

# Mercury waste management and inventory in Japan

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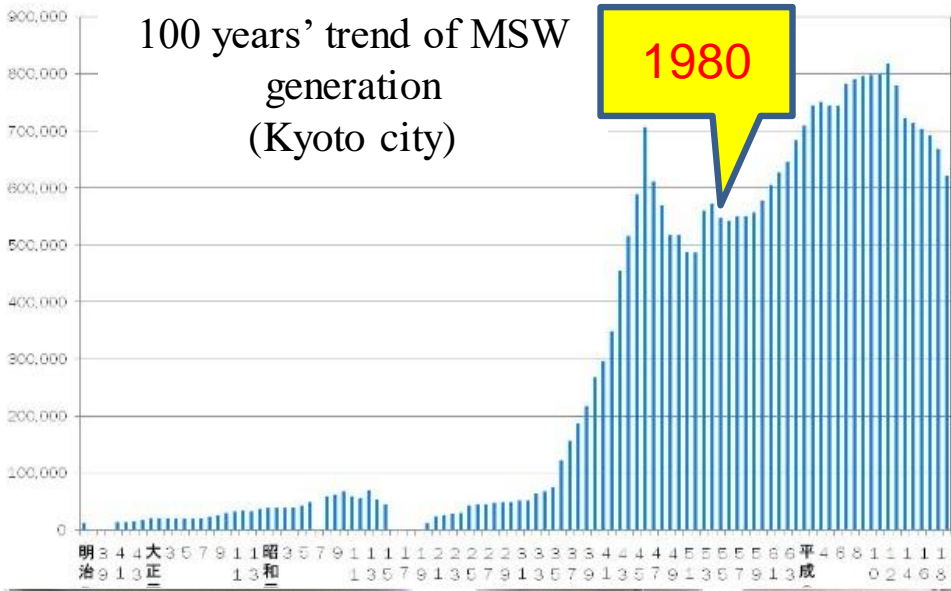
# 0. Self Introduction

# Targets of my research



# MSW Compositional Analysis

Kyoto city and Kyoto University continue the survey since 1980.



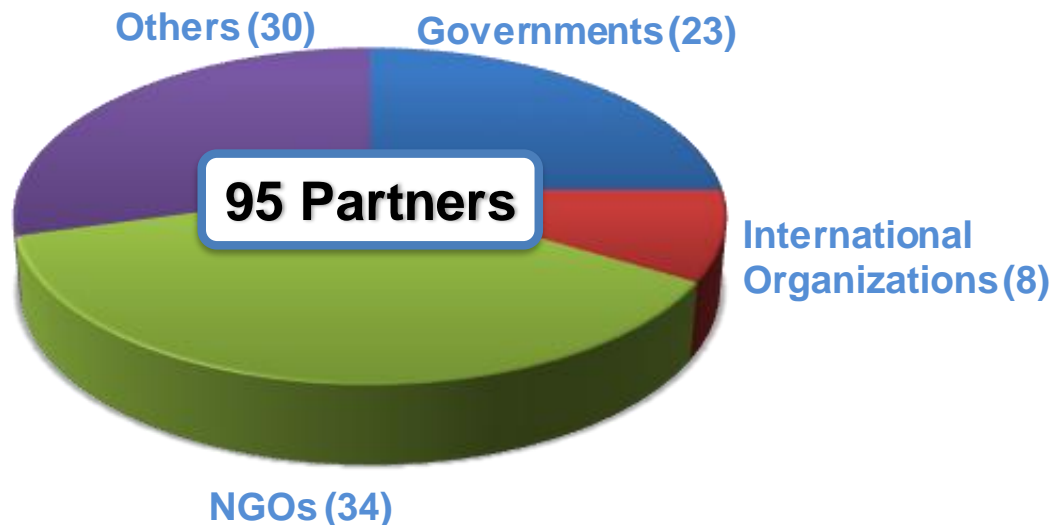
300 categories based on the product type and material



# 1. Introduction to UNEP Global Mercury Partnership

# Global Mercury Partnership Waste Management Area (WMA)

- **Started in 2008**
- **Lead**: Associate Professor Misuzu Asari (Kyoto University)  
Ministry of the Environment, Japan (MOEJ)
- **Number of Partners**: 95 (as of September 2019)



The WMA has the biggest number of partners.

- **ASGM**: 70 partners
- **Coal Combustion**: 61 partners
- **Chlor-alkali**: 12 partners
- **Cement Industry**: 10 partners
- **Products**: 75 partners
- **Air Transport and Fate**: 43 partners
- **Supply and Storage**: 29 partners

(There are some overlapping)

## **2. Mercury Emission Inventory**

**(Ministry of the Environment, Japan)**

# Mercury Emission Inventory (FY2016)

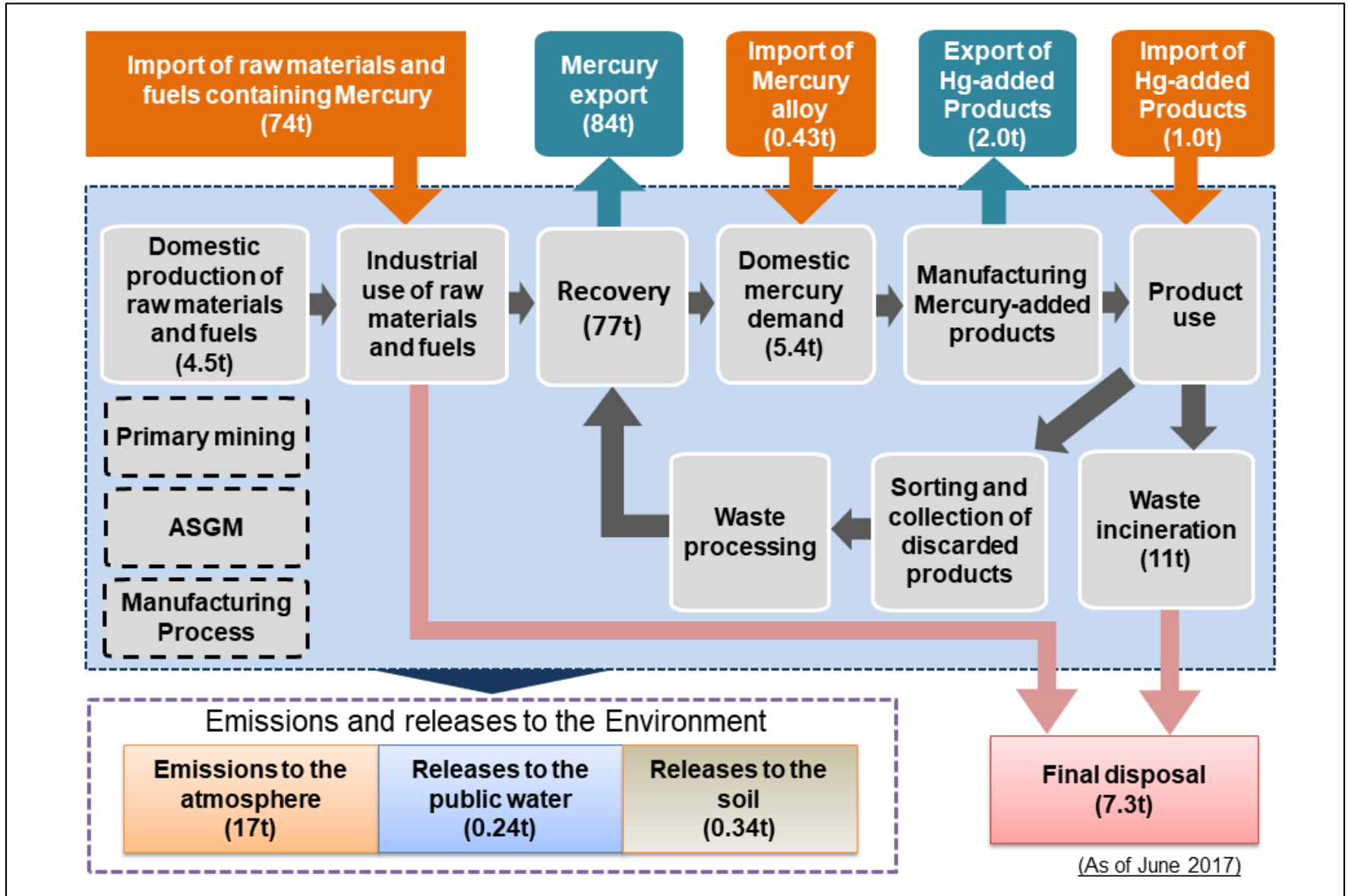
Category	Emission Source	Emission (t)	
Annex D	Coal-fired power plants	1.3	
	Coal-fired industrial boilers	0.22	
	Non-ferrous metal production facilities	1.4	
	Waste incineration facilities	5.3	
	Cement clinker production facilities	5.4	
Other than Annex D	Iron and steel manufacturing facilities	2.4	
	Oil refineries	0.12	
	Oil and gas production facilities	0.00005	
	Combustion of oil and gas	0.011	
	Facilities which use mercury in manufacturing processes	N.O.	
	Mercury-added products	Battery production facilities	N.E.
		Lamp production facilities	0.005
	Other	Production of lime products	0.10
		Pulp and paper mill (black liquor)	< 0.04
		Carbon black production	0.08
		Crushing of fluorescent lamps	0.000005
		Cremation	0.07
Transportation		0.06	
<b>Total</b>		<b>16</b>	

\*Emission sources are simplified for presentation N.E.:Not Estimated N.O.:Not Occurring



### **3. Development of Mercury Material Flow**

# 3.1 What is the Mercury Material Flow?

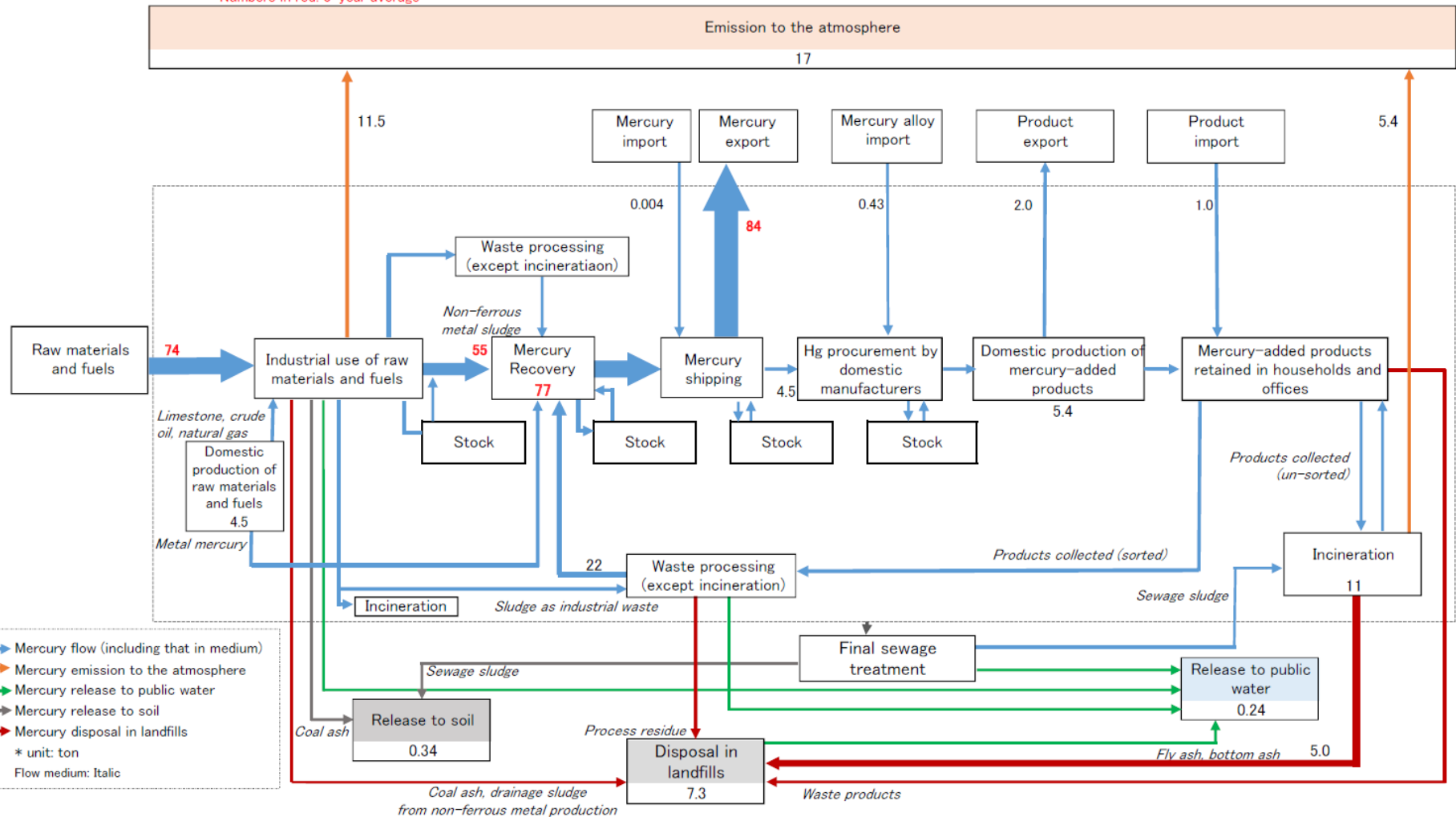


Note: The amount of mercury in mercury compounds is reflected as far as being identified.

# 3.1 What is the Mercury Material Flow?

## Mercury Material Flow in Japan (FY2014)

Numbers in red: 3-year average



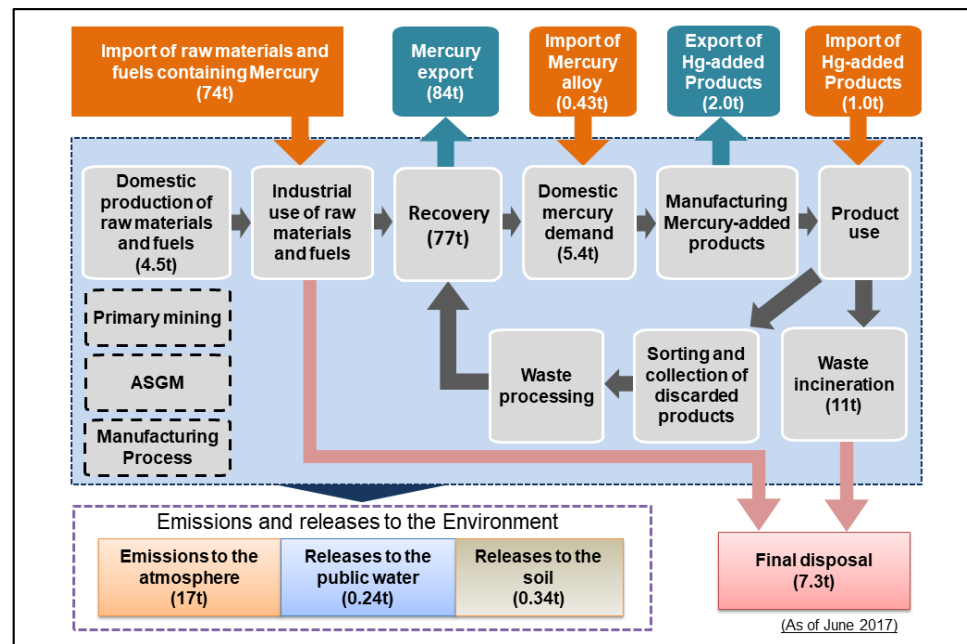
Note: This mercury material flow is developed based on best available statistics, literatures, and surveys on the private sectors, and does not indicate accurate and comprehensive mercury flow.

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 supply and demand balance of mercury in the long-term may be equivalent, whereas that of a single year may not be equivalent due to the transport and the use of stock between years.

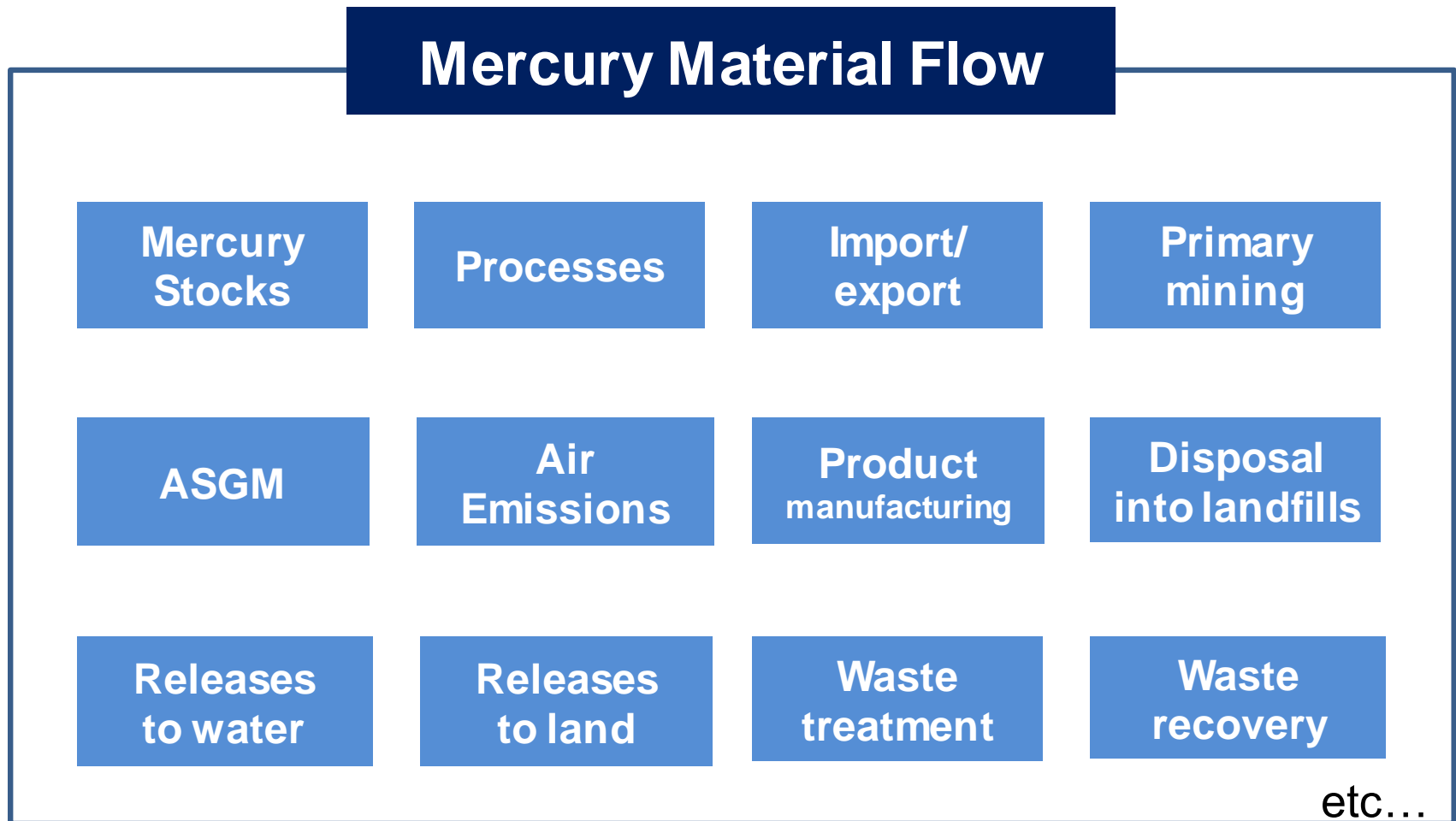
## 3.2 The general purpose of developing the MMF

1. To get the overall picture of the domestic flow of mercury
2. To identify the areas where mercury management is feasible and required with emphasis
3. To identify potentially responsible entities for final disposal of excess mercury
4. To review the effectiveness of policy measures

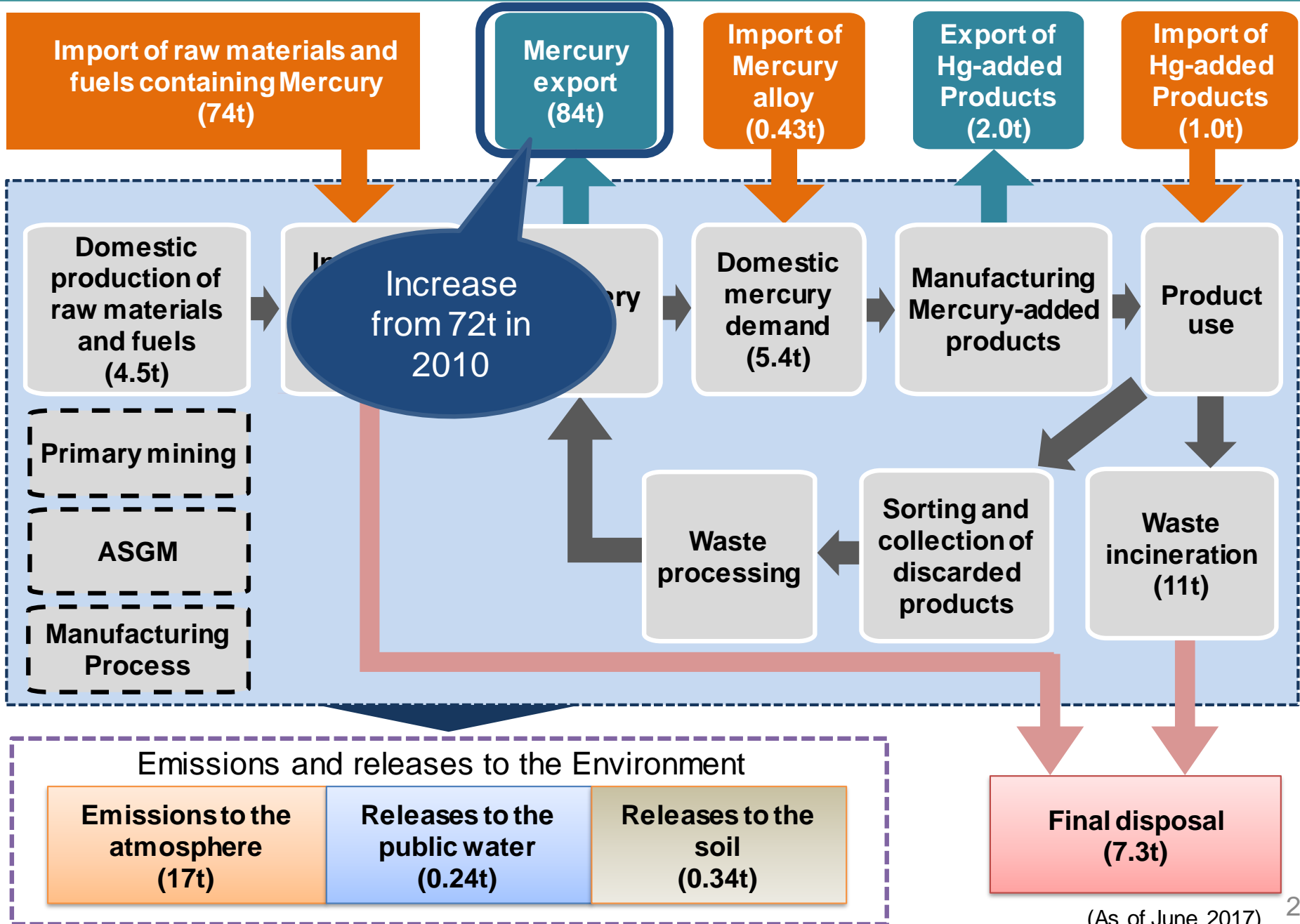


## 3.2 The general purpose of developing the MMF

5. It can also be utilized to collect data to be reported to COP



# 3.3 Policy implication of the MMF (Import / Export)

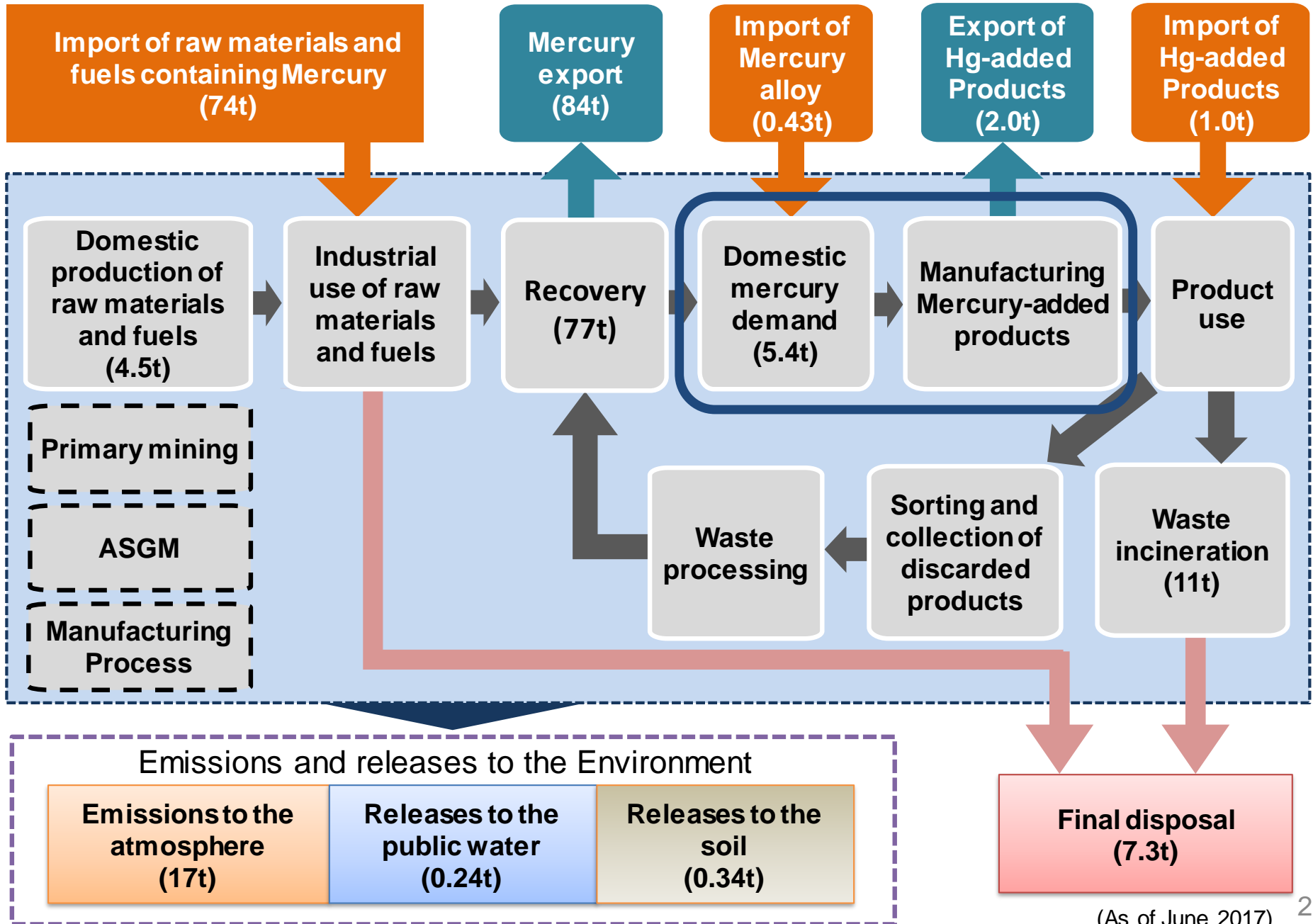


### 3.3 Policy implication of the MMF (Import / Export)

Policy implications :

- The amount of mercury export greatly exceeds the amount of mercury import
- ➔ The development of mercury export regulations is essential, considering the impact of exported mercury
- ➔ Reporting is crucial to prevent inappropriate use of mercury in the importing country  
(Foreign Exchange and Foreign Trade Act)

# 3.3 Policy implication of the MMF (Mercury-added Products)

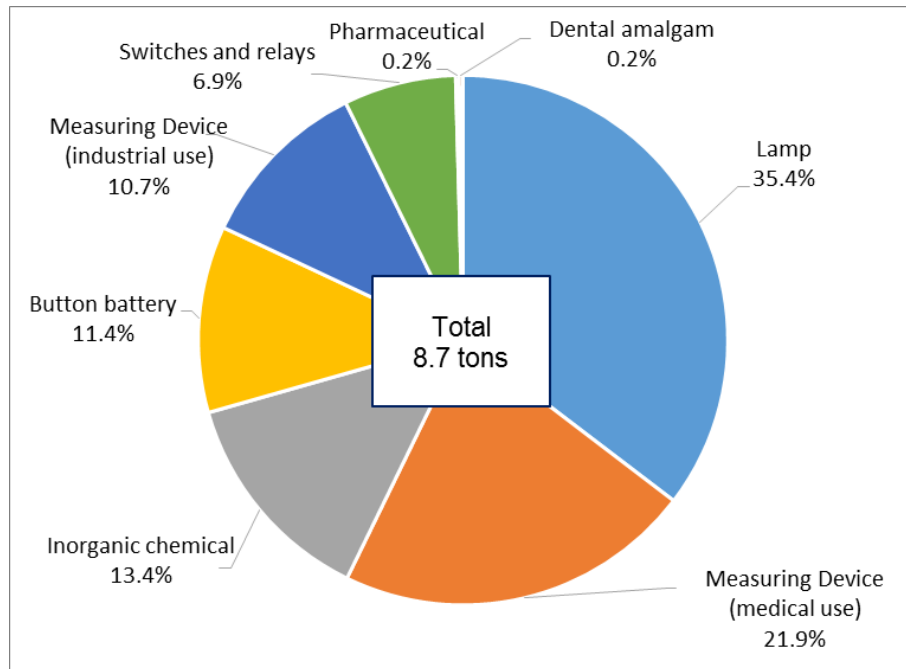




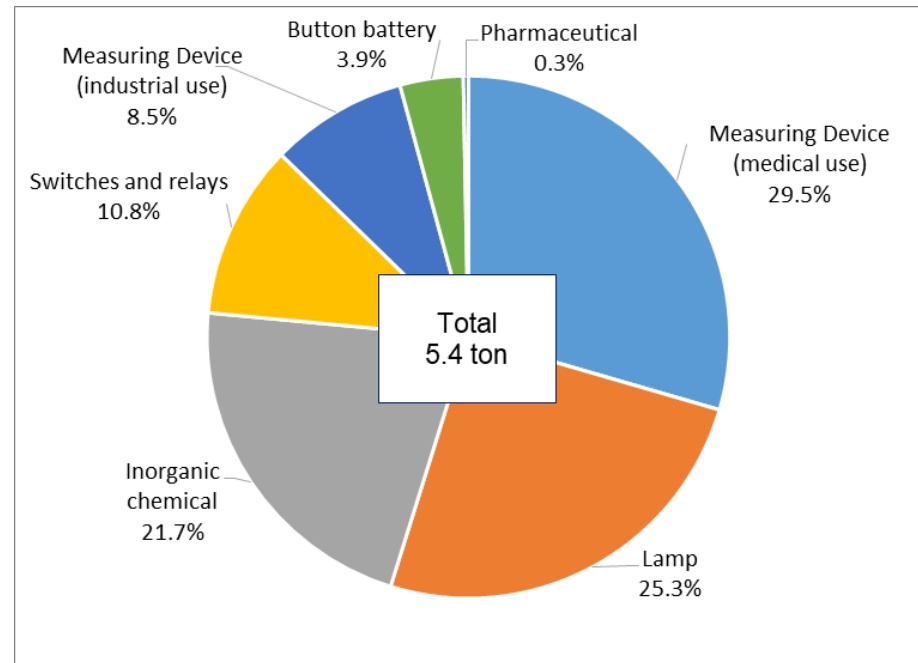
# 3.3 Policy implication of the MMF (Mercury-added Products)

## Policy implications:

- Decrease in the amount of mercury used to produce mercury-added products
- ➔ Less demand of mercury-added products, or products improving to more mercury-efficient/mercury-free. We may observe the effectiveness of regulation in the future.

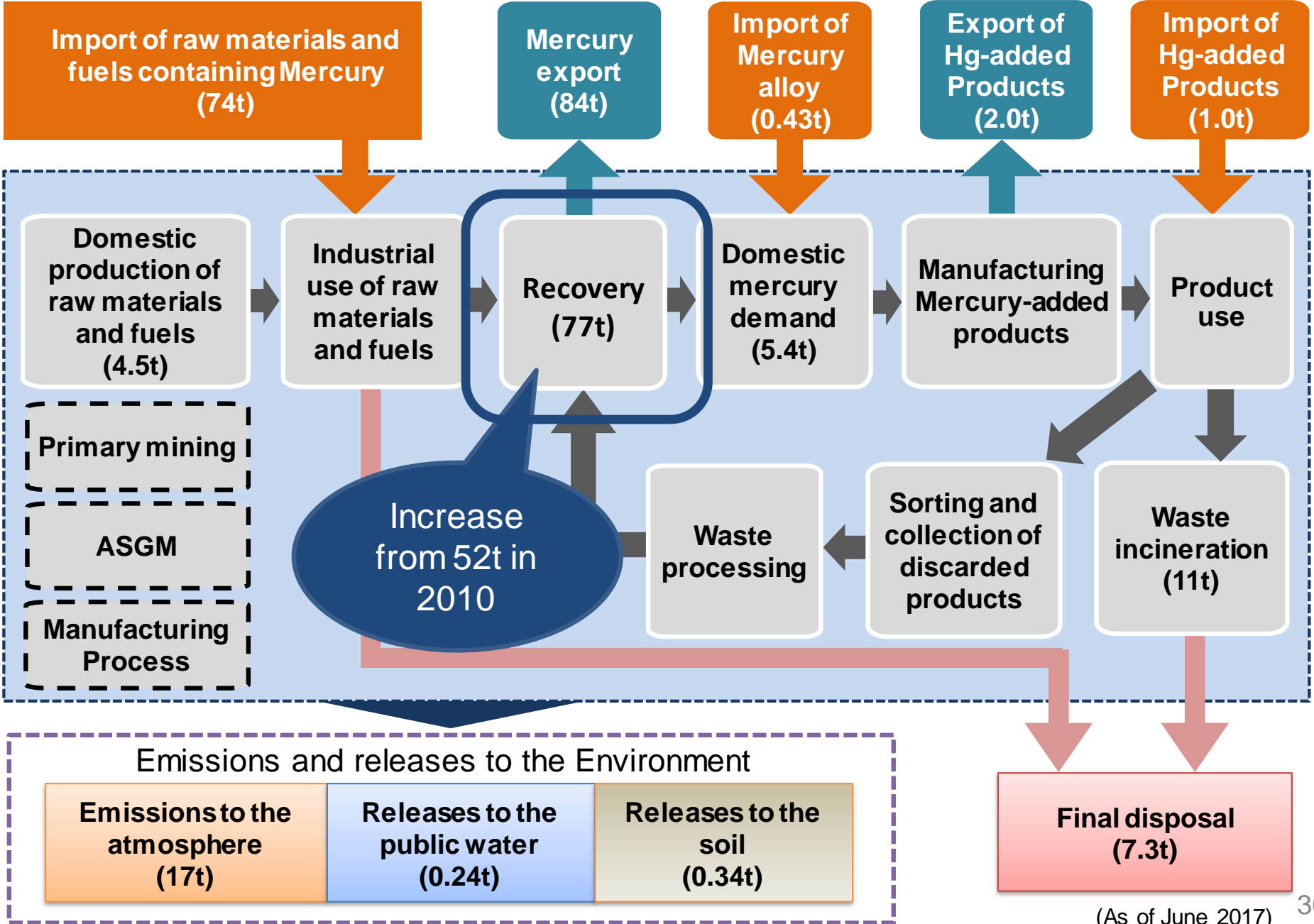


FY2010



FY2014

# 3.3 Policy implication of the MMF (Mercury Recovery from Waste)



## 3.3 Policy implication of the MMF (Mercury Recovery from Waste)

### Policy implications:

- It is likely that wastes would continue to be generated in the future, even after the manufacture of mercury-added products is prohibited.
- ➔ Effective collection of discarded products should be further promoted by stakeholders, such as municipalities and industries.
- In Japan, primary mercury mining does not exist, and also there is very little mercury import. Therefore, the domestic mercury demand (5.4 tons) is met by waste-recovered mercury (77 tons).
- ➔ After the Minamata Convention entered into force, the mercury demand is expected to decline, resulting in dis-incentives to recover mercury from waste.
- ➔ A framework for appropriate management of materials with high mercury concentrations (e.g. sludge generated from non-ferrous metal industry) must be discussed (e.g. long-term monitoring, institutional arrangement).

## 3.4 Further Refinement

Expected Measures	Data Source
<u>Stock of mercury-added products in households</u> Possibly effective in evaluating the establishment of the responsibilities for each sector on the proper separation, discharge and collection.	<ul style="list-style-type: none"><li>• Estimation by modeling</li></ul>
<u>Mercury stocks in manufacturers</u> Observe the changes in the mercury stocks after the establishment of the new Act	<ul style="list-style-type: none"><li>• Report on mercury stock more than 30 kg</li></ul>
<u>The amount of recyclable resources containing mercury generated and disposed</u> The resources may lose its value due to the changes in demand-supply balance.	<ul style="list-style-type: none"><li>• Report on the management of recyclable resources containing mercury</li></ul>



Based on the Act on Preventing the Environmental Pollution of Mercury

## 3.5 How to utilize the MMF

- To review the new Act and the Implementation Plan
  - ✓ Collect data for the review planned 5 years after the implementation of the new Act
  - ✓ Combine the reports under the Act and the results of the sample purchase surveys
- The information on mercury-free alternatives and new technologies can help develop new policies

## 3.6 Challenges of developing MMF in Japan

- Lack of cooperation from the private sector
  - ✓ Reluctant to provide data
  - ✓ Low answer rate of a questionnaire survey (the industrial waste treatment and disposal sector)
- Uncertainty
  - ✓ Limited available data
  - ✓ The amount of stock is unknown especially mercury-added products retained in households

## 4. Conclusion

### The Mercury Material Flow:

- provides the broad picture of the domestic flow of mercury.
- can be an effective tool to implement the policy measures.
- requires the cooperation with stakeholders when it is being developed.
- should be reviewed periodically to reflect the latest circumstances.

Spring

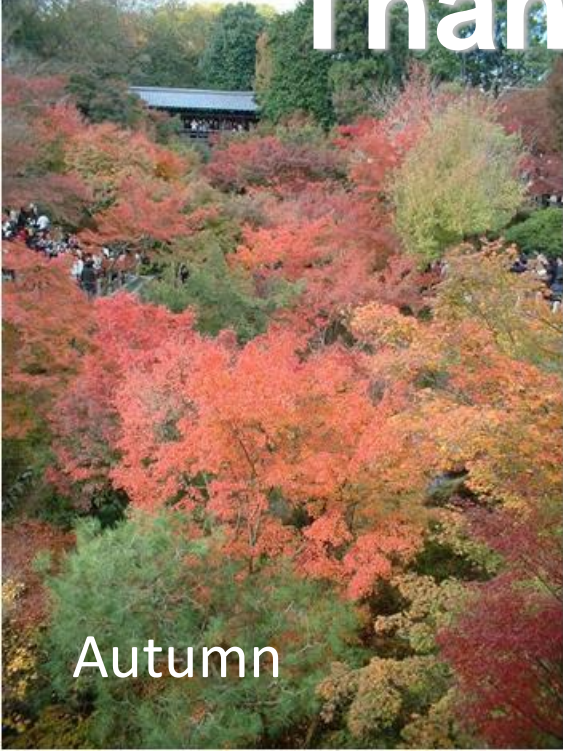


Summer



Thank you for your kind attention!

Autumn



Winter

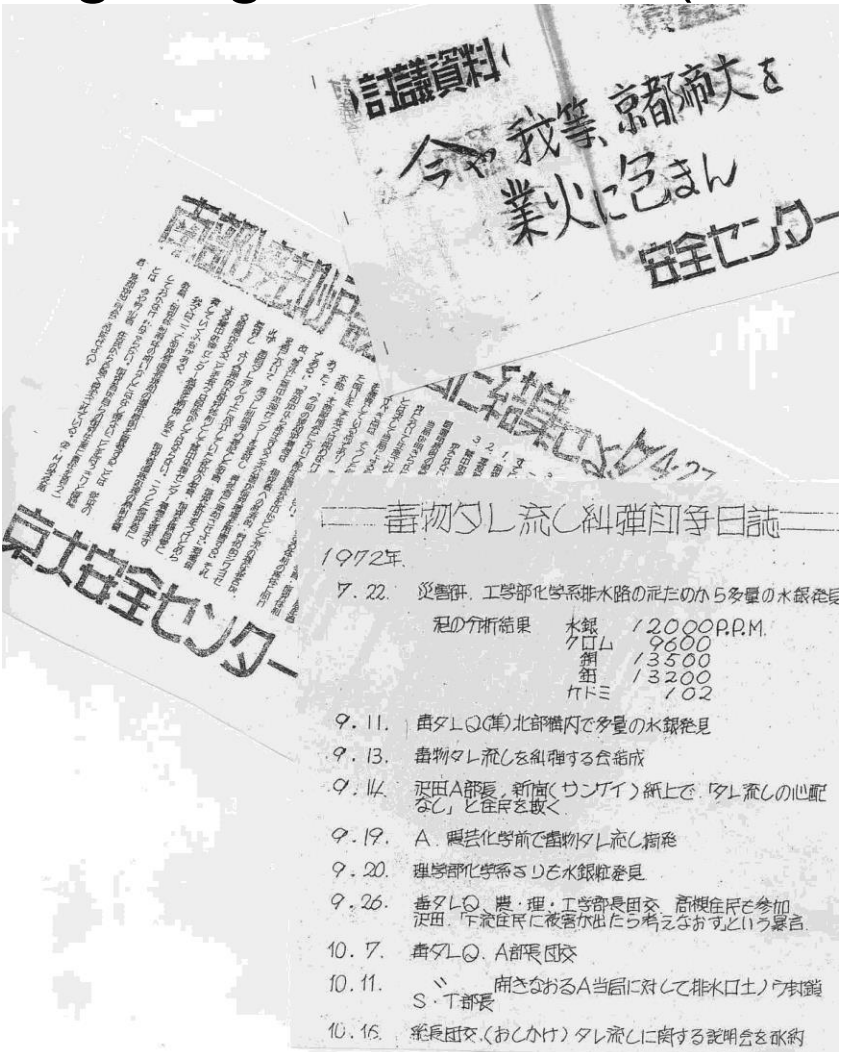




# Supplement 1. Mercury Waste Management in Japan

# Kyoto University -Laboratory waste treatment on campus “Treatment from the source” & “polluter responsibility”

## Hg Illegal emission (1972)



- Treatment of laboratory liquid waste inside the campus from 1970's
- Environment Preservation Center from 1977



# Challenges of Hg products in houses

1. Proper management (100% collection and recycling) of Hg containing products which will be used in the future
2. Collection of **dead stocked (sleeping)** Hg products

→Moreover,  
most important issue are...

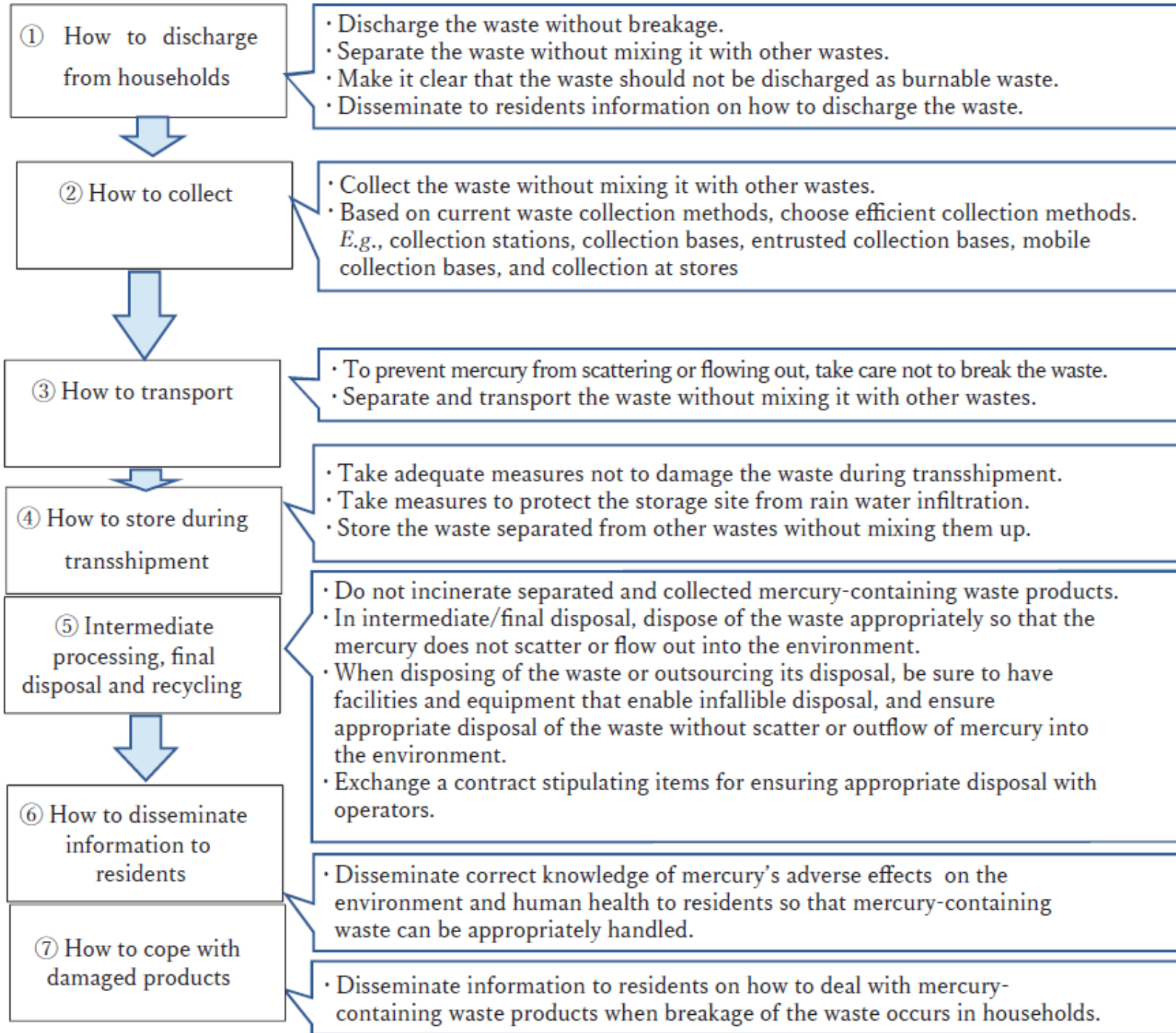
○Understanding of proper management of collected and recycled mercury

○Tradition of effort to overcome challenges



悩みのごみ相談

# Flowchart of discharge to processing/disposal of mercury-containing products and summary of measures at each stage of the process



# Good practice: Special collection in Kyoto City

## Pick up service of HHW at the community



- Since February 2012 including holyday
- 2-3 hours at the community's park etc.
- Every two years for each community
- Many items including HHW



# Good practice: Special collection in Kyoto City

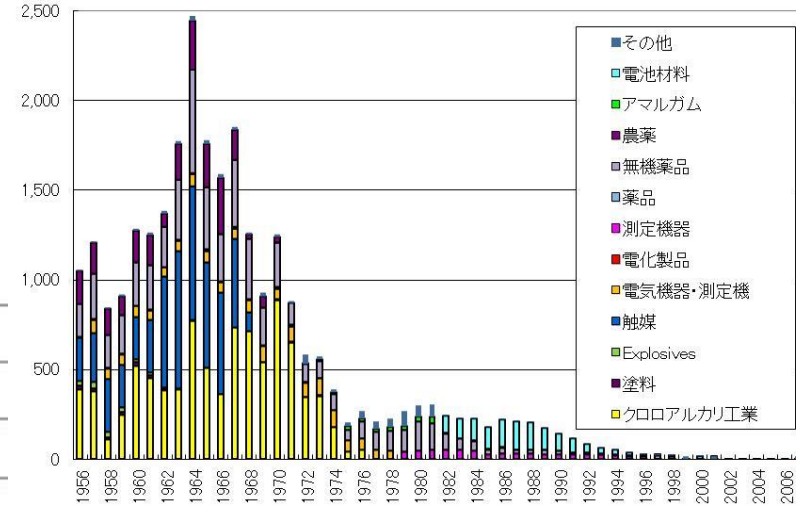
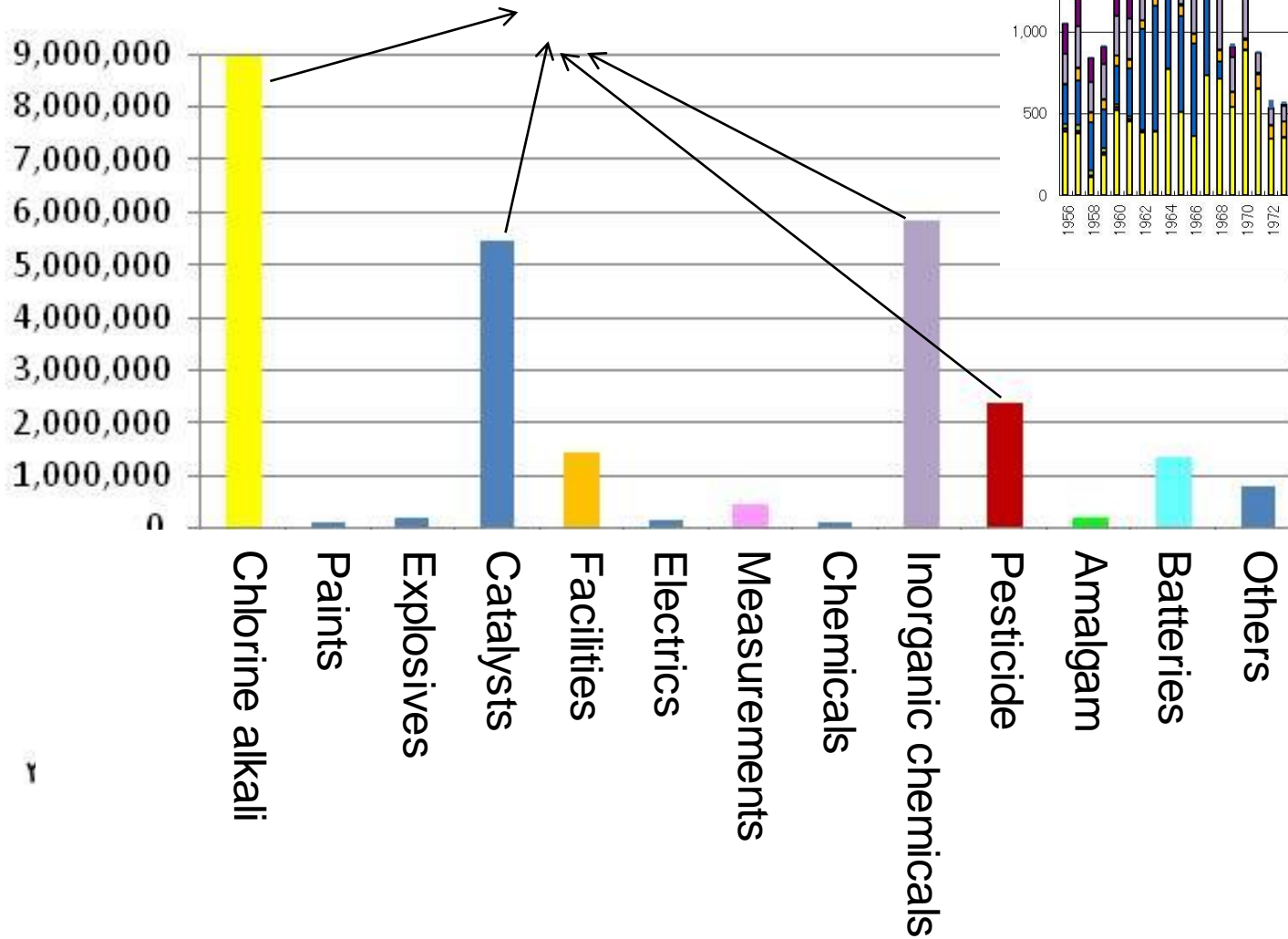
Pick up service of HHW at the community

- Many Kyoto city workers learn about HHW (hazardous household waste) and get licenses.
- Residents can talk and consult directory to city workers.
- They are “teachers of waste”.



# Cumulative usage amount

No dead stock?  
Too difficult to know?





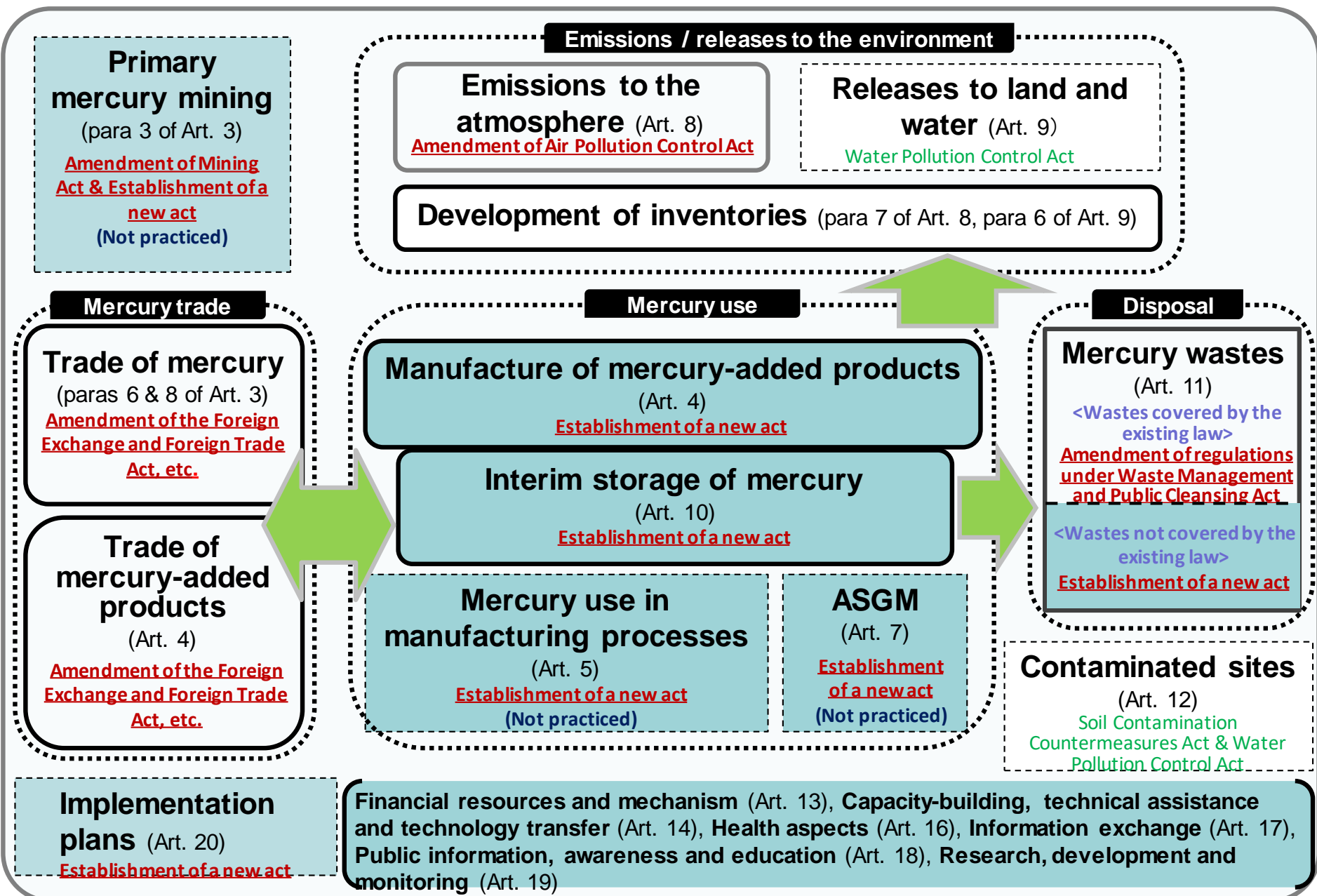
# Survey of Sleeping/dead stocked Mercury containing products in each household

- We visited 15 families and checked all mercury products (fluorescent lamps, measurements, etc.) and clarify types (during/before/after the usage, dead stocked, etc.), places (living room, desks, warehouse, etc.) .
- There is a range depending on the household, but from the three products, about 1 g of mercury is present per household, and approx. 30% is stocked.
- This equal to 46 ton in Japan, 10 times larger from domestic Hg demand (5 ton).



## **Supplement 2. Implementation of Minamata Convention in Japan**

# Policy Framework to Implement the Minamata Convention



# Policy Framework to Implement the Minamata Convention

Emissions / releases to the environment

## Outline of measures under Foreign Exchange and Foreign Trade Act

- Import and export of mercury, mercury compounds and specified mercury-added products are regulated by Foreign Exchange and Foreign Trade Act (Act no. 228 of 1949) which addresses relevant issues (including specified mercury-added products incorporated into other products)
- The concentrations of mercury and specified mercury-added products, phase-out date, and exemptions same as those provided by the Act on Preventing Environmental Pollution of Mercury.

### Primary mercury mining

(para 3 of Art. 3)

Amendment of Mining Act & Establishment of the new act  
(No practice)

### Mercury trade

#### Trade of mercury

(paras 6 & 8 of Art. 3)

Amendment of the order under Foreign Exchange and Foreign Trade Act, etc.

#### Trade of mercury-added products

(Art. 4)

Amendment of the order under Foreign Exchange and Foreign Trade Act, etc.

### Implementation plan

(Art. 20)

Establishment of the new act

Establishment of the new act  
(No practice)

of the new act  
(No practice)

(Art. 12)  
Soil Contamination Countermeasures Act & Water Pollution Prevention Act

Financial resources and mechanism (Art. 13), Capacity-building, technical assistance and technology transfer (Art. 14), Health aspects (Art. 16), Information exchange (Art. 17), Public information, awareness and education (Art. 18), Research, development and monitoring (Art. 19)

# Policy Framework to Implement the Minamata Convention

## Emissions / releases to the environment

Promulgation of a new Act (Act on Preventing Environmental Pollution of Mercury) in order to account for the parts not covered by other laws and regulations (highlighted in blue)

### Primary mercury mining

(para 3 of Art. 3)

Amendment of Mining Act & Establishment of the new act  
(No practice)

## Mercury trade

### Trade of mercury

(paras 6 & 8 of Art. 3)

Amendment of the order under Foreign Exchange and Foreign Trade Act, etc.

### Trade of mercury-added products

(Art. 4)

Amendment of the order under Foreign Exchange and Foreign Trade Act, etc.

### Implementation plan

(Art. 20)

Establishment of the new act

## Mercury use

### Manufacture of mercury-added products

(Art. 4)

Establishment of the new act

### Interim storage of mercury

(Art. 10)

Establishment of the new act

### Mercury use in manufacturing processes

(Art. 5)

Establishment of the new act  
(No practice)

### ASGM

(Art. 7)

Establishment of the new act  
(No practice)

## Disposal

### Mercury wastes

(Art. 11)

<Wastes covered by the existing law>

Amendment of regulations under Waste Management and Cleansing Act

<Wastes not covered by the existing law>

Establishment of the new act

### Contaminated sites

(Art. 12)

Soil Contamination Countermeasures Act & Water Pollution Prevention Act

Financial resources and mechanism (Art. 13), Capacity-building, technical assistance and technology transfer (Art. 14), Health aspects (Art. 16), Information exchange (Art. 17), Public information, awareness and education (Art. 18), Research, development and monitoring (Art. 19)

# Details of Act on Preventing Environmental Pollution of Mercury

## ● Enforced from 16<sup>th</sup> August, 2017.

※ The day on which the Minamata Convention entered into force in Japan

## ● Structure of the Act

- |            |  |
|------------|--|
| Chapter 1  | General provisions   |
| Chapter 2  | National implementation plans on preventing mercury pollution                      |
| Chapter 3  | Prohibition of primary mercury mining  |
| Chapter 4  | Measures on manufacture and distribution in commerce of mercury-added products     |
| Chapter 5  | Measures on manufacturing processes in which mercury or mercury compounds are used |
| Chapter 6  | Prohibition of gold extraction by methods using mercury or mercury compounds       |
| Chapter 7  | Measures on storage of mercury or mercury compounds                                |
| Chapter 8  | Measures on management of recyclable materials containing mercury                  |
| Chapter 9  | Miscellaneous provisions   |
| Chapter 10 | Penal provisions   |

# Policy Framework to Implement the Minamata Convention

## Emissions / releases to the environment

**Primary mercury mining**

(para 3 of Art. 3)

Amendment of Mining Act & Establishment of the new act  
(No practice)

**Emissions to air**

(Art. 8)

Amendment of Air Pollution Control Act

**Releases to water and soil** (Art. 9)

Water Pollution Prevention Act

**Development of inventories** (para 7 of Art. 8, para 6 of Art. 9)

## Mercury trade

Emission/release to the environment is regulated under some related Acts, and Japan has developed Mercury Emission Inventory and Mercury Material Flow for effective control of mercury emission/release to the environment.

(Art. 4)

Amendment of the order under Foreign Exchange and Foreign Trade Act, etc.

## Mercury manufacturing process

(Art. 5)

Establishment of the new act  
(No practice)

Amendment of the new act  
(No practice)

## Disposal

**Mercury wastes**

(Art. 11)

<Wastes covered by the existing law>  
Amendment of regulations under Waste Management and Cleansing Act

<Wastes not covered by the existing law>  
Establishment of the new act

**Contaminated sites**

(Art. 12)

Soil Contamination Countermeasures Act & Water Pollution Prevention Act

**Implementation plan**

(Art. 20)

Establishment of the new act

Financial resources and mechanism (Art. 13), Capacity-building, technical assistance and technology transfer (Art. 14), Health aspects (Art. 16), Information exchange (Art. 17), Public information, awareness and education (Art. 18), Research, development and monitoring (Art. 19)

# Supplement 3. Development of Mercury Emission Inventory (Ministry of the Environment, Japan)



# Objectives to Develop MEI in Japan

- To identify source categories whose atmospheric emissions of mercury are significant so that mercury emissions can be controlled effectively.
- To evaluate the impact and effectiveness of mercury emission control measures (through comparing inventories of different years).

# History of Development of MEI in Japan

2011

- Established an expert group meeting to develop MEI in Japan
- Developed draft version of “Mercury Emission Inventory FY2010”

2012

- Finalized and published “Mercury Emission Inventory FY2010” (“Mercury Material Flow FY2010” was published at the same time)

Until today

- Developed and published the updated MEI for FY2014 in 2015, and then updated every year
- MEI FY2010, FY2014, FY2015 and FY2016 are viewable at MOEJ’s website.  
(<http://www.env.go.jp/air/suigin/inventory.html>) \*only in Japanese

# Steps to Develop MEI in Japan

- **Step 1: Identification of emission sources**

- Sources identified in the inventories developed in the past
- Sources listed as candidate for the emission control under the Minamata Convention
  - Priority is given to those facilities discussed in the INCs

- **Step 2: Estimation of mercury emissions**

- Mercury contents of raw materials
- Emission reduction efficiency
- Total emission factor
  - ✓ Measurement data
  - ✓ The latest research results in Japan
  - ✓ Researches in other countries

