15.11
Architecture	Building interior board	130	1.38
	Artificial lightweight aggregate	41	0.44
	Concrete secondary product	34	0.36

Category	Purpose of use Note1	Electric industry	
		Utilization (10^3 t)	Rate (%)
Subtotal		205	2.18
Agriculture, forestry and fisheries	Fertilizer (incl. snow melting agent)	35	0.37
	Fish reef	39	0.41
	Soil improvement material	36	0.38
	Subtotal	110	1.17
Others	Sewage treatment agent	1	0.01
	Iron and steel production	1	0.01
	Others	1,479	15.73
	Subtotal	1,481	15.75
Total		9,403	100.00

Source: "Study Report on coal ash nationwide situation (FY2014)", March 2016, Japan Coal Energy Center http://www.jcoal.or.jp/ashdb/ashstatistics/H27_ashstatistics_r1.pdf

Note 1: The shaded application (either mixture with soil or direct spreading over soil) is categorized into "soil-contact type application" and other application except for cement-related and soil-contact type application is categorized into "non-soil-contact type application".

Note 2: Engineering works means construction works of roads, railways, rivers, bridges, harbors and others conducted using soil and stone, timber, iron compact, etc.

Table 1.3.11 Coal-fired power generation: Mercury transfer associated with utilization of fly ash (FY2014)

Application	Composition rate (%)	Fly ash utilization (1,000 t)	Mercury transfer	
			(kg-Hg)	(t-Hg)
Cement-related	65.79	5,008	746	0.75
Soil-contact type	15.86	1,207	180	0.18
Non-soil-contact type	18.34	1,396	208	0.21
Total	100.00	7,611	1,134	1.1

Source of composition rates by application: "Coal Ash Nationwide Survey Report (2014 FY results)" (March 2016, Japan Coal Energy Center) http://www.jcoal.or.jp/ashdb/ashstatistics/H27_ashstatistics_r1.pdf

4) Utilization/final disposal of flue gas desulfurized gypsum

Table 1.3.12 shows the amount of generation, utilization and final disposal of flue gas desulfurized gypsum in coal-fired power generation as per the interview with Federation of Electric Power Companies in FY2016. It needs to be noted that the coal consumption rates shown in 2) was used to extrapolate the data to the whole of Japan.

Table 1.3.12 Coal-fired power generation: Generation, Utilization and final disposal of flue gas desulfurized gypsum (FY2014)

Flue gas desulfurized gypsum		Federation of Electric Power Companies data (10,000 t)	Nationwide data (estimation) (10,000 t)	Estimation of the amount of mercury throughout Japan Note	
				(kg-Hg)	(t-Hg)
Generation		163.1	166.0	710	0.71
	Utilization	163.0	165.9	710	0.71
	Final disposal	0.1	0.1	0.44	0.00044

Source: Interview with Federation of Electric Power Companies in FY2016. It needs to be noted that the ratio of coal consumption for Federation of Electric Power Companies data to Survey of Electric Power Statistics data, 80,230:81,645 (100:102) is used for nationwide estimation.

Note: Mercury concentration of flue gas desulfurized gypsum applied is 0.428 mg/kg, as per interview with Federation of Electric Power Companies in FY2016.

5) Utilization/final disposal of sludge

Table 1.3.13 shows the amount of generation, utilization and final disposal of sludge in coal-fired power generation as per interview with Federation of Electric Power Companies in FY2016. It needs to be noted that nationwide estimation has been carried out using the coal consumption rates shown in 1).

Table 1.3.13 Coal-fired power generation: Generation, utilization, and final disposal of sludge (FY2014)

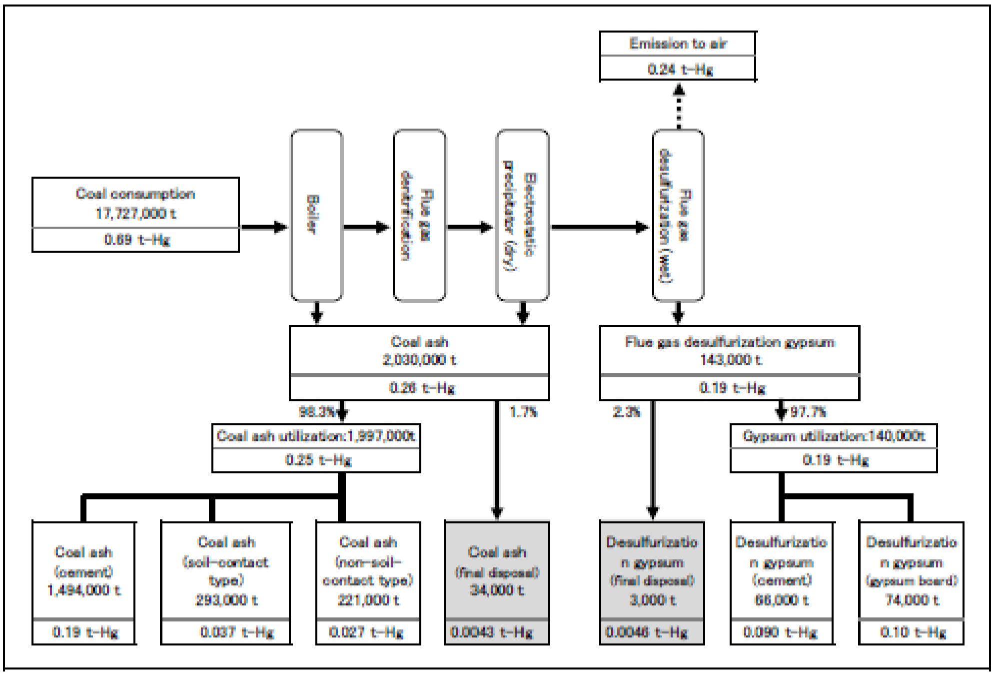
Sludge		Federation of Electric Power Companies data (10,000 t)	Nationwide data (estimation) (10,000 t)	Mercury amount extrapolated to entire Japan Note	
				(kg-Hg)	(t-Hg)
Generation		6.5	6.6	437	0.44
	Utilization	2.7	2.7	181	0.18
	Final disposal	3.8	3.9	255	0.26

Source: Interview with Federation of Electric Power Companies in FY2016. It needs to be noted that the ratio of coal consumption for Federation of Electric Power Companies data to Survey of Electric Power Statistics data, 80,230:81,645 (100:102) is used for nationwide estimation.

Note: Mercury concentration in sludge applied is 6.60 mg/kg as per interview with Federation of Electric Power Companies in FY2016.

(3) Coal-fired industrial boiler

The mercury flow in coal-fired industrial boilers is as shown in Figure 1.3.3.



Flow: Based on interview with Japan Boiler Association

Values in the flow: The estimation results of "Mercury Emission Inventory (FY2014)" and "Coal Ash Nationwide Survey Report (FY2014)" (March 2016, Japan Coal Energy Center) are used but values are updated.

Figure 1.3.3 Mercury flow in coal-fired industrial boilers (FY2014)

1) Emission

Table 1.3.14 shows the estimation result of the mercury emission from coal-fired industrial boilers in Japan's "Mercury Emission Inventory (FY2014)".

Table 1.3.14 Mercury emission from coal-fired industrial boilers (FY2014)

Coal consumption (10^3 t)	Emission factor (coal consumption-base)[Note] (mg-Hg/t)	Emission (t-Hg)
17,727	13.425	0.24

Source: Coal consumption data is retrieved from "Total Energy Supply and Demand Balance (FY2014)" issued by the Agency of Natural Resources and Energy.

Note: Using the following formula, the emission factor was calculated based on the measurement results of 69 facilities (coverage is about 49%) obtained from the survey on the actual situation of mercury emission in FY2015:

(1) Σ (average concentration of mercury in flue gas x average gas flow (dry)) = 552,458,664 (μg-Hg/d)

(2) Σ (coal consumption) = 41,151 (t/d)

Emission factor = (1) / (2) = 13.425 mg-Hg/t (from Mercury Emission Inventory (FY2014))

2) Transfer to residue

Table 1.3.15 shows the mercury transfer to residue in coal-fired industrial boilers. It is assumed that mercury not being emitted to air transfers to residue (coal ash, flue gas desulfurized gypsum).

Table 1.3.15 Coal-fired boiler: Mercury transfer to residue (FY2014)

Coal consumption (10^3 t)	Mercury in coal consumption Note (t-Hg)	Mercury transfer to residue	
		(kg-Hg)	(t-Hg)
17,727	0.69	453	0.45

Source: Coal consumption data was retrieved from "Total Energy Supply and Demand Balance (FY2014)" issued by the Agency of Natural Resources and Energy.

Note: Mercury concentration in coal applied is 0.0390 g/t (Interview with Federation of Electric Power Companies in FY2016).

3) Utilization/final disposal of coal ash

Table 1.3.16 shows the amount of generation, utilization and final disposal of coal ash generated from coal-fired industrial boilers. Estimation is carried out based on coal consumption, coal ash generation, and the utilization and final disposal rates among "general industries", which includes coal-fired industrial boilers obtained from the "Report of Nationwide Survey on Coal Ash (FY2014)".

Table 1.3.16 Coal-fired boilers: Generation, utilization and final disposal of coal ash (FY2014)

	Coal consumption (10^3 t)	Generation (10^3 t)	Utilization (10^3 t)	Final disposal (10^3 t)
General industries	26,411	3,025	2,975	50
Coal-fired industrial boilers	17,727	2,030	1,997	34

[Source]

General industries: "Report of Nationwide Survey on Coal Ash (FY2014)" (March 2016, Japan Coal Energy Center) http://www.jcoal.or.jp/ashdb/ashstatistics/H27_ashstatistics_r1.pdf

Coal-fired industrial boilers: The utilization and final disposal, the rates of coal consumption and generation are estimated using consumption rates of general industries to coal-fired industrial boilers. 98.3% is attributed to utilization and 1.7% is attributed to final disposal.

Table 1.3.17 shows the estimated breakdown of mercury transfer to residue (coal ash, flue gas desulfurized gypsum) based on the mercury concentration and the generation ratio of each residue.

Table 1.3.17 Coal-fired boilers: Breakdown of mercury transfer to coal ash/desulfurization gypsum

	Mercury concentration Note1 (ppm)	Generation ratio Note2	Mercury transfer ratio Note3	Mercury transfer (t-Hg)
Coal ash	0.149	4	4	0.26

	Mercury concentration Note1 (ppm)	Generation ratio Note2	Mercury transfer ratio Note3	Mercury transfer (t-Hg)
Flue gas desulfurized gypsum	0.428	1	3	0.19

Note 1: The concentration of mercury in each residue is obtained from interview with Federation of Electric Power Companies in FY2016.

Note 2: According to "A Report for the Environmentally Sound Management of Mercury Wastes" (March 2014, Ministry of the Environment, Japan), the generation ratio of coal ash to flue gas desulfurized gypsum is 4:1.

Note 3: The ratio of mercury transfer: mercury concentration ratio (1:3) x generation ratio (4:1) = 4:3

Table 1.3.18 shows the amount of utilization of coal ash in general industries and their application as per the "Report of Nationwide Survey on Coal Ash (FY2014)". Table 1.3.19 shows the flow of mercury associated with the utilization of coal ash, estimated using the composition rates of utilization by its application.

Table 1.3.18 Utilization of coal ash and its application (FY2014)

Category	Purpose of use Note 1	General industry	
		Utilization (10^3 t)	Rate (%)
Cement production	Cement material	2,212	74.33
	Cement admixture	10	0.34
	Concrete admixture	4	0.13
	Subtotal	2,226	74.8
Engineering	Soil improvement material	182	6.12
	Construction material Note 2	53	1.78
	Electric construction material	0	0
	Soil stabilizer	140	4.7
	Asphalt filler	0	0
	Coal mine filling	0	0
	Subtotal	1,421	12.6
Architecture	Building interior board	269	9.04
	Artificial lightweight aggregate	0	0
	Concrete secondary product	0	0
	Subtotal	269	9.04
Agriculture, forestry and fisheries	Fertilizer (incl. snow melting agent)	7	0.24
	Fish reef	0	0
	Soil improvement material	54	1.81
	Subtotal	61	2.05
Others	Sewage treatment agent	0	0
	Iron and steel production	3	0.1

Category	Purpose of use Note 1	General industry	
		Utilization (10^3 t)	Rate (%)
	Others	42	1.41
	Subtotal	45	1.51
Total		2,976	100.00

Source: "Report of Nationwide Survey on Coal Ash (FY2014)", March 2016, Japan Coal Energy Center http://www.jcoal.or.jp/ashdb/ashstatistics/H27_ashstatistics_r1.pdf

Note 1: The shaded applications (either mixture with soil or direct spreading over soil) are categorized into "soil-contact type application". Other applications apart from "cement-related" and "soil-contact type application" are categorized into "non-soil-contact type application".

Note 2: Engineering works means construction works of roads, railways, rivers, bridges, harbors and others conducted using soil and stone, timber, iron compact, etc.

Table 1.3.19 Coal-fired boiler: Mercury transfer associated with the utilization of coal ash (FY2014)

Purpose of use	Composition rate (%)	Utilization of coal ash (10^3 t)	Mercury transfer	
			(kg-Hg)	(t-Hg)
Cement-related	74.80	1,494	191	0.19
Soil-contact type	14.65	293	37	0.037
Non-soil-contact type	10.55	211	27	0.027
Total	100.00	1,997	255	0.25

Source: Composition rates was obtained from "Report of Nationwide Survey on Coal Ash (FY2014)" (March 2016, Japan Coal Energy Center) http://www.jcoal.or.jp/ashdb/ashstatistics/H27_ashstatistics_r1.pdf

4) Utilization/final disposal of flue gas desulfurized gypsum

Table 1.3.20 shows the amount of generation, utilization and final disposal of flue gas desulfurized gypsum. They are estimated based on coal consumption, generation of flue gas desulfurized gypsum, and the utilization and final disposal rates among "general industries", which includes coal-fired industrial boilers in the "Report of Nationwide Survey on Coal Ash (FY2014)".

Table 1.3.20 Coal-fired boilers: Generation, utilization and final disposal of flue gas desulfurized gypsum (FY2014)

	Coal consumption (10^3 t)	Generation (10^3 t)	Utilization (10^3 t)	Final disposal (10^3 t)
General industries	26,411	213	208	5
Coal-fired industrial boilers	17,727	143	140	3.4

[Source]

General industries: "Report of Nationwide Survey on Coal Ash (FY2014)" (March 2016, Japan Coal Energy Center) http://www.jcoal.or.jp/ashdb/ashstatistics/H27_ashstatistics_r1.pdf

Coal-fired industrial boilers: The utilization and final disposal, the coal consumption and generation rates are estimated using consumption rate of general industries to coal-fired industrial boilers. 98.3% is attributed to utilization and 1.7% is attributed to final disposal.

According to the report above, 48% of flue gas desulfurized gypsum is used as cement material and the rest (52%) is used for gypsum boards. Table 1.3.21 shows mercury transfer associated with the utilization of flue gas desulfurized gypsum.

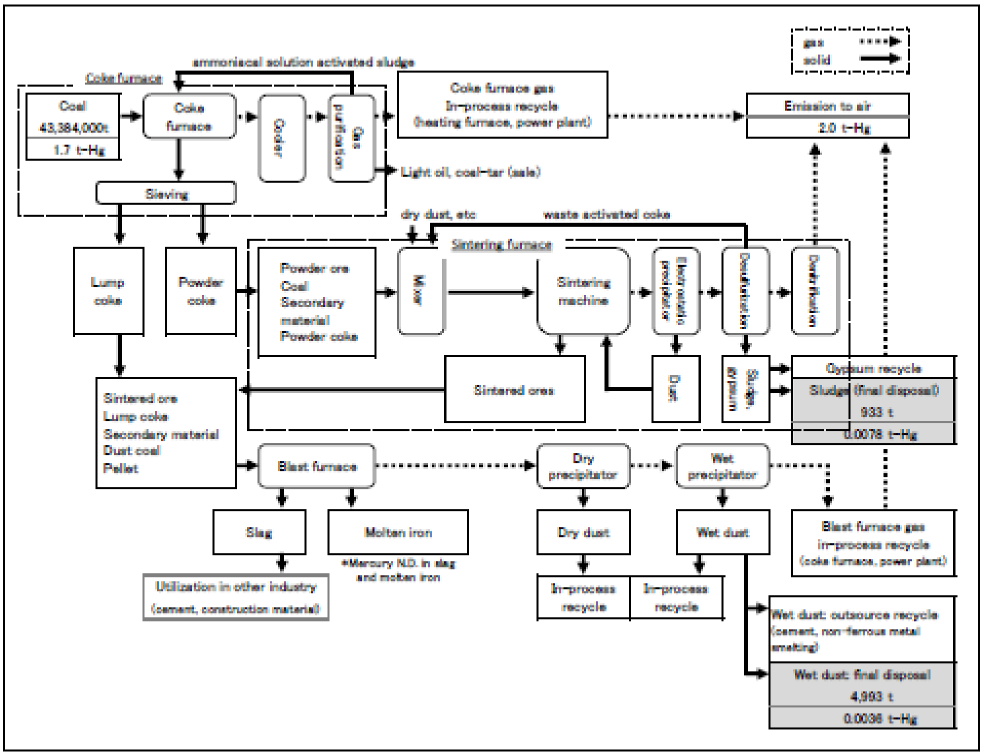
Table 1.3.21 Coal-fired boilers: Mercury transfer associated with the utilization of flue gas desulfurized gypsum (FY2014)

Purpose of use	Composition rate (%)	Mercury transfer	
		(kg-Hg)	(t-Hg)
Cement material	48	90	0.090
Gypsum board	52	100	0.10
Total	100.00	190	0.19

Source: Composition rates by utilization purpose of use is obtained from the "Report of Nationwide Survey on Coal Ash (FY2014)" (March 2016, Japan Coal Energy Center) http://www.jcoal.or.jp/ashdb/ashstatistics/H27_ashstatistics_r1.pdf

(4) Primary iron production facility

Mercury flow in primary iron production facilities is shown in Figure 1.3.4.



Flow: Based on interview with Japan Iron and Steel Federation

Final disposal in the flow: Interview with Japan Iron and Steel Federation in FY2016

Amount of mercury in the flow: Estimated by Ministry of the Environment, Japan based on the final disposal above and the concentration of mercury in residue ("Mercury Emission Behavior in the Iron and Steel Industry", Masaki Takaoka, Kazuyuki Oshita, 2007.). It needs to be noted that a limited number of data samples were available (n = 1 or 3).

Figure 1.3.4 Mercury flow in primary iron production facilities (FY2014)

1) Emission

Table 1.3.22 shows the estimation results of mercury emission from primary iron production facilities in "Mercury Emission Inventory (FY2014)".

Table 1.3.22 Mercury emission from primary iron production facilities (FY2014)

Items	Emission factor Note1 (mg-Hg/t-product)	Annual production Note2 (10^3 t)	Emission (t-Hg)
Sintering furnaces (including pelletizing furnace)	16.2	111,967	1.8
By-product gas from blast	1.6	83,900	0.13

Items	Emission factor Note1 (mg-Hg/t-product)	Annual production Note2 (10^3 t)	Emission (t-Hg)
furnaces			
By-product gases from coke oven	0.89	25,979	0.023
		Total	2.0

*Mercury emission from sintering furnaces is estimated by multiplying the emission factor, based on an independent survey conducted by Japan Iron and Steel Federation (FY2008 - FY2015), by the annual production.

*Mercury emission included in the by-product gas from blast furnace and coke oven is estimated by multiplying the emission factor in FY2010 by the annual production in FY2014.

Note 1: The emission factor of sintering furnace is calculated based on the survey of 25 sintering furnaces and one pelletizing furnace (26 facilities in total, coverage is 100%).

Note 2: The annual production for sintering furnace refers to the production of sintered ore and iron ore pellet, the production for by-product gas from blast furnace refers to the production of crude steel, and the production for by-product gas from coke oven refers to the production of coke.

2) Coal input

Table 1.3.23 shows the amount of coal put into coke ovens and the corresponding mercury content in FY2014.

Table 1.3.23 Primary iron production: Coal input (FY2014)

Coal input (10^3 t)	Mercury concentration in coal (g/t)	Mercury content (t-Hg)
43,384	0.0390	1.7

[Source]

Coal input: Interview with Japan Iron and Steel Federation in FY2016.

Mercury concentration in coal: Interview with Federation of Electric Power Companies in FY2016.

Mercury content in coal input: Estimated by the Ministry of the Environment, Japan based on the amount of coal input and mercury concentration of coal shown above.

3) Final disposal of waste

Table 1.3.24 shows the final disposal of waste from primary iron production facilities and the mercury content in final disposal.

Table 1.3.24 Primary iron production: Final disposal of waste (FY2014)

Waste	Final disposal Note (t)	Mercury concentration in waste (g/t)	Mercury content (t-Hg)
Desulfurization sludge	933	8.340	0.0078
Wet dust	4,993	0.716	0.0036

[Source]

Final disposal: Interview with Japan Iron and Steel Federation in FY2016

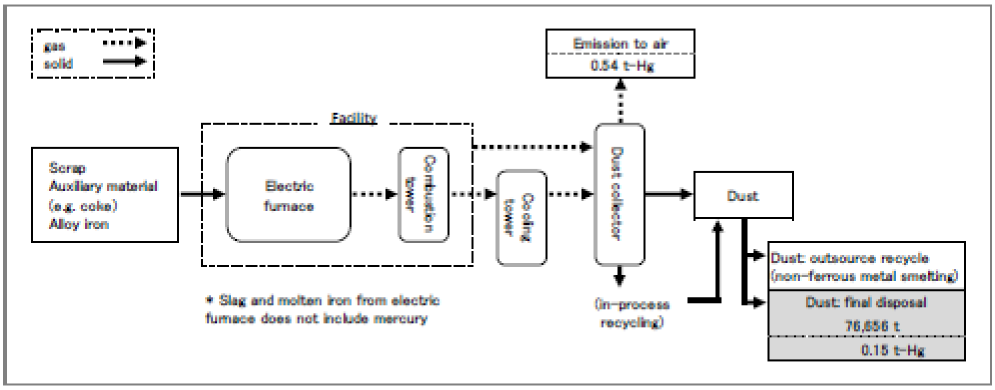
Mercury concentration in waste: "Mercury Emission Behavior in the Iron and Steel Industry" (Masaki Takaoka, Kazuyuki Oshita, 2007). It needs to be noted that only a limited number of data samples were available (n = 1 or 3).

Mercury content in waste: Estimated by the Ministry of the Environment, Japan based on the final disposal and mercury concentration in waste shown above.

Note: Both types of waste are disposed of in leachate-control type landfills.

(5) Secondary iron production facility

Mercury flow in secondary iron production facilities is shown in Figure 1.3.5.



Flow: Based on interview with Japan Iron and Steel Federation.
Final disposal in the flow: Interview with Japan Iron and Steel Federation in FY2016.
Amount of mercury in the flow: Estimated by Ministry of the Environment, Japan based on final disposal above and the mercury concentration in waste (result of an independent survey conducted by Japan Iron and Steel Federation obtained from Interview with the federation in FY2013). It needs to be noted that only a limited number of mercury-concentration-data samples (n = 19) were used because the independent survey was conducted at limited number of manufacturers.

Figure 1.3.5 Mercury flow in secondary iron production facilities (FY2014)

1) Emission

Table 1.3.25 shows mercury emission from secondary iron production facilities summarized in Japan's "Mercury Emission Inventory (FY2014)".

Table 1.3.25 Mercury emission from secondary iron production facilities (FY2014)

Target facility	Emission factor Note (mg-Hg/t-product)	Annual production of electric steel (1,000 t)	Emission (t-Hg)
Electric furnace for steel production (excluding waste treatment facility)	25.8	21,095	0.54

*Emission from electric furnace for steel production (excluding waste treatment facility) is estimated by multiplying the emission factor, based on an independent survey conducted by Japan Iron and Steel Federation (FY2008-FY2015), by the annual production. It needs to be noted that the emission from waste treatment facilities is estimated as a part of the emission from waste incineration facilities.

Note: The emission factor is calculated based on the survey of 60 facilities among 64 facilities of electric furnaces for steel production operating all over the country (coverage is 93.8%).

2) Final disposal of waste

Table 1.3.26 shows the final disposal of waste generated from secondary iron production facilities and the

mercury content therein.

Table 1.3.26 Secondary iron production: Final disposal of waste (FY2014)

Waste	Final disposal Note (t)	Mercury concentration of waste (g/t)	Mercury content (t-Hg)
Precipitator dust	76,656	2.0	0.15

[Source]

Final disposal: Interview with Japan Iron and Steel Federation, FY2016

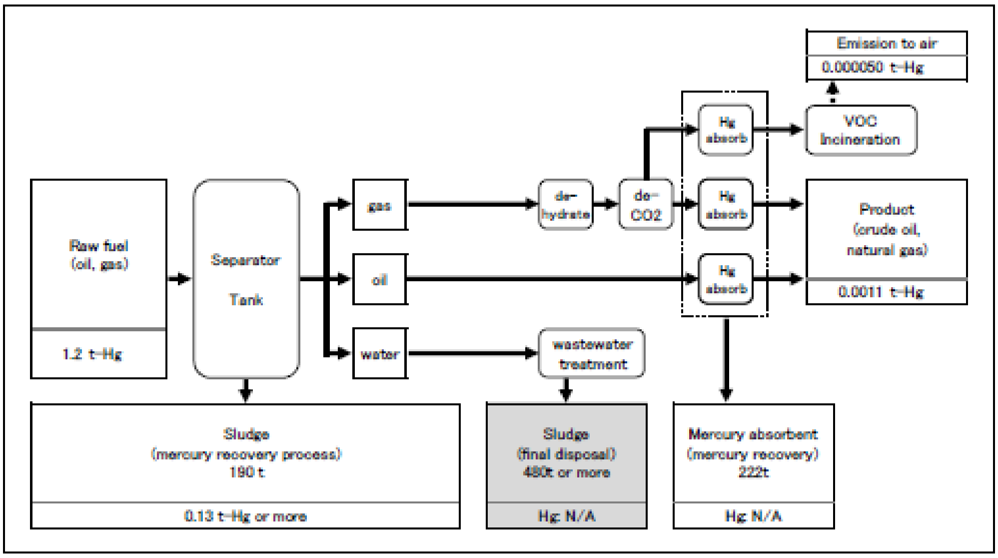
Mercury concentration: The independent survey result conducted by Japan Iron and Steel Federation obtained at the interview with Japan Iron and Steel Federation in FY2013. It needs to be noted that only a limited number of data samples were available (n=19), since the survey was conducted at a limited number of manufacturers.

Mercury content in final disposal: Estimated by Ministry of the Environment, Japan, based on final disposal and mercury concentration shown above.

Note: The waste are disposed of in leachate-control type landfills.

(6) Oil and gas production facility

The mercury flow in oil and gas processing facilities is shown in Figure 1.3.6. It needs to be noted that this figure is only an example and not all facilities employ same equipment.



Flow: Based on interview with Japan Petroleum Development Association.
Values in the flow: Interview with domestic companies in FY2016.

Figure 1.3.6 Mercury flow in oil and natural gas production facilities (FY2014)

1) Emission

According to Japan's "Mercury Emission Inventory (FY2014)", mercury emission from oil and gas production facilities is 50 g-Hg (0.000050 t-Hg).

2) Transfer to residue

Figure 1.3.27 shows the mercury transfer to residue at oil and gas production facilities obtained from interviews with domestic companies in FY2016.

Figure 1.3.27 Oil and gas production: Mercury transfer to residue (FY2014)

Residue	Generation (t)	Mercury concentration (g/t)	Mercury content (t-Hg)	Treatment method
Separator tank sludge	190	N/A	0.13 or more	Mercury recovery
Mercury adsorbent	222	N/A	N/A	Mercury recovery
Waste water treatment sludge	480 or more	N/A	N/A	Final disposal

Source: Interview with domestic companies in FY2016

3) Transfer to products

Figure 1.3.28 shows the mercury transfer to products (crude oil and natural gas) obtained from interviews with domestic companies in FY2016

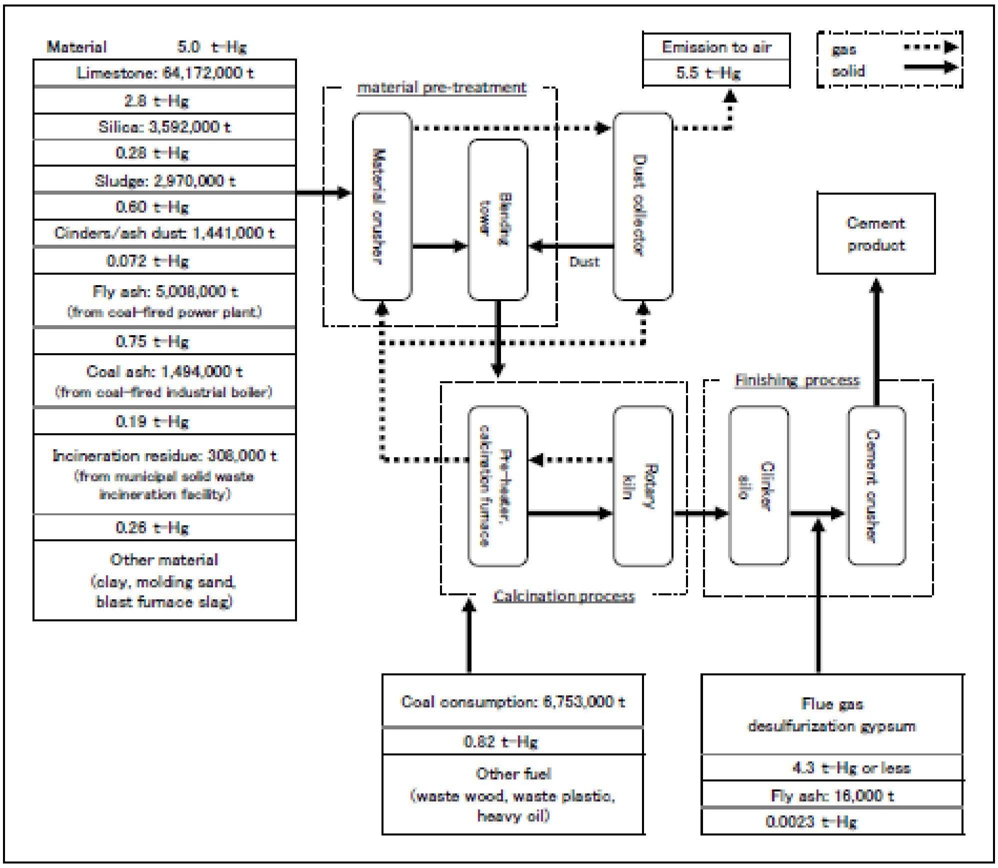
Figure 1.3.28 Oil and natural gas production: Mercury transfer to products (FY2014)

Product	Mercury transfer to product (t-Hg)
Crude oil	0.00092
Natural gas	0.00020
Total	0.0011

Source: Interview with domestic companies in FY2016

(7) Cement production facility

The mercury flow in cement clinker production facilities is shown in Figure 1.3.7.



Flow: Based on interview with Cement Association of Japan.

Values in the flow: Interview with Cement Association of Japan in FY2016, and estimated mercury flow of other industries.

Figure 1.3.7 Mercury flow in cement production facilities (FY2014)

1) Emission

According to Japan's "Mercury Emission Inventory (FY2014)", the mercury emission from cement production facilities is 5.5 t-Hg. The emission data is the summation of the emissions in 51 facilities. Emission in each facility is calculated by multiplying the average mercury concentration in flue gas, the average volume of flue gas and the annual operation hours at each facility. The average mercury concentration and the average volume of flue gas at each facility is retrieved from the on-site investigation on mercury emission in FY2015 and the measurement conducted by Cement Association of Japan from 2007 to 2015.

2) Input from raw/recovered material

Figure 1.3.29 shows the input of raw/recovered material in the process of cement production and the mercury content therein obtained from interview with Cement Association of Japan in FY2016 and the estimated mercury flow for other industries shown in section 1.3.

Figure 1.3.29 Cement production: Raw/utilized material input (FY2014)

Input material	Source	Input (1,000 t)	Mercury concentration (mg/kg)	Mercury content (t-Hg)
Limestone	-	64,172	0.044	2.8
Silica	-	3,592	0.077	0.28
Sludge	-	2,970	0.202	0.60
Cinders/soot and dust	-	1,441	Less than 0.05	0.072
Fly ash	Coal-fired power plant	5,008	0.149	0.75
Coal ash	Coal-fired industrial boiler	1,494	0.149	0.19
Incineration residue	Municipal solid waste incineration facility	308	0.84	0.26
			Total	5.0

[Source]

Amount of input: Interview with Cement Association of Japan in FY2016 and the mercury flow in other industries estimated in section 1.3.

Mercury concentration in limestone: Implementation of measures for mercury emission based on the Minamata Convention on Mercury (first recommendations) reference material 2 "On-site measurement of mercury emission ", Investigation result by Cement Association of Japan.

Mercury concentration in silica, sludge, cinders, soot and dust: Implementation of measures for mercury emission based on the Minamata Convention on Mercury (first recommendations) reference material 2 " On-site measurement of mercury emission ", Table II-5-3 "Mercury content in raw fuel" (The values of "Silica", "Sludge/clay, etc.", and "Bottom ash" in this table)

Mercury concentration in fly ash, coal ash, incineration residue: mercury flow of other industries estimated in section 1.3.

3) Coal consumption in the burning process

Table 1.3.30 shows the coal consumption in the process of cement production obtained from interview with Cement Association of Japan in FY2016.

Table 1.3.30 Cement production: Coal consumption (FY2014)

Coal consumption (1,000 t)	Mercury concentration (mg/kg)	Mercury content (t-Hg)
6,753	0.121	0.82

[Source]

Coal consumption: Interview with Cement Association of Japan in FY2016.

Mercury concentration in coal: Implementation of measures for mercury emission based on the Minamata Convention on Mercury (first recommendations) reference material 2.

4) Input of flue gas desulfurized gypsum in finishing process

Table 1.3.31 shows the input of flue gas desulfurized gypsum in the finishing process of the cement production obtained from mercury flow estimation of other industries summarized in section 1.3. It needs to be noted that mercury included in the flue gas desulfurized gypsum generated from non-ferrous metal smelting is considered to be less than 3.5 t-Hg, according to the mercury flow in non-ferrous metal smelting facilities.

Table 1.3.31 Cement production: Flue gas desulfurized gypsum input (FY2014)

Input object	Source	Input (1,000 t)	Mercury concentration (mg/kg)	Mercury content (t-Hg)
Flue gas desulfurized gypsum	Non-ferrous metal smelting	N/A	N/A	Less than 3.5
	Coal-fired power plant	Less than 1,660	0.428	Less than 0.71
	Coal-fired industrial boiler	66	0.428	0.090
			Total	Less than 4.3

Source: Material flow of other industries estimated in section 1.3

[Reference] The following table shows the mercury content in cement products. It can be anticipated that the mercury content in utilized material input into the finishing process may be less than the estimated result.

Table 1.3.32 (Reference) Mercury included in cement products

	Mercury concentration (ppm)	Production in FY2014 (10^3 t)	Mercury content (t-Hg)
Portland cement	0.0051	43,281	0.22
Blended cement	0.0110	13,230	0.15
		Total	0.37

[Source]
Mercury concentration: The average concentration of mercury in "Normal Portland cement" and "Blast-furnace slag cement type B" in Table 3.1.1 in "Current Situation and Issues of Leaching of Minor Component from Concrete" (Japan Society of Civil Engineers, 2003).
Production in FY2014: Cement Association of Japan "Cement handbook FY2016"

5) Fly ash fed into fly ash cement production

Fly ash generated from coal combustion is added during the finishing process of fly ash cement production. Table 1.3.33 shows the estimation of the fly ash fed into the process of fly ash cement production. It needs to be noted that the maximum estimated value of fly ash input (15,673 t) is applied in the material flow, and the mercury input (0.0023 t-Hg) calculated from this value is used as the maximum value.

The fly ash input above is different from the total 88,000 t of utilization as cement mixture (Table 1.3.10, Table 1.3.18) among coal ash generated from coal-fired power plants and coal-fired industrial boilers, but this data is used since the data provided by Cement Association of Japan reflects the situation more

accurately as it is based on the fly ash cement production in a single year.

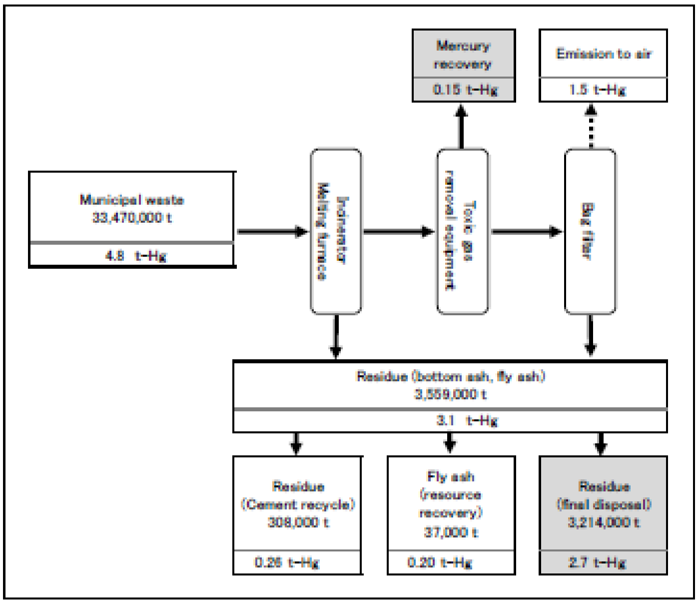
Table 1.3.33 Cement production: Fly ash input for fly ash cement production (FY2014)

Type of fly ash cement (Mixing rate: mass %)	Production in FY2014 (t)	Fly ash input (t)	Hg concentration (mg/kg)	Hg content (t-Hg)
A type (5 to 10)	0	0	0.149	0
B type (10 to 20)	66,310	6,631 to 13,262		0.0010 to 0.0020
C type (20 to 30)	8,037	1,607 to 2,411		0.00024 to 0.00036
Total	74,347	8,238 to 15,673		0.0012 to 0.0023
Adopted value		15,673		0.0023

[Source]
Fly ash cement type/mixing rate: Cement handbook (2016)
Fly ash cement production: Interview with Cement Association of Japan
Mercury concentration in coal ash: Interview with Federation of Electric Power Companies which is used for the flow in coal-fired power plants.

(8) Municipal solid waste incineration facility

The mercury flow in municipal solid waste incineration facilities is shown in Figure 1.3.8.



Flow: Based on the interview with non-industrial waste treatment companies.
Values in the flow: Estimation result based on on-site measurement of non-industrial waste treatment (FY2014), and interview with companies that recover mercury, FY2016.

Figure 1.3.8 Mercury flow in municipal solid waste incineration facilities (FY2014)

1) Emission

Table 1.3.34 shows the result of mercury emission in Japan from municipal solid waste incineration facilities as estimated in "Mercury Emission Inventory (FY2014)".

Table 1.3.34 Mercury emission from municipal solid waste incineration facilities (FY2014)

Type of municipal solid waste incineration facility	Non-industrial waste incineration (10^3 t)	Overall emission factor Note (mg-Hg/t)	Emission (t-Hg)
Incineration facility (excluding facilities with ash melting furnace)	25,995	43	1.1
Facilities with ash melting furnace	8,809	43	0.38
Total	34,804		1.5

Source: Amount of incineration is obtained from "On-site measurement of non-industrial waste treatment" (Ministry of the Environment, Japan, FY2013). At the time of the inventory development, the data in FY2013 was the latest (http://www.env.go.jp/recycle/waste_tech/ippan/).

Note: The overall emission factor is the median of the data in 17 domestic furnaces (coverage rates is 0.8%) obtained through the on-site measurement of mercury emission conducted in FY2015 (Since facilities with relatively high mercury

concentration were targeted in the investigation, the median was applied).

2) Utilization/final disposal of incineration residue

Table 1.3.35 shows the concentration of mercury in residue generated at municipal solid waste incineration facilities.

Table 1.3.35 Municipal solid waste incineration: Mercury concentration in incineration residue (bottom ash, fly ash)

Medium	Mercury concentration (g/t)
Bottom ash	0.03
Fly ash	5.4
Residue (bottom ash 85%, fly ash 15%) Note	0.84

Source: Mercury concentration in bottom ash and fly ash are obtained from "Report on the investigation on mercury emissions from waste treatment facilities in FY2011" (Ministry of the Environment, Japan, March 2012)

Note: Although the breakdown for bottom ash and fly ash are unclear, estimation was carried out under the assumption that the composition of 85% of bottom ash and 15% of fly ash, as obtained from the "Study report for the environmentally sound management of mercury wastes" (Ministry of the Environment, Japan, March 2012).

Table 1.3.36 shows the amount of utilization and final disposal of incineration residue generated from municipal solid waste incineration facilities and the mercury content therein, as summarized in Table 1.3.35, and on-site investigation of municipal waste treatment facilities conducted by Ministry of the Environment, Japan.

Table 1.3.36 Municipal solid waste incineration: Utilization and final disposal of incineration residue (FY2014)

Medium	Destination	Utilization/disposal (t)	Mercury transfer (t-Hg)
Incineration residue	Conversion to cement material	307,973	0.26
	Final disposal	3,213,902	2.7
Fly ash	Resource recovery Note1	37,364	0.20
		Total	3.1

Source: Amount of utilization/disposal are retrieved from "On-site investigation of municipal waste treatment" (Ministry of the Environment, Japan, FY2014) http://www.env.go.jp/recycle/waste_tech/ippan/stats.html

Note: Resource recovery of fly ash means input into non-ferrous metal smelting for recovering precious metal from the ash.

Molten slag derived from municipal waste is not included in the material flow since the mercury content is a very small.

[Reference] Mercury content in molten slag (FY2010 estimation)

National Federation of Industrial Waste Management[2] investigated the amount of molten slag generation from municipal waste in FY2006. About 90% has been utilized as alternate materials such as aggregate of concrete products or asphalt mixture[3]. The amount of utilization in FY2010 is identified through the investigation on municipal waste treatment[4] conducted by Ministry of the Environment, Japan. The concentration of mercury in molten slag was measured by Ministry of the Environment, Japan[5] in FY2011[6].

According to data above, the mercury content of utilization of molten slag generated from municipal waste is as shown below:

Table 1.3.37 (Reference) Utilization of molten slag generated from municipal waste

Molten slag production (FY2006)	Molten slag effectively utilized (FY2010)	Mercury concentration	Mercury content
770,000 t	557,000 t	Less than 0.01 mg/kg-dry	Less than 5.6 kg-Hg

Source: Ministry of the Environment, Japan, "Report for the investigation on mercury waste treatment in 2013" (March, 2014)

Note: The average concentration of mercury in soil sampled from 3,020 measuring points was 0.1 ppm according to data[7] published by National Institute of Advanced Industrial Science and Technology (in 2007 at 3,024 measurement points, (excluding 4 points whose mercury concentration is more than 10 ppm)). The concentration of mercury in molten slag is less than 0.01 ppm (mg/kg-dry), which is less than the concentration in soil.

3) Mercury recovery

According to interviews with waste treatment companies in FY2016, the amount of recovered mercury from municipal solid waste incineration facilities in FY2014 is 0.15 t-Hg.

[2] "Investigation Report on JIS Compliance of Molten Slag Derived from Industrial Waste (2008 FY)" (March, 2009)

[3] In July 2006, JIS for molten slag as road building material and aggregate for the concrete was established.

JIS A 5032: Molten slag for roads, which is made by melt-solidification of municipal waste, sewage sludge, or their bottom ash

JIS A 5031: Molten slag aggregate for concrete, which is made by melt-solidification of municipal waste, sewage sludge, or their bottom ash

[4] "Municipal waste treatment investigation in 2010 FY" http://www.env.go.jp/recycle/waste_tech/ippan/h22/index.html

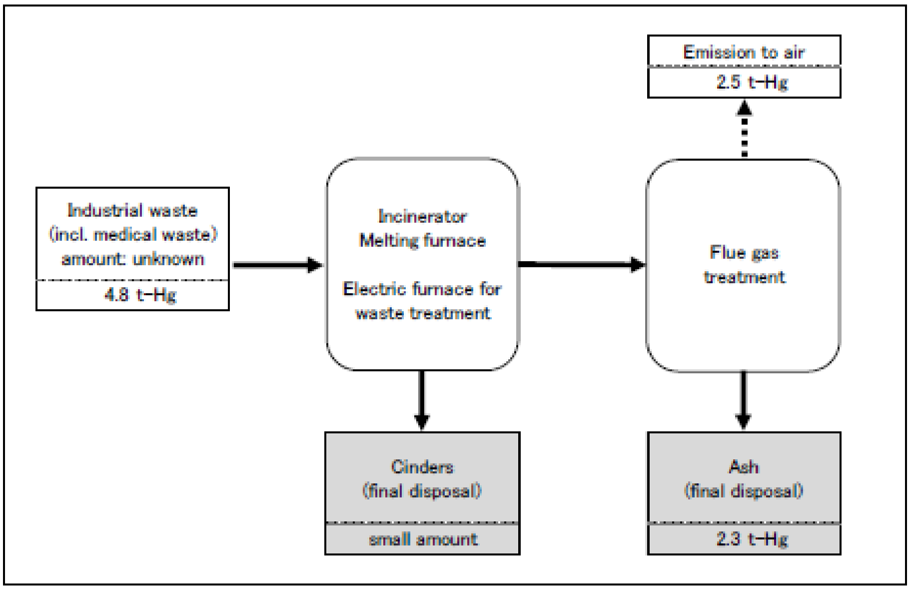
[5] "Report for investigation on emission status of mercury and others from waste treatment facilities and others in 2011 FY" (March in 2012)

[6] Although JIS A 5032 and JIS A 5031 define the content standard related with molten slag as "total mercury 15mg/kg or less", mercury is scarcely detected because heating up to the temperature of 1200°C or higher is conducted in the production process.

[7] http://riodb02.ibase.aist.go.jp/geochemmap/data/download.htm

(9) Industrial waste incineration facility

The mercury flow in industrial waste incineration facilities is shown in Figure 1.3.9.



Values in the flow: Estimated by Ministry of the Environment, Japan based on "Mercury Emission Inventory (FY2014)"

Figure 1.3.9 Mercury flow in industrial waste incineration facilities (FY2014)

1) Emission

Table 1.3.38 shows mercury emission from industrial waste incineration facilities in Japan obtained from "Mercury Emission Inventory (FY2014)". Table 1.3.39 shows mercury emission from electric furnaces for steel production that treat waste. The total of these values, 2.5 t-Hg, is considered as emission from industrial waste incineration facilities in the inventory.

Table 1.3.38 Mercury emission from industrial waste incineration facilities (FY2014)

Mercury concentration in flue gas Note1 (μg-Hg/Nm^3)	Nationwide flue gas emission Note2 (Nm^3)	Emission (t-Hg)
15	1.5×10^{11}	2.3

Note 1: Based on the on-site measurement data (2013 to 2015, 177 facilities, coverage rates 14%) obtained through the on-site measurement of mercury emission in FY2015, the weighted average efficiency (Σ (Mercury concentration in flue gas x flue gas flow) / Σ (Flue gas flow)) was calculated.

Note 2: The estimated value of nationwide flue gas emission from industrial waste incineration facilities by Ministry of the Environment, Japan, "Investigation on the emission status of dioxin and the like from industrial waste incineration facilities in FY2014" was used.

Table 1.3.39 Mercury emission from electric furnaces for steel production (waste treatment process) (FY2014)

Electric furnace for steel production (treated waste)	Emission factor Note (mg-Hg/product t)	Electric steel annual production (10^3 t)	Emission (t-Hg)
Waste other than dry-cell batteries	33.4	1,548	0.052
Dry-cell battery	41.8	2,482	0.10
		Total	0.15

*Mercury emission was calculated by dividing emission factor based on an independent measurement conducted by Japan Iron and Steel Federation (FY2008-FY2015) by the annual production.

Note: Measurement target facilities: Among electric furnaces for steel making operating in Japan, facilities treating waste other than discarded dry-cell batteries (four facilities out of seven (coverage rates 71.4%)) and facilities treating discarded dry-cell batteries (seven facilities out of seven (coverage rates 100%))

2) Transfer to residue

Emission reduction efficiency in industrial waste incineration facilities is 47.9% according to Kida (2007). Assuming that mercury not emitted to the atmosphere is transferred to bottom ash, the mercury transfer to ash dust is estimated to be 2.3 t-Hg.

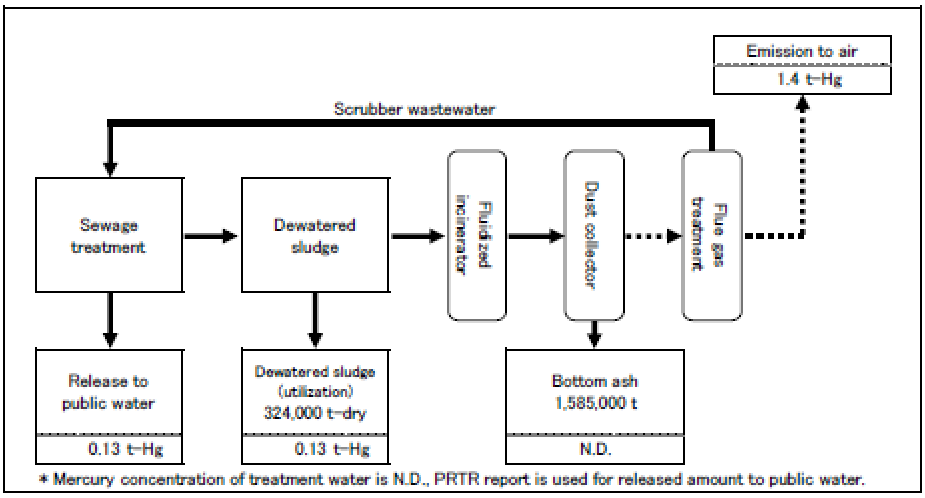
Table 1.3.40 Industrial waste incineration: Mercury transfer to ash dust (2014 FY)

Mercury emission (t-Hg)	Emission Reduction Efficiency*	Mercury transfer to incinerator ash (t-Hg)
2.5	0.479	2.3

*Source: Akiko Kida, Shinichi Sakai, Yasuhiro Hirai, Hiroshi Moritomi, Masaki Takaoka, Kenji Yasuda (2007), "Study on the emission inventory of mercury including waste management processes and emission reduction measures".

(10) Sewage sludge incineration facilities

Mercury flow in sewage sludge incineration facilities is shown in Figure 1.3.10.



Flow: Data provided by Ministry of Land, Infrastructure and Transport, Japan
Values in the flow: Data provided by Ministry of Land, Infrastructure and Transport, Japan (actual amount in FY2014)

Figure 1.3.10 Mercury flow in sewage sludge incineration facilities (FY2014)

1) Emission

Table 1.3.41 shows the estimation result of mercury emission from sewage sludge incineration facilities in "Mercury Emission Inventory (FY2014)".

Table 1.3.41 Mercury emission from sewage sludge incineration facilities (FY2014)

Sewage sludge incineration Note1		Overall emission factor Note2 (mg-Hg/t-dry)	Emission Note3 (t-Hg)
Wet weight (10^3 t-wet)	Dry weight (10^3 t-dry)		
4,797	1,055	1.36	1.4

Note 1: The amount of sewage sludge incineration (dry-weight base) was calculated by "amount of incineration (weight-base (wet)) x (1 - 0.78)". 0.78 is retrieved from the arithmetic mean (78%) of "average water content (%) in dewatered sludge being brought in to sludge incineration facilities" (Source: Sewage statistics). The sewage statistics in 2007 to 2009 and 2013 were referred to but the arithmetic mean was approximately the same in any years (77.6% for 2013). The amount of incineration used for the estimation refers to the value in FY2013.

Note 2: The overall emission factor was calculated based on 30 samples (six domestic facilities x five times for each) obtained through the investigation of the actual situation on mercury emission conducted in FY2015.

Note 3: Mercury emission = Sewage sludge incineration (dry) x Overall emission factor

2) Transfer to residue

If the emission reduction efficiency of 47.9% at industrial waste incineration facilities estimated by Kida (2007) could also be applied to emission reduction efficiency at sewage sludge incineration facilities,

mercury not being emitted to the atmosphere and transferred to residue is estimated to be 1.3 t-Hg. However, since the concentrations of mercury in both treated sewage water and bottom ash are N.D. and there is no data on the amount of mercury transfer, this estimated value is treated as a reference value in the material flow.

The amount of mercury in effluent to public water is obtained from PRTR data (0.13 t-Hg).

Table 1.3.42 Sewage sludge incineration: Mercury flow to residue

Mercury emission (t-Hg)	Emission Reduction Efficiency*	Mercury transfer to residue (t-Hg)
1.4	0.479	1.3

*Source: Akiko Kida, Shinichi Sakai, Yasuhiro Hirai, Hiroshi Moritomi, Masaki Takaoka, Kenji Yasuda (2007), "Study on the emission inventory of mercury including waste management processes and emission reduction measures" The emission reduction efficiency at industrial waste incineration facilities in this study is alternatively applied.

3) Utilization of sewage sludge

Table 1.3.43 shows the mercury flow associated with the utilization of sewage sludge (utilization for green farm). It needs to be noted that mercury transfer associated with the utilization of sewage sludge for green farm is considered as release to soil in the material flow.

Table 1.3.43 Mercury flow associated with the utilization of sewage sludge (FY2014)

<table>
<tr><th>Item</th><th>Utilization for green farm
(t-dry)</th><th>Mercury concentration
(ppm-dry)</th><th>Mercury transfer
(t-Hg)</th></tr>
<tr><td>Compost</td><td>265,152</td><td>0.4</td><td>0.11</td></tr>
<tr><td>Mechanically dried sludge</td><td>25,191</td><td rowspan="2">0.3</td><td>0.0076</td></tr>
<tr><td>Carbonized sludge</td><td>3,294</td><td>0.0010</td></tr>
<tr><td>Dewatered sludge</td><td>29,463</td><td rowspan="2">0.4</td><td>0.012</td></tr>
<tr><td>Others</td><td>425</td><td>0.00017</td></tr>
<tr><td>Total</td><td>323,524</td><td></td><td>0.13</td></tr>
</table>

[Source]

Amount of utilization for green farm: Data provided by Ministry of Land, Infrastructure and Transport, Japan, "National disposal and utilization" (Amount of generated solid-base, the actual amount in FY2014)

Mercury concentration in each item: Ministry of Agriculture, Forestry and Fisheries, Japan, Manual on Heavy Metal Management in Sludge Fertilizer (August, 2010), Weighted average of mercury concentration based on on-site inspection conducted from FY2003 to FY2009 (Compost: Concentration in fermented sludge fertilizer is used, Mechanically dried sludge/carbonized sludge: Concentration in burned sludge fertilizer is used, Dewatered sludge and others: Concentration in sewage sludge fertilizer is used)

2. Mercury-added products

2.1 Production, import and export of mercury-added products

Table 2.1.1 shows the amount of mercury used for the domestic production of mercury-added products, and mercury content in imported/exported products in reference to the information obtained through the interview with industry organizations and business entities. Total amount of mercury used for the domestic production is estimated as 5.4 t-Hg, mercury content in imported products is estimated as 1.0 t-Hg and mercury content in exported products is estimated as 2.0 t-Hg. The figure in the table shows data obtained through interviews with the business entities and does not include exhaustive information on the entire domestic market.

Table 2.1.1 Mercury in domestic production, import/export of products (2014)

Product		Hg used for domestic production (t-Hg)	Year Note1	Hg in imported products (t-Hg)	Hg in exported products (t-Hg)	Year
Button batteries	Alkaline button batteries	0.000040	CY2014	N/A	0	FY2014
	silver-oxide batteries	0.17	CY2014	0	0.17	FY2014
	Zinc-air batteries	0.037	CY2014	0.39	0.057	FY2014
Mercury-added dry-cell batteries		0	FY2014	N/A	0	FY2014
Switches and relays		0.59	FY2014	N/A	0.42	FY2014
Lamps	Fluorescent lamps Note2	0.98	FY2014	0.28	0.026	FY2014
	HID lamps	0.37	FY2014	0.22	0.17	FY2014
	Neon lamps	0.023	FY2014	N/A	N/A	FY2014
Measuring devices	Glass Hg thermometers	0.29	FY2014	0.054	0.056	FY2014
	Hg-filled thermometers	0.034	FY2014	N/A	N/A	
	Diaphragm manometers for high temperature	0.042	FY2014	N/A	N/A	
	Liquid manometers	0.0075	FY2014	0	0	FY2014
	Liquid column barometers	0	FY2014	N/A	0	FY2014
	Vacuum gauges	0.090	FY2014	N/A	N/A	
Medical measuring devices	Mercury thermometers	0	FY2014	0.095	0	FY2014
	Sphygmomanometers	1.6	CY2014	0.0047	1.1	CY2014
Mercury for dental use		0	FY2014	0	0	FY2014
Pharmaceuticals	Vaccine preservative	0.00023	FY2014	0.00015	0.0000030	FY2014
	Merbromin solution	0.014	2014	0	0	2014
	Merbromin products	0.0025	FY2014	0	0	FY2014
Inorganic chemicals	Mercuric sulphide	1.1	FY2014	N/A	N/A	
	Mercury compounds	0.083	FY2014	N/A	N/A	
Total		5.4		1.0	2.0	

Source: Information obtained through interview with manufacturers/importers and other business entities, 2016
Note1: FY stands for fiscal year, CY stands for Calendar year
Note2: Fluorescent lamps include cold cathode fluorescent lamps (CCFL)

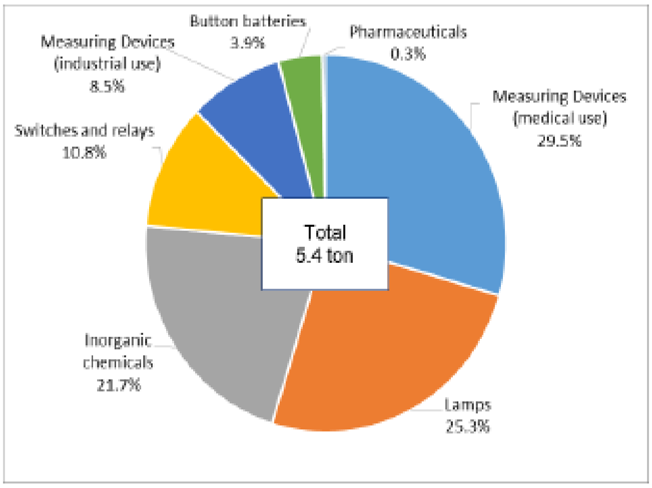


Figure 2.1.1 Mercury used for the domestic production of mercury-added products (FY2014)

(1) Button batteries

Table 2.1.2 shows the amount of mercury used for the domestic production of button batteries by Battery Association of Japan (BAJ) member companies. Further, mercury contained in import/export of button batteries obtained through interview with BAJ is also shown in Table 2.1.2.

It is estimated that 0.024 t of mercury was contained in imported alkaline manganese batteries by BAJ member companies. Besides this amount, it is assumed that there are certain amounts of mercury-added batteries imported by non-BAJ member companies and some mercury-added batteries are included in and imported with assembled products. Hence, the total picture is unknown.

Table 2.1.2 Mercury in button batteries (CY2014, BAJ members)

Product	Hg in produced amount (t-Hg)	Hg in import (t-Hg)	Hg in export (t-Hg)
Alkaline manganese	0.000040	N/A	0
Silver oxide	0.17	0	0.17
Air zinc	0.037	0.39	0.057
Total	0.21	0.39	0.23

Source: Interview with Battery Association of Japan (BAJ), 2016

(2) Dry-cell batteries

Domestically manufactured dry-cell batteries are all mercury free. The amount of mercury-added dry-cell batteries import remains unknown. Further, it is also conceivable that some mercury-added dry-cell batteries are included in and imported with assembled products, but this amount remains unknown. Hence they are not included in the material flow.

(3) Switches and relays

Table 2.1.3 shows mercury used for the production and contained in exports of switches and relays, as obtained through interview with a domestic manufacturer of switches and relays. There are some possibilities that switches and relays are included in and imported with large assembled products, but these amounts remain unknown.

Table 2.1.3 Mercury in switches and relays (FY2014)

Product	Production	Hg in produced amount (t-Hg)	Exports	Hg in exports (t-Hg)
Over current relay Note1	12,352	0.19	5,395	0.081
Seismoscopes Note2	1,336,823	0.40	1,134,921	0.34
Total		0.59		0.42

Source: Interview with manufacturers of switches and relays, 2016
Note1: 15g of mercury is used in one over current relay.
Note2: 0.3g of mercury is used in one seismoscope.

(4) Lamps

Table 2.1.4 shows mercury content in domestically produced lamps and Table 2.1.5 shows mercury content in imported and exported mercury-added lamps.

Table 2.1.4 Mercury content in lamps (FY2014, production)

Product	Hg concentration (mg-Hg/unit)	Lamp production (1,000 pcs)	Hg in produced lamps (t-Hg)
Fluorescent lamps*	6.2	157,566	0.98
HID lamps	53.5	6,957	0.37
Neon lamps	227	102	0.023
Total			1.4

[Source]
Fluorescent lamps, HID lamps: Interview with JELMA, 2016
Neon lamps: Interview with Japan Sign Association, 2016
*Category "Fluorescent lamps" include cold cathode fluorescent lamps (back light)

Table 2.1.5 Mercury in lamps (FY2014, import/export)

Product	Imported lamps (1,000 pcs)	Hg in imported lamps (t-Hg)	Exported lamps (1,000 pcs)	Hg in exported lamps (t-Hg)
Fluorescent lamps*	44,680	0.28	4,191	0.026
HID lamps	4,170	0.22	3,104	0.17
Neon lamps	N/A	N/A	N/A	N/A
Total		0.50		0.19

[Source]
Fluorescent lamps, HID lamps: Interview with JELMA, 2016

Neon lamps: Interview with Japan Sign Association, 2016
*Category "Fluorescent lamps" include cold cathode fluorescent lamps (back light)

(5) Industrial measuring devices

Table 2.1.6 shows the amount of mercury used for the production of industrial measuring devices obtained through interviews with manufacturers of such devices conducted in 2016. Table 2.1.7 shows the amount of mercury contained in import and export of measuring devices.

Table 2.1.6 Mercury in industrial measuring devices (FY2014, production)

Product	Mercury content (g-Hg/unit)	Number of production (unit)	Hg in produced devices (t-Hg)
Glass mercury thermometers Note1	3.7	77,333	0.29
Mercury filled thermometers	100	341	0.034
Diaphragm manometers for high temperature Note2	40	1,052	0.042
Liquid manometers	1,500	5	0.0075
Liquid column barometers	N/A	0	0
Macleod vacuum gauges	135	52	0.00702
U-shape vacuum gauge	125	661	0.083
Total			0.46

[Source]
Glass mercury thermometers: Japanese Cooperative Kumiai for Glass Measuring Instruments Industry
Mercury filled thermometers, Diaphragm manometers for high-temperature, liquid manometers: Japan Pressure Gauges and Thermometers Manufacturers' Association
Liquid column barometers: Japan Association of Meteorological Instrument Engineering
Vacuum gauges: Japan Scientific Instruments Association
Note1: "Glass mercury thermometers" includes devices assembled in float-type hydrometers
Note2: "Diaphragm-seal manometer for high temperature" includes high pressure diaphragm-seal pressure transmitter

Table 2.1.7 Mercury in industrial measuring device (FY2014, import/export)

Product	Number of imported devices	Hg in imported devices (t-Hg)	Number of exported devices	Hg in exported devices (t-Hg)
Glass mercury thermometers Note	14,622	0.054	15,000	0.056
Mercury filled thermometers	N/A	N/A	N/A	N/A
Diaphragm manometers for high temperature	N/A	N/A	N/A	N/A
Liquid manometers	0	0	0	0
Liquid barometers	N/A	N/A	0	0
Vacuum gauges	N/A	N/A	N/A	N/A
Total		0.054		0.056

[Source]
Glass mercury thermometers: Japanese Cooperative Kumiai for Glass Measuring Instruments Industry
Mercury filled thermometer, Diaphragm manometers for high temperature, Liquid column manometers: Japan Pressure Gauges and Thermometers Manufacturers' Association
Liquid barometers: Japan Association of Meteorological Instrument Engineering
Vacuum gauges: Japan Scientific Instruments Association
Note: "Glass mercury thermometers" includes devices assembled in float-type hydrometers

(6) Medical measuring devices

Table 2.1.8 shows mercury use for the production of medical devices obtained from interviews with manufacturer/s and importer/s of medical measuring devices, and interview with Japan Federation of Medical Devices Associations. Table 2.1.9 shows mercury contained in imported/exported devices.

Table 2.1.8 Mercury in medical measuring devices (FY2014, production)

Product	Mercury concentration (g-Hg/unit)	Number of production	Mercury in produced devices (t-Hg)
Sphygmomanometers	47.6	33,578	1.6
Mercury thermometers	1.2	0	0
		Total	1.6

[Source]
Mercury content in sphygmomanometers: Interview with Japan Federation of Medical Devices Associations, 2016. 47.6 g-Hg/unit is a representative value, and the actual mercury concentration varies by manufacturers (36~70 g-Hg/unit)
Mercury content in mercury thermometers: Interview with importer, 2016
Number of produced devices: Statistical Survey on Trends in Pharmaceutical Production

Table 2.1.9 Mercury in medical measuring devices (FY2014, import/export)

Product	Number of imported devices	Hg in imported devices (t-Hg)	Number of exported devices	Hg in exported devices (t-Hg)
Sphygmomanometers	99	0.0047	22,153	1.1
Mercury thermometers	78,999	0.095	0	0
Total		0.099		1.1

[Source]
Sphygmomanometer import/export, mercury thermometers export: Statistical Survey on Trends in Pharmaceutical Production
Mercury thermometers import: Interview with importer, 2016

(7) Dental mercury

According to the interview with Japan Dental Materials Manufacturers Association in FY2013, the production and import of dental mercury in Japan has ceased since February 2014. Hence, the produced/imported amount of dental mercury in FY2014 is 0.

(8) Pharmaceuticals

1) Vaccine containing thimerosal

Table 2.1.10 shows the amount of mercury used for the production of vaccine containing thimerosal and imported/exported amount of vaccine, obtained through an interview with Japan Vaccine Industry Association in 2016.

Table 2.1.10 Mercury in vaccine containing thimerosal (FY2014)

Product	Mercury in production (g-Hg)	Mercury in imported vaccine Note (g-Hg)	Mercury in exported vaccine (g-Hg)
Vaccine containing thimerosal	230	150	3

Source: Interview with Japan Vaccine Industry Association, 2016
Note: Imported vaccine is used only for animals.

2） Merbromin solution

Table 2.1.11 shows the amount of mercury used for the production of merbromin solution obtained through interviews with the manufacturers in 2015. Merbromin solution itself is no longer being imported or exported and each manufacturer retains merbromin concentrate that had been imported in the past.

Table 2.1.11 Mercury in merbromin solution (2014)

Product	Merbromin concentrate use (t)	Hg in merbromin concentrate	Hg in produced solution (t-Hg)
Merbromin solution	0.057	25%	0.014

Source: Interview with manufacturers of merbromin solution, 2015
Note: Mercury concentration in merbromin concentrate is defined as 22.4-26.7% in the Japanese Pharmacopoeia. Taking into account the information obtained through interviews with manufacturers, 25% is applied in this estimation.

3） Merbromin products (adhesive plaster containing merbromin)

Table 2.1.12 shows the estimation of mercury use for products containing merbromin (adhesive plaster) in reference to interviews with manufacturer in 2016. These products are not imported or exported.

Table 2.1.12 Mercury in adhesive plaster containing mercurochrome (FY2014)

Product	Produced amount (1,000 pcs)	Mercury concentration Note (mg-Hg/unit)	Hg in produced amount (t-Hg)
Adhesive plaster containing merbromin	10,820	0.231	0.0025

Source: Interview with manufacturers of adhesive plaster containing merbromin, 2016
Note: There are several types of adhesive plasters with different sizes. Average mercury concentration in different types of plaster is applied in this estimation.

(9) Inorganic chemicals

1) Mercuric sulfide

Table 2.1.13 shows the amount of mercury used for production of mercuric sulfide for pigment use obtained from interviews with manufacturers in 2016. Imported/exported amount of mercuric sulfide remains unknown and is excluded from the material flow.

Table 2.1.13 Mercury in mercuric sulfide (FY2014)

Product	Mercury in produced amount	
	(kg-Hg)	(t-Hg)
Mercuric sulfide (pigment use)	1,091	1.1

Source: Interview with manufacturer of mercuric sulfide, 2016

2) Mercury compounds

Table 2.1.14 shows mercury used for the production of mercury compounds obtained from interview with domestic producer. The amount of import/export of mercury compounds are unknown.

Table 2.1.14 Mercury content in produced mercury compounds (FY2014)

Product	Mercury use	
	(kg-Hg)	(t-Hg)
Mercury compounds [Note]	83	0.083

Source: Interview with domestic producer of mercury compounds

Note: Mercury compounds include mercuric sulfide (II), mercury acetate (II), mercury nitrate (I), and others. Mercuric sulfide is produced for reagents, not for pigments.

3. Mercury and mercury compounds

3.1 Mercury import

Table 3.1.1 shows the amount of mercury imported to Japan. Mercury compounds are not included in this table since the breakdown of specific types of mercury compounds is not available in the statistics.

Table 3.1.1 Imported amount of mercury and mercury alloy (FY2014)

Types of mercury	Imported amount (t-Hg)	Note
Mercury	0.004	Actual value in FY2014
Mercury alloy (Hg equivalent)	0.43	Actual value in FY2014
Total	0.44	

[Source]
Mercury import: Current Survey of Supply and Demand of Non-ferrous Metals (Natural Resources and Fuel Department)
Mercury alloy import: Interview with Japan Lighting Manufacturers Association (JELMA), 2016

(1) Mercury import

Table 3.1.2 shows the imported amount of mercury based on the statistics. The actual value in FY2014 (4 kg-Hg) is applied in the material flow.

Table 3.1.2 Mercury import (FY2013-FY2015)

	FY2013	FY2014	FY2015	Average
Mercury import (kg-Hg)	0	4	5	3

Source: Current Survey of Supply and Demand of Non-ferrous Metals (Natural Resources and Fuel Department)

(2) Mercury alloy import

Table 3.1.3 shows the imported amount of mercury alloy used for the manufacturing process of lamps obtained from interview with Japan Lighting Manufacturers Association (JELMA). The actual value in FY2014 (432 kg-Hg (0.43 t-Hg)), is applied in the material flow.

Table 3.1.3 Mercury alloy import (FY2013-FY2015)

	FY2013	FY2014	FY2015	Average
Mercury alloy import (Hg equivalent value)	458	432	402	431

Source: Interview with Japan Lighting Manufacturers Association (JELMA), 2016

3.2 Mercury export

Table 3.2.1 shows the export amount of mercury from Japan during FY2013 to FY2015 obtained from the Current Survey of Supply and Demand of Non-ferrous Metals. Average of FY2013-FY2015 (83,912 kg-Hg (84 t-Hg)) is applied in the material flow.

Table 3.2.1 Mercury export (FY2013-FY2015)

	FY2013	FY2014	FY2015	Average
Mercury export (kg-Hg)	76,858	59,863	115,015	83,912

Source: Current Survey of Supply and Demand of Non-ferrous Metals (Natural Resources and Fuel Department)

3.3 Year-end stock of mercury

Table 3.3.1 shows the year-end stock of mercury by consumers based on the statistics.

Table 3.3.1 Year-end stock of mercury by consumers (FY2013-FY2015)

	FY2013 (March 2014)	FY2014 (March 2015)	FY2015 (March 2016)
Year-end stock of mercury by consumers (kg-Hg)	10,980	10,276	10,130

Source: Current Survey of Supply and Demand of Non-ferrous Metals (Natural Resources and Fuel Department)

3.4 Onshore procurement of mercury

Table 3.4.1 shows the estimation of the onshore procurement of mercury based on the amount of mercury used for product manufacturing, mercury import and year-end stock as set out in section 3.3.

Table 3.4.1 Onshore procurement of mercury (FY2014)

Mercury used for product manufacturing	Year-end stock of FY2014	Mercury import	Year-end stock of FY2013	Onshore procurement of mercury
+5.6 t-Hg	+10 t-Hg	−0.44 t-Hg	−11 t-Hg	4.5 t-Hg

Note: Onshore procurement of mercury (FY2014) = Mercury used for product manufacturing + Year-end stock of FY2014 – Mercury import – End of the FY2013 stock

3.5 Domestic shipment of mercury

In the Current Survey of Supply and Demand of Non-ferrous metals, the domestic shipment of mercury in FY2014 is calculated as 15,009 kg-Hg (15 t-Hg). Since the amount of shipment via intermediary agents is included in this statistics, there is some possibility of double counting. Hence, 15 t-Hg is used as a reference in the material flow. 4.5 t-Hg, the estimated amount in section 3.4, is applied in the material flow.

3.6 Mercury storage and stocks

Currently there is no available data on the amount of mercury storage and stocks by business operators conducting mercury recovery and mercury distributors.

4. Mercury waste, recyclable resources containing mercury

4.1 Mercury recovery from waste and recyclable resources containing mercury

Table 4.1.1 shows the amount of mercury recovery from waste and recyclable resources containing mercury in reference to the "Survey on mercury recovery from industrial waste in 2016" conducted with industrial waste treatment companies (hereinafter referred to as "Industrial waste survey") and the "Interview with mercury recovery companies in 2016" (hereinafter referred to as "Industrial waste interview"). The total amount of recovered mercury is estimated as 76,711 kg-Hg (77 t-Hg).

Table 4.1.1 Mercury recovery from waste and recyclable resources (FY2014)

Type of medium		Mercury recovery (kg-Hg)	Source of reference
(1) Discarded product	Industrial waste	1,544	Industrial waste survey Note 1
	Municipal waste	475	Industrial waste interview Note 2
(2) Waste mercury		9,272	Industrial waste interview
(3) Sludge		10,185	Industrial waste survey
(4) Non-ferrous metal smelting sludge		55,000	Industrial waste interview (Average of FY2013-FY2015)
(5) Others	Dental amalgam	233	Industrial waste interview
	Silver oxide battery	2	Industrial waste interview
Total		76,711	

Note 1: "Survey on mercury recovery from industrial waste in 2016", conducted with industrial waste treatment companies (Questionnaires sent to 293 companies, valid responses: 179, rates of valid responses: 61%). The survey result shown in the table is the integrated value of actual results of the responded companies in 2014.
Note 2: Interview with waste processing company that recovers mercury from waste in 2016.

(1) Discarded products (industrial waste and municipal waste)

Table 4.1.2 shows the amount of discarded product that have been treated to recover mercury as well as the amount of recovered mercury obtained from the industrial waste survey in 2016 and the industrial waste interview in 2016. The amount of recovered mercury from discarded products is estimated as 2,019 kg-Hg. The numbers are actual values of the companies who responded to the survey (response rates: 61%) and there are considered as the minimum values in this material flow. However, since most of the major companies that carry out mercury recovery treatments responded to the survey, it is assumed that the domestic status of the mercury recovery amount has been well grasped.

Table 4.1.2 Mercury recovery from discarded mercury-added products

Product	Intermediate treatment (kg) Note		Mercury recovery (kg-Hg)	
	Industrial waste	Municipal waste	Industrial waste	Municipal waste
Button batteries	20,837	84	42	0
Dry-cell batteries	1,428,224	11,215,069	29	224
Switches and relays	13,214	0	130	0

Product	Intermediate treatment (kg) Note		Mercury recovery (kg-Hg)	
	Industrial waste	Municipal waste	Industrial waste	Municipal waste
Fluorescent lamps	7,384,300	4,477,318	226	179
Cold cathode fluorescent lamps	58,193	0	2	0
HID lamps	122,015	473	12	0
Mixed lamps	2,386,122	0	87	0
Industrial measuring devices	657	0	96	0
Mercury thermometers	3,931	318	289	31
Sphygmomanometers	13,125	824	630	41
		Subtotal	1,544	475
		Industrial/municipal waste total	2,019	
		Industrial/municipal waste total (t-Hg)	2.0	

Source: Survey on mercury recovery from industrial waste in 2016, interview with mercury recovery companies
Note: The mercury recovery treatment includes roasting, thermal treatment, distillation and extraction of metal mercury.

(2) Waste mercury

Table 4.1.3 shows the amount of recovered mercury from waste mercury and the emission sources thereof obtained from the industrial waste interview in 2016.

Table 4.1.3 Mercury recovery from waste mercury (FY2014)

Medium	Emission sources of waste mercury	Mercury recovery (kg-Hg)
Waste mercury	Business	6,728
	University/school	1,122
	Lighthouse	507
	Hospital	221
	Municipal solid waste incineration facility	154
	Others	540
	Total	9,272
	Total (t-Hg)	9.3

Source: Interview with mercury recovery companies in 2016.

(3) Sludge

According to the industrial waste survey in 2016, mercury recovery treatment is conducted for sludge. Table 4.1.4 shows the amount of treated sludge and the recovered mercury.

Table 4.1.4 Mercury recovery from sludge (FY2014)

Medium	Mercury recovery treatment amount (kg)	Mercury recovery (kg-Hg)
Sludge	2,826,389	10,185

Source: Survey on mercury recovery from industrial waste in 2016

(4) Non-ferrous metal smelting sludge

Table 4.1.5 shows the amount of treated sludge generated through the process of non-ferrous metal smelting sludge (recyclable resources containing mercury) and recovered mercury in 2014 obtained from the industrial waste survey in 2016.

The amount of treatment refers to the amount of sludge that members or non-members of Japan Mining Industry Association contracted-out for the recovery of mercury to waste treatment companies.

Table 4.1.5 Mercury recovery from non-ferrous metal smelting sludge (FY2014)

Medium	Classification	Treatment amount (kg)	Mercury recovery (t-Hg)
Non-ferrous metal smelting sludge	Valuables (recyclable resources)	1,614,911	59.5

Source: Survey on mercury recovery from industrial waste in 2016

Table 4.1.6 shows the amount of mercury recovered from non-ferrous metal sludge in reference to the industrial waste interview in 2016 (recovery side) and the data provided by Japan Mining Industry Association (generation side). Considering the variation of mercury recovery across the year, the three-year average of 55 t-Hg at the recovery side is used in the material flow.

Table 4.1.6 Mercury recovery from non-ferrous smelting sludge (FY2013-FY2015)

Source	Mercury recovery amount (t-Hg) Note2			
	FY2013	FY2014	FY2015	Average
Industrial waste interview in 2016 Note1 (Recovery side, Members and non-members of Japan Mining Industry Association)	48.5	59.5	57.0	55.0
Japan Mining Industry Association Note3 (Generation side, Only members of Japan Mining Industry Association)	46.8	42.0	71.6	53.5

Note1: The data of the industrial waste interview in 2016 (recovery side) includes the amount of non-members of Japan Mining Industry Association.

Note2: Difference between the amount of mercury recovery at the generation side and the recovery side might be caused by the difference of timing between emission and recovery, and the difference of calculation timing between the amount of treatment and mercury recovery.

Note3: The data provided by Japan Mining Industry Association are estimated values of the amount of mercury included in

those contracted-out and carried out from offices of non-ferrous metal smelting companies.

(5) Others

1) Dental amalgam

Table 4.1.7 shows the amount of dental amalgam treatment and mercury recovery obtained from the industrial waste survey in 2016. It needs to be noted that dental amalgam includes industrial waste as valuables (recyclable resources containing mercury) to be treated and mercury is recovered from both types of dental amalgam.

Table 4.1.7 Mercury recovery from dental amalgam (FY2014)

Medium	Classification	Treatment amount (kg)	Mercury recovery (kg-Hg)	(t-Hg)
Dental amalgam	Industrial waste	279	130	0.13
	Valuables (recyclable resources)	220	103	0.103
	Total	499	233	0.23

Source: Survey on mercury recovery from industrial waste in 2016

2) Silver oxide batteries

Table 4.1.8 shows the amount of silver oxide batteries treated and mercury recovery thereof obtained from the industrial waste survey in 2016. Table 4.1.2 shows the amount of treatment of mercury recovery from silver oxide batteries as industrial waste.

Table 4.1.8 Mercury recovery from silver oxide batteries as recyclable resources (FY2014)

Medium	Classification	Treatment amount (kg)	Mercury recovery (kg-Hg)	(t-Hg)
Silver oxide battery	Valuables (recyclable resources)	1,634	2	0.002

Source: Survey on mercury recovery from industrial waste in 2016

4.2 Intermediate treatment of waste

(1) Intermediate treatment of discarded products (industrial waste)

Table 4.2.1 shows the amount of intermediate treatment (sorting, crushing, incinerating, and melting) obtained from the industrial waste survey in 2016. The amount of mercury in the intermediate treatment is calculated using the amount of treatment and the mercury recovery per item obtained from the survey conducted with mercury recovery companies.

Table 4.2.1 Intermediate treatment amount and mercury content in discarded products as industrial waste (FY2014)

Item	Sorting/crushing		Incinerating/melting	
	Treated amount (kg)	Mercury content (kg-Hg)	Treated amount (kg)	Mercury content (kg-Hg)
Dry-cell batteries	1,233,823	25	5,687	0.11
Button batteries	1,240	2.5	0	0
Mixed batteries Note1 (Dry-cell, button)	81,450	1.6	1,007,836	20
Fluorescent lamps	2,125,925	85	20	0.00080
Cold cathode fluorescent lamps	19,925	0.69	0	0
HID lamps	22,673	0.77	0	0
Mixed lamps Note2	462,166	18	0	0
Mercury thermometers	26	2.6	1	0.099
Sphygmomanometers	116	5.8	11	0.55
Total		142		21

Source: Survey on mercury recovery from industrial waste in 2016

Note1: For mixed batteries, based on the existing data on the ratio of treatment, most batteries were assumed to be dry-cell batteries for the estimation of mercury.

Note2: For mixed lamps, based on the existing data on the ratio of treatment, most lamps were assumed to be fluorescent lamps for the estimation.

(2) Intermediate treatment of industrial wastes other than discarded products

Table 4.2.2 shows the amount of intermediate treatment (incinerating, melting) of industrial wastes other than discarded products in reference to the industrial waste survey in 2016. It needs to be noted that the mercury content in the intermediate treatment is not estimated since the concentration of mercury in waste is unknown.

Table 4.2.2 Intermediate treatment of industrial wastes other than discarded products (FY2014)

Type of waste	Intermediate treatment method
	Incineration/melting (kg)
Ash dust	98,910,830
Sludge	12,538,022
Waste acid	82,594
Waste alkali	70,824
Cinders	4,485

Source: Survey on mercury recovery from industrial waste in 2016

4.3 Final disposal

(1) Final disposal from processing/industrial use of raw minerals

Table 4.3.1 shows the amount of final disposal derived from the processing/industrial use of raw minerals mentioned in section 1.3. Mercury contained in the final disposal is 7.3 t-Hg from eight types of industries.

Table 4.3.1 Final disposal derived from processing/industrial use of raw minerals (FY2014)

Emission source	Medium	Final disposal (t)	Mercury contained in final disposal (t-Hg)
Non-ferrous metal smelting facility	Waste water treatment sediment	N/A	1.2
	Slag, etc.	N/A	0.25
	Other waste	N/A	0.47
Coal-fired power plant	Fly ash	200,000	0.030
	Flue gas desulfurized gypsum	1,000	0.00044
	Sludge	39,000	0.26
Coal-fired industrial boiler	Coal ash	34,000	0.0043
	Flue gas desulfurized gypsum	3,400	0.0046
Primary iron-manufacturing plant	Desulfurization sludge	933	0.0078
	Wet dust	4,993	0.0036
Secondary iron-manufacturing plant	Precipitator dust	76,656	0.15
Oil and natural gas processing facility	Waste water treatment sludge	480 or more	N/A
Municipal solid waste incineration facility	Incineration residue	3,213,902	2.7
Industrial waste incineration facility	Ash dust	N/A	2.3
	Cinders	N/A	Small amount
		Total	7.3

(2) Survey on mercury recovery from industrial waste in 2016

The amount of final disposal of discarded products and industrial wastes other than discarded products (e.g. sludge) containing mercury were obtained through "Industrial waste survey in 2016" conducted with companies treating industrial waste.

1) Final disposal of discarded products (industrial waste)

Table 4.3.2 shows the estimation result of the amount of final disposal in discarded products as industri waste and the mercury content in the final disposal. The mercury content in the final disposal is calculat using the amount of treatment and mercury recovery per item obtained from the survey conducted wi mercury recovery companies.

Table 4.3.2 Final disposal of discarded products as industrial waste (FY2014)

Item	Final disposal (kg)	Mercury in final disposal (kg-Hg)	Number of treatment companies
Dry-cell batteries	21,590	0.43	4
Button batteries	1	0.0020	
Mixed batteries Note1 (Dry-cell, button)	51,535	1.0	
Fluorescent lamps	280,530	11	8
Cold cathode fluorescent lamps	3,000 Note2	0.10	
HID lamps	7,000	0.24	
Mercury thermometers	3	0.30	2
Sphygmomanometers	67	3.3	
Switches and relays	N/A Note2	-	1
Mercury-containing reagents	N/A Note2	-	1
Total		17	

Source: Survey on mercury recovery from industrial waste in 2016

Note1: For mixed batteries, based on the existing data on the ratio of treatment, most batteries were assumed to be dry-c batteries for the estimation of mercury amount.

Note2: Final disposal of switches and relays and mercury-containing reagents are included in the disposal of cold catho fluorescent lamps.

2) Final disposal of industrial wastes other than discarded products

Table 4.3.3 shows the final disposal of industrial wastes other than discarded products. The mercury conte is not estimated since the concentration of mercury in waste is unknown.

Table 4.3.3 Final disposal of industrial wastes other than discarded products (FY2014)

Type of waste	Final disposal (kg)	Number of treatment companies
Ash dust	1,000,680	2
Sludge	1,433,673	11
Waste acid	193,681	7
Waste alkali	3,727	3
Cinders	1,920	1

Source: Survey on mercury recovery from industrial waste in 2016

(3) Final disposal of municipal waste (direct landfilling)

Direct landfilling of municipal waste is not included in the material flow since the amount of discarded mercury-added products to be landfilled as non-burnable refuse is not available. For reference, in the report on "Investigation on the situation of mercury waste disposal in 2013", the amount of mercury to be landfilled contained in mercury-added products in 2010 is estimated to be16 kg-Hg.

Table 4.3.4 (Reference) Mercury contained in direct landfilling of discarded products (FY2010)

Product	Number of responding municipalities	Treated amount (t)	Mercury content (kg-Hg)
Fluorescent lamp	17	297	12
Dry-cell battery, other battery (excluding button battery)	14	213	3.6
Mercury thermometer	0	N/A	-
Mercury manometer	0	N/A	-
Total			16

Source: Ministry of the Environment, Japan, Report on "Investigation on the situation of mercury waste disposal in 2013" (March 2014)

Note: The amount of mercury to be contained in discarded mercury-added products is calculated using the actual treatment data provided by mercury recovery companies in reference to the survey conducted on companies treating industrial waste in 2012.

Table 4.3.5 (Reference) Mercury content per discarded mercury-added products (FY2010)

Product	Discarded product treatment (t)	Mercury recovery (kg)	Mercury content(kg-Hg/t)
Fluorescent tubes	8,185	325	0.040
Dry-cell batteries, other batteries (excluding button batteries)	12,159	209	0.017

Source: Ministry of the Environment, Japan, Report on "Investigation on the situation of mercury waste disposal in 2013" (March 2014)

(4) Final disposal of waste

Based on the subsection (1) - (3), the amount of final disposal derived from processing/industrial use of raw material was estimated to be 7.3 t-Hg, and the final disposal of discarded mercury-added products (industrial waste) was estimated to be 0.017 t-Hg. Final disposal of waste in total accounts for 7,328 kg-Hg (7.3 t-Hg).

4.4 Import of specified hazardous waste

Table 4.4.1 shows the specified hazardous wastes imported to Japan whose Y number is 29 (containing mercury or mercury compound) obtained from the aggregated data on the enforcement status of "Law for the Control of Export, Import and Others of Specified Hazardous Wastes and Other Wastes". Since the

mercury content in all wastes listed in the table is unknown, this data is not used in the material flow.

Table 4.4.1 Import of specified hazardous wastes (CY2013-CY2015)

Year	Waste [Note1]	Partner country	Weight transferred (t)
2013	Waste fluorescent lamps Waste HID lamps	Philippines	5
2014	Waste button batteries	Taiwan [Note 2]	13
	Waste HID lamps	Taiwan	6
2016	Mercury-containing sludge	Indonesia	1
	Mercury-containing waste liquid	Indonesia	10
	Mercury-containing solid wastes	Indonesia	7
	Mercury-containing waste catalyzers	Indonesia	28
	Mercury-containing filters	Indonesia	7
	Mercury-containing sludge	Indonesia	50
	Mercury-containing sludge	Indonesia	272
	Waste mercury	Indonesia	0.05

Source: Status of import/export of waste, etc. (1) Enforcement status of Basel Law
http://www.env.go.jp/recycle/yugai/index4.html

Note 1: The purpose of all the import is "metal recovery".

Note 2: For import from Taiwan, since documents for import/move are not issued, the weight transferred is the value that Ministry of the Environment, Japan obtained.

5. Emissions and releases of mercury

5.1 Mercury emissions to air

Table 5.1.1 shows the estimation results of atmospheric mercury emissions obtained from Japan's "Mercury Emission Inventory (FY2014)". Total amount of anthropogenic atmospheric mercury emission is 17 t-Hg.

Table 5.1.1 Atmospheric Mercury Emission Inventory (FY2014)

Source category	Emission source		Emission (t-Hg/year)[1] FY2014	Emission (t-Hg/year)[1] Subtotal
Sources listed in Annex D of Minamata Convention	Coal-fired power plants		1.3	14
	Coal-fired industrial boilers		0.24	
	Non-ferrous metals production		1.4	
	Waste incineration	Municipal solid waste	1.5	
		Industrial waste	2.5	
		Sewage sludge[2]	1.4	
	Cement clinker production		5.5	
Other sources	Iron and steel production	Primary iron production	2.0	2.7
		Secondary iron production	0.54	
	Oil refining		0.1	
	Oil and gas production		0.00005	
	Combustion of oil and others	Oil-fired power plants	0.01	
		LNG-fired power plants	0.002	
		Oil-fired industrial boilers	0.002	
		Gas-fired industrial boilers	0.0006	
	Production process using mercury or mercury compounds[3]	Chlor-alkali	N.O.	
		Vinyl chloride monomer	N.O.	
		Polyurethane	N.O.	
		Sodium methylate	N.O.	
		Acetaldehyde	N.O.	
		Vinyl acetate	N.O.	
	Hg-containing products manufacturing	Battery[4]	0	
		Mercury switch	N.E.	
		Mercury relay	N.E.	
		Lamp[5]	0.005	
		Soaps and cosmetics	N.O.	
		Pesticides and biocides (agricultural chemicals)	N.O.	
		Sphygmomanometer	N.E.	
		Hg thermometer	N.O.	
		Dental amalgam	N.O.	
		Thimerosal production facility	N.E.	
		Vermillion production facility	N.E.	
	Others[6]	Limestone production	< 0.22	0.48
		Pulp and paper manufacturing (black liquor)	< 0.041	
		Carbon black manufacturing	0.09	
		Fluorescent lamp collecting and shredding	0.000003	
		Cremation	0.07	

Source category	Emission source		Emission (t-Hg/year)[1]	
			FY2014	Subtotal
		Transportation derived from fuel[7]	0.06	
		Intermediate treatment of waste[8]	N.E.	
		Mercury recovery (excluding roasting furnace)	N.E.	
Natural sources	Volcano		> 1.4	> 1.4
Total (excluding natural sources)				18 (17)

Source: Implementation of measures for mercury emission based on the Minamata Convention on Mercury (First Proposal), Reference document "Mercury emission inventory (FY2014)" http://www.env.go.jp/press/102627.html

Note: Basically, data in FY2014 is used for the activity rate and other relevant information. If no data was available for FY2014, data for CY2014 is used. If no data was available for 2014, the latest data before 2014 is used.

1. "N.E." stands for "Not Estimated" (Existence of the emission source is unknown, or emission sources exist but no estimation has been done). "N.O." stands for "Not Occurring" (emission sources do not exist).
2. Although some facilities do not fall within waste incineration facilities under domestic laws of Japan, they are categorized as waste incineration facilities in the inventory.
3. There are no domestic industries that use mercury or mercury compounds in their processes.
4. Although mercury is used in the domestic production of button batteries, there is no mercury emission from the manufacturing processes since the processes use equipment to prevent mercury emission.
5. "Lamp" includes fluorescent lamps for general use, cold cathode fluorescent lamps and HID lamps.
6. "Others" include sources that are not discussed in the past INC meetings, but has a probability of mercury emission.
7. "Transportation derived from fuel" includes gasoline and light oil (business use).
8. Waste incineration process is excluded.

5.2 Mercury releases to water

Table 5.2.1 shows mercury releases to water obtained from interviews with business organizations in charge of processing/industrial use of raw minerals and manufacturers of mercury-added products, and data obtained from Japanese PRTR.

Table 5.2.1 Mercury releases to water (FY2014)

Release source	Mercury release (t-Hg)
Processing/industrial use of raw minerals	0.087
Production process of mercury-added products	0
PRTR (Registered amount + Estimation of exempted amount)[Note]	0.16
Total	0.24

Note: In order to avoid double-counting of the release from processing/industrial usage of raw fuel (non-ferrous metal smelting process), the value of "non-ferrous metal production" is excluded from the PRTR data.

(1) Mercury releases to water from processing/industrial use of raw minerals

Table 5.2.2 shows mercury releases to water from processing/industrial use of raw minerals in reference to section 1.3. The total amount of release to water accounts for 0.087 t-Hg.

Table 5.2.2 Mercury releases to water from processing/industrial use of raw minerals (FY2014)

Release source	Mercury content in waste water (t-Hg)	Source (remarks)
Non-ferrous metal smelting	0.087	Interview with Japan Mining Industry Association
Coal-fired power plants	0	Interview with Federation of Electric Power Companies (Waste water from stack gas desulfurization facility: Mercury elution N.D.)
Coal-fired industrial boilers	0	-
Primary iron-manufacturing	N/A	Interview with Japan Iron and Steel Federation (Process managed based on the effluent standard in the Water Pollution Control Law)
Secondary iron-manufacturing	0	Interview with Japan Iron and Steel Federation (Waste water does not occur due to dry-type flue gas treatment)
Oil and natural gas processing	0	Interview with domestic companies
Cement clinker production	0	Interview with Cement Association of Japan
Municipal solid waste incineration	0	-
Industrial waste incineration	0	-
Sewage sludge incineration	0	-
Total	0.087	

(2) Mercury releases to water from manufacturing processes of mercury-added products

Table 5.2.3 shows mercury releases to water from manufacturing processes of mercury-added products. According to interviews with business organizations and others in 2016, the amount of release was 0 or unknown for all the manufacturing processes.

Table 5.2.3 Mercury releases to water from manufacturing processes of mercury-added products (FY2014)

Product	Mercury release (kg-Hg)	Interviewee
Button batteries	0	Battery Association of Japan
Switches and relays	0	Manufacturer
Lamps	N/A	Japan Lighting Manufacturers Association
Industrial measuring devices	0	Japanese Cooperative Kumiai for Glass Measuring Instruments Industry, Japan Pressure Gauge and Thermometer Manufacturers' Association, Japan Association of Meteorological Instrument Engineering,

Product	Mercury release (kg-Hg)	Interviewee
		Japan Scientific Instrument Association
Medical measuring devices	0	The Japan Federation of Medical Devices Association
Medicine	0	Japanese Association of Vaccine Industries, Manufacturers
Inorganic chemicals	0	Manufacturer
Total	0	

Source: Interview with organizations/companies shown in the column of "Interviewee" in 2016.

(3) Mercury releases to public waters (PRTR data)

Table 5.2.4 shows the reported data on mercury releases to public waters and the estimated releases outside notification in reference to the PRTR data in FY2014. In the material flow, in order to avoid double-counting with "(1) Mercury releases to water from processing/industrial use of raw minerals", a sum of PRTR notification amount excluding "non-ferrous metal production" with estimated amount (for estimation for portion under the cutoff amount for notification) , which amounts to 0.16 t-Hg, is used.

Table 5.2.4 Mercury releases to public waters (FY2014, PRTR data)

Industry code	Industry type	Reported data of releases to water (kg)	Estimated releases outside notification (kg)
1200	Manufacture of food	-	0.1
1300	Manufacture of beverages, tobacco and feed	-	0.02
1400	Manufacture of textile mill products	-	0.4
1800	Manufacture of pulp, paper and paper products	11	0
1900	Publishing, printing and allied industries	-	0.04
2000	Manufacture of chemical and allied products	-	3.8
2100	Manufacture of petroleum and coal products	-	0.1
2200	Manufacture of plastic products	-	0.03
2300	Manufacture of rubber products	-	0.004
2500	Manufacture of ceramic, stone and clay products	-	3.2
2700	Manufacture of non-ferrous metals and products Note	~~23~~	~~0.1~~
2800	Manufacture of fabricated metal products	-	0.02
2900	Manufacture of general-purpose machinery	-	0.1
3000	Manufacture of electrical machinery, equipment and supplies	-	0.4
3100	Manufacture of transportation equipment	-	0.4
3200	Manufacture of precision instruments and machinery	-	0.2
3400	Miscellaneous manufacturing industries	-	0.03

Industry code	Industry type	Reported data of releases to water (kg)	Estimated releases outside notification (kg)
3830	Sewage industry	128	0
5132	Wholesale trade (petroleum)	-	0.002
7210	Laundry industry	-	0.001
7810	Machine repair industry	-	0.008
8620	Product inspection industry	-	0.1
8630	Measurement certification industry	-	0.2
8716	Municipal solid waste treatment service	2	-
8722	Industrial waste disposal business (including special controlled industrial waste disposal business)	4	0.001
8800	Medical and other health services	-	1.2
9140	Higher education institution	-	0.04
9210	Natural science research institution	-	0.2
	Subtotal	145	11
	Total	156	

Source: PRTR data in FY2014 (published on 4 March 2016), http://www.env.go.jp/chemi/prtr/result/gaiyo.html

Note: In order to avoid double counting of the released amount from processing/industrial usage of raw material (non-ferrous metal smelting process), the value of "non-ferrous metal production" is excluded when aggregating the material flow.

5.3 Mercury releases to land

For residue generated from the processing/industrial use of raw minerals, "mercury releases to land" refers to the release amount of mercury to soil from the portion that either comes in direct contact with soil or gets mixed, or is utilized by directly spreading over the soil.

Table 5.3.1 shows the amount of residue utilization that falls within the definition mentioned above and mercury content therein. The total amount of mercury release to land is estimated as 0.34 t-Hg.

Table 5.3.1 Mercury releases to land (FY2014)

Release source	Medium	Utilization purpose	Utilization (10^3 t)	Mercury content (t-Hg)
Coal-fired power plants	Fly ash	Soil-contact type	1,207	0.18
Coal-fired industrial boilers	Coal ash	Soil-contactless type	293	0.037
Others	Sewage sludge	Compost use at green farms	324	0.13
			Total	0.34

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