

## Information relevant to thresholds for mercury wastes

February 2019

Information submitted by Japan upon the request from the Minamata Convention secretariat on mercury waste thresholds

Parties and other stakeholders are invited to submit the following information, pursuant to Decision MC-2/2, for the further discussion at the expert working group on mercury waste thresholds.

1. Examples of wastes to be added to the annex to document UNEP/MC/COP.2/6, including, for wastes consisting of mercury compounds, specific names of compounds, and, for wastes containing mercury or mercury compounds (i.e., mercury-added products), the names and types of the mercury or mercury compounds, and pictures, if available;
2. Current practices of managing overburden, waste rock and tailings from mining other than primary mercury mining (e.g., laws, regulations and guidelines) and various approaches to thresholds for special care/handling, if any; and
3. Sampling and analysis methods that may be useful for verifying wastes thresholds.

Japan hereby submit such information as follows:

# 1. Types of mercury wastes

## A) Wastes consisting of mercury or mercury compounds

"Wastes consisting of mercury or mercury compounds" refer to mercury or mercury compounds that have become waste. They are classified into (1) waste mercury or mercury compounds generated at specified sources; or (2) waste mercury recovered from either substances or objects contaminated with mercury or mercury compounds or waste mercury-added products. These examples are shown in Table 1 and Table 2.

To ensure the implementation of the Minamata Convention, Japan's Waste Management and Public Cleansing Act specifies domestic sources of wastes consisting of mercury or mercury compounds, which are likely to regularly discharge a certain amount of waste mercury or mercury compounds even after the use of mercury or mercury compounds are restricted. The specified sources are shown in Table 1.

Table 1 Waste mercury or mercury compounds generated at specified sources

Source	Example of waste mercury or mercury compounds
1. Facilities that recover mercury from either substances or objects contaminated with mercury or mercury compounds, or waste mercury-added products	<ul style="list-style-type: none"><li>• Among mercury recovered from mercury-containing recyclable resources or waste mercury-added products at mercury-recovering facilities, mercury that had not been treated as waste at the time of recovery, which have become waste due to a decrease of demand for such mercury or other reasons.</li></ul>
2. Facilities provided for manufacturing of mercury-added products	<ul style="list-style-type: none"><li>• Mercury or mercury compounds that had been stored for manufacturing of mercury-added products, which have become waste.</li><li>• Mercury being recovered when replacing mercury in mercury-added products as part of the maintenance, which have become waste.</li></ul>
3. Lighthouses equipped with mercury bearings	<ul style="list-style-type: none"><li>• Mercury that had been in the mercury bearing to float and revolve a lens apparatus, which have become waste</li><li>• Mercury that had been stored to replenish mercury in the mercury bearing to float and revolve a lens apparatus, which have become waste</li></ul>
4. Facilities that possess measuring devices which use mercury as measuring medium (excluding mercury-added products other than porosimeters)	<ul style="list-style-type: none"><li>• Mercury that had been used in the porosimeter, which have become into waste</li></ul>

Source	Example of waste mercury or mercury compounds
5. Public research and testing institutes	<ul style="list-style-type: none"> <li>Waste reagents</li> </ul>
6. Universities and their ancillary research and testing institutes	
7. Research institutes that conduct research and testing relevant to academic research, product manufacturing, or improvement, development, or invention of technologies	
8. High schools, technical colleges, vocational schools, and other schools, as well as personnel training facilities and vocational training facilities that provide technical education in the field of agriculture, fishery, or industry	
9. Health centers	
10. Quarantine stations	
11. Animal quarantine stations	
12. Plant protection stations	
13. Livestock hygiene service centers	
14. Facilities that provide testing services	
15. Facilities that provide product testing services	
16. Facilities that provide clinical examination services	
17. Criminal identification centers	

Source: Ministry of the Environment, Japan. (2017). Guidelines on mercury wastes (in Japanese).

Table 2 Waste mercury recovered from either substances or objects contaminated with mercury or mercury compounds, or mercury-added products

Those subject to mercury recovery	Example of waste mercury
Substances or objects contaminated with mercury or mercury compounds	<ul style="list-style-type: none"> <li>Waste mercury recovered from mercury-containing recyclable resources</li> <li>Waste mercury recovered from wastes</li> <li>Waste mercury recovered at the process of flue gas treatment at waste incineration facilities</li> <li>Waste mercury recovered at production facilities of natural resources which contain mercury as impurities</li> </ul>
Waste mercury-added products	Waste mercury recovered from fluorescent lamps,

Those subject to mercury recovery	Example of waste mercury
	mercury cells, mercury switches and relays, and measuring devices containing mercury such as barometers, hydrometers, manometers, thermometers, and sphygmomanometers

*Source: Ministry of the Environment, Japan. (2017). Guidelines on mercury wastes (in Japanese).*

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## B) Wastes contaminated with mercury or mercury compounds

"Wastes contaminated with mercury or mercury compounds" include slag, soot and dust, cinders, sludge, waste acid, waste alkali, wastepaper, waste wood chips, and waste textiles contaminated with mercury or mercury compounds. Table 3 indicates major sources and types of wastes contaminated with mercury or mercury compounds which are generated in Japan. Japan's Waste Management and Public Cleansing Act designates wastes with mercury concentrations higher than the limit value<sup>1</sup> as "dust and others contaminated with mercury" in order to ensure the environmentally sound management of such wastes, considering the objective of the Minamata Convention.

Table 3 Major sources and types of wastes contaminated with mercury or mercury compounds

Source	Type of substances or objects contaminated with mercury or mercury compounds
Non-ferrous metal smelting plants	Flue gas treatment sludge
Crude oil and natural gas production facilities	Sludge generated at separator tanks and sedimentary sand tanks, mercury absorbers
Municipal waste incinerators	Incineration residues
Industrial waste incinerators	Cinders, soot and dust
Non-ferrous metal smelting plants	Slags, sediment in wastewater
Coal-fired power plants	Coal ash, flue gas desulfurization gypsum, sludge
Sewage sludge incinerators	Fly ash
Secondary steel plants	Collected dust
Primary steel plants	Dust collected with a wet-type dust collectors, flue gas desulfurization sludge
Coal-fired industrial boilers	Coal ash
Crematories	Collected dust, residual bone ash

*Source: Committee on the environmentally sound management of mercury wastes, Working Group on the recovery and disposal of mercury. (2014). Report on the environmentally sound management of mercury wastes (in Japanese).*

<sup>1</sup> Wastes contaminated with mercury or mercury compounds whose mercury concentrations are more than 15 ppm are designated as "dust and others contaminated with mercury", and mercury recovery is required for wastes whose mercury concentrations are at least 1,000 ppm.

Mercury concentrations of these wastes are summarized in Figure 1.

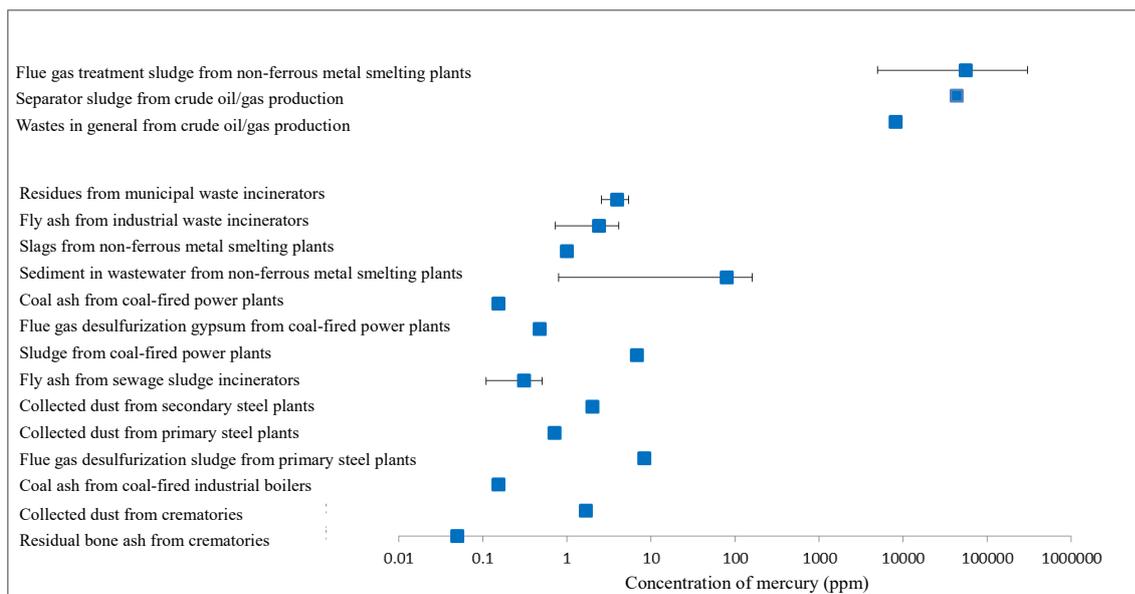


Figure 1 Examples of wastes contaminated with mercury or mercury compounds and their mercury concentrations

*Source: Committee on the environmentally sound management of mercury wastes, Working Group on the recovery and disposal of mercury. (2014). Report on the environmentally sound management of mercury wastes (in Japanese).*

In addition, waste dental amalgam (contains about 50% mercury) is one of the wastes contaminated with mercury or mercury compounds.

### **C) Wastes containing mercury or mercury compounds**

Most of wastes containing mercury or mercury compounds are waste mercury-added products. Mercury-added products, as far as being recognized in Japan, are "mercury-added products used for the existing purposes" provided in Article 13 of the Act on Preventing Environmental Pollution of Mercury. "Mercury-added products used for the existing purposes" include:

- Products listed in the following Table 4, which used for the existing purposes;
- Products manufactured by using those listed from 1 to 60 in Table 4 for (a) material(s) or part(s) as the existing purposes;
- Products listed from 1 to 60 or formulation of mercury or mercury compounds, which are used for calibration, experiment and research, or analysis; and
- Other mercury-added products with high historic or artistic value that had been manufactured or imported prior to the entry into force of the Act on Preventing Environmental Pollution of Mercury, which are sold for the purpose of exhibition.

Japan's Waste Management and Public Cleansing Act defines industrial wastes of mercury-added products in order to ensure the environmentally sound management of such wastes by requiring additional management standards such as the prevention of breakage and mixture with other wastes during collection and transport, the prevention of mercury emissions during treatment, and mercury recovery for specified mercury-added products, and by requiring waste generators to contract out transportation/treatment of their wastes to those who have obtained a permit to transport/treat such wastes according to the standards, which would contribute to the reduction of mercury emissions by reducing mercury input to waste incinerators.

Industrial wastes of mercury-added products are limited to those in which waste generators can identify that mercury or mercury compounds are used through product names or numbers on the product bodies, labels on the packages, or their specific uses, or visually recognize that mercury is used (because it is impossible to label mercury-added products which have already sold). Therefore, industrial wastes of mercury-added products do not include those whose market distribution in reality is not identified and whose mercury use is not indicated on the products.

For better identification of mercury-added products by consumers upon their disposal, the Japanese government published in December 2016 the guidelines for providing information about mercury use in mercury-added products whose production and distribution in commerce are allowed under the Minamata Convention to guide producers and importers of such products. Responding to such guidelines, for example, Japan Lighting Manufactures Association, the industry association of fluorescent lamp manufacturers, has decided to indicate the following

mark (“Hg” in a circle) on their products if they contain mercury.

Table 4 Mercury-added products used for the existing purposes

1. Primary batteries (limited to: alkaline button batteries, mercury batteries, zinc-air batteries, silver-oxide batteries, manganese dry-cell batteries, and alkaline dry-cell batteries)	11. Hygrometers	31. Diffusion pumps	51. Dropping mercury electrode
2. Standard cells	12. Liquid manometers	32. Pressure relief devices	52. Coulometers
3. Switches/relays	13. Elastic manometers (limited to diaphragm type)	33. Dampers	53. Reference electrodes
4. Fluorescent lamps (including cold cathode fluorescent lamps- CCFL, and external electrode fluorescent lamps- EEFL)	14. Pressure transmitters (limited to diaphragm type)	34. Mercury trim and heel adjusting devices	54. Mercury vapor generators (limited to those vaporizing enclosed mercury by heating or reduction)
5. High-intensity discharge (HID) lamps	15. Vacuum gauges	35. Discharge tubes (excluding discharge lamps including fluorescent/HID lamps)	55. gyrocompasses
6. Discharge lamps (excluding fluorescent lamps and HID lamps)	16. Glass thermometers	36. X-ray tubes	56. Mirrors
7. Cosmetic products	17. Mercury-filled pressure thermometers	37. Mercury resistance standards	57. Grip dynamometers
8. Agricultural chemicals	18. Mercury clinical thermometers	38. Rotary connectors	58. Pharmaceutical products
9. Pesticide, biocide, topical antiseptics (excluding pharmaceutical products and agricultural chemicals)	19. Mercury sphygmomanometers	39. Infrared detection elements	59. Polishing agents
10. Barometers	20. Temperature fixed-point cells	40. Differential pressure flowmeters	60. Arts and crafts
	21. Rubber	41. Float type densitometers	61. Formulation of mercury <sup>2</sup>
	22. Pigment	42. Clinometers	62. Formulation of mercury (I) chloride
	23. Perfume	43. Porosimeters	63. Formulation of mercury (II) chloride
	24. Detonators	44. Frequency standards	64. Formulation of mercury (II) iodide
	25. Fireworks	45. Radiation detectors	65. Formulation of mercury (I) nitrate
	26. Paints	46. Detector tubes	66. Formulation of mercury (II) nitrate
	27. Daguerreotypes	47. Gas analyzers (excluding those using mercury as reference standard)	67. Formulation of mercury (II) thiocyanate
	28. Mercury alloy pellets and powder	48. Elapsed time indicators	68. Formulation of phenylmercury (II) acetate
	29. Boilers (limited to those used in a two phase fluid cycle)	49. Volume type power meters	
	30. Rotating lens assembly of a lighthouse	50. Strain gauge sensors	

Major mercury-added products are shown in the following tables.

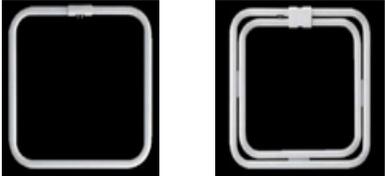
<sup>2</sup> When "formulations" of mercury and mercury compounds listed from No.61 to No.68 are used as reagents, they are considered as mercury-added products only if they are processed (e.g. diluted and mixed) for the specific purpose under the Act on Preventing Environmental Pollution of Mercury.

## List of major mercury-added products

The following tables show major mercury-added products, including pictures, which are currently circulated, used, and stored in Japan in order to facilitate the appropriate separation and collection thereof. Table 5 lists major products used in both households and business operations, and Table 6 lists such products used mainly in business operations.

**Table 5 Major mercury-added products (major products used in both households and business operations)**

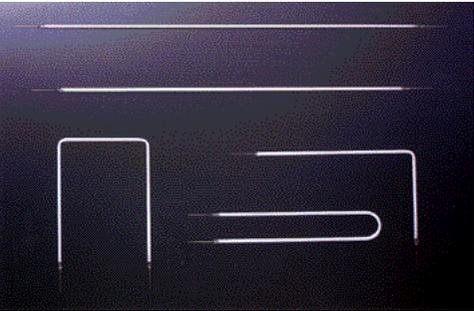
(1) Mercury-added products which are relatively easy to be changed or removed

Item	Product	Example of products in which the products in the left column are used and assembled
Lamps	<p>Fluorescent lamps including straight tube type, circular type, square type, compact type, and self-ballasted type (The first alphabet of the item number is "F" for straight tube type, circular type, square type, and compact type fluorescent lamps.)</p> <ul style="list-style-type: none"> <li>• Straight tube type (10-20W)               <div style="display: inline-block; vertical-align: middle;">  </div> </li> <li>• Circular type               <div style="display: inline-block; vertical-align: middle;">  </div> </li> <li>• Square type               <div style="display: inline-block; vertical-align: middle;">  </div> </li> <li>• Compact type (not more than 27W)               <div style="display: inline-block; vertical-align: middle;">  </div> </li> </ul>	General lighting equipment

Item	Product	Example of products in which the products in the left column are used and assembled
	<ul style="list-style-type: none"> <li>• Self-ballasted type (The first two alphabets of the item number are "EF".)</li> </ul> 	
Batteries	Alkali button batteries (The first two alphabets of the item number are "LR" among button cells.) 	Quartz clocks (watch, clock), toys, pedometers, calculators, crime prevention buzzers, timers, household remote controllers, lightning ornaments and shoes, small lights, medical devices such as digital thermometers
	Silber-oxide batteries (The first two alphabets of the item number are "SR".) 	Quartz clocks (watch), medical devices such as digital thermometers
	Zinc-air batteries (The first two alphabets of the item number are "PR", or those have an air hole.) 	Hearing aids, pagers
	Mercury batteries (The first two alphabets of the item number are "NR" or "MR".)	Hearing aids, exposure meters of silver halide camera
	Dry cells	Imported toys

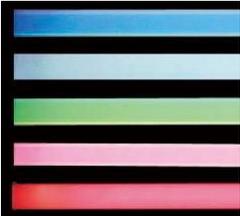
Item	Product	Example of products in which the products in the left column are used and assembled
		
Measuring devices for medical and household use)	Mercury thermometers 	—
	Mercury sphygmomanometers 	—
Measuring devices (except for medical use)	Mercury thermometers	Hydrometers
Topical antiseptics	Merbromin solution	—
Pharmaceutical products	Pharmaceutical products including merbromin	Products containing merbromin (adhesive plaster)

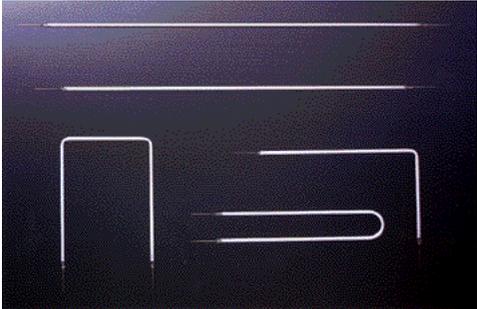
(2) Mercury-added products that are not easy to be changed or removed because they are assembled into other products

Item	Products	Examples of products in which the products in the left column are used and assembled
Lamps	<p>Cold Cathode Florescent Lamps (CCFL) External Electrode Fluorescent Lamps (EEFL)</p>  <p>Note: CCFL and EEFL are disposed of as assembled into products such as liquid crystal display televisions.</p>	Liquid crystal display televisions <sup>3</sup> , liquid crystal displays, scanners, copiers, car navigation equipment
Switches and relays	<p>Inclination switches</p> 	Outdoor gas fan heaters

<sup>3</sup> Products subject to the Law for Recycling of Specified Kinds of Home Appliances.

Table 6 List of major mercury-added products (mainly used in business operations)

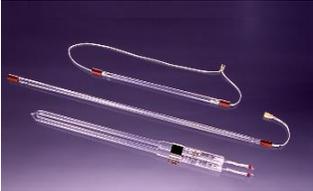
Item	Product	Examples of products in which the products in the left column are used and assembled
Lamps	<p>Fluorescent lamps including straight tube type, compact type, electrodeless fluorescent type, and specially-shaped type</p> <p>Straight tube type (The first alphabet of the item number is "F".)</p> <div data-bbox="400 469 752 703" style="display: inline-block; vertical-align: top;">  </div> <p style="margin-left: 100px;">For general lighting purposes (4-8W) (30-110W)</p> <div data-bbox="400 748 752 938" style="display: inline-block; vertical-align: top;">  </div> <p style="margin-left: 100px;">Lamps for cleaning rooms of semiconductor factories</p> <div data-bbox="400 983 752 1129" style="display: inline-block; vertical-align: top;">  </div> <p style="margin-left: 100px;">Black lights</p> <div data-bbox="400 1158 640 1374" style="display: inline-block; vertical-align: top;">  </div> <p style="margin-left: 100px;">Color lamps</p>	<p><u>For general lighting purposes</u> General lighting equipment</p> <p><u>For the special purposes</u> Lighting for art museums and museums, lighting for goods and food display, fluorescent lighting, insect traps, medical devices, tanning machines, lighting for semiconductor factories, lighting for agricultural cultivation facilities such as glass greenhouses, printing machines for diazo papers and blueprint sensitized papers, emergency lights, guiding lights, aeronautical lights</p>

Item	Product	Examples of products in which the products in the left column are used and assembled
	<ul style="list-style-type: none"> <li>• Compact type fluorescent lamps (equal to or more than 28W) (The first alphabet of the item number is "F".)</li> </ul>  <ul style="list-style-type: none"> <li>• Electrodeless fluorescent lamps</li> </ul> 	
	<p>CCFL EEFL</p> 	<p>Car navigation equipment, advertisement displays, medical devices, display equipment, emergency lights, guiding lights, two-dimensional electrophoresis equipment and relevant equipment, measuring devices</p>

Item	Product	Examples of products in which the products in the left column are used and assembled
	<p>Note: CCFL and EEFL are disposed of as assembled into products such as liquid crystal display televisions.</p>	
	<p>HID lamps such as high pressure mercury lamps, metal-halide lamps, high pressure solid lamps, and mercury-xenon lamps (including medium pressure and ultra-high pressure lamps)</p> <p>HID lamps for general lighting purposes</p> <ul style="list-style-type: none"> <li>• High pressure mercury lamps</li> </ul> <div style="display: flex; justify-content: space-around; align-items: center;">  </div> <ul style="list-style-type: none"> <li>• High pressure mercury lamps (ballastless)</li> </ul> <div style="display: flex; justify-content: space-around; align-items: center;">  </div> <ul style="list-style-type: none"> <li>• Metal-halide lamps</li> </ul>	<p><u>For general lighting purposes</u></p> <p>Lighting for road, park, stadium, and gymnasium, portable lighting</p> <p><u>For the special purposes</u></p> <p>Lighting for art museums and museums, lighting for goods and food display, medical devices, tanning machines, lighting for squid fishing, fluorescent microscopes, ultraviolet curing/drying/bonding apparatus, semiconductor inspection apparatus, DNA analysis devices, semiconductor exposure apparatus, printed board exposure apparatus, headlight units (for automobiles, motorcycles, agricultural tractors, and railway vehicles), working lights (machines for construction and agriculture), sign lights, projectors, aeronautical lights, landscape lighting, stage lighting</p>

Item	Product	Examples of products in which the products in the left column are used and assembled
	 <p data-bbox="398 691 763 719">• High pressure sodium lamps</p> <p data-bbox="385 970 739 999">HID lamps for industrial use</p> <p data-bbox="405 1018 1084 1094">• Ultra-high pressure UV lamps    • High pressure UV lamps</p>	

Item	Product	Examples of products in which the products in the left column are used and assembled
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>• Lamps for projectors</p> </div> <div style="text-align: center;">  <p>• Lamps for stage lighting</p> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;">  <p>• Lamps for floodlighting</p> </div> <div style="text-align: center;">  <p>• Mercury-xenon lamps</p> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>	
	<p>Low pressure mercury lamps other than fluorescent lamps including ultra violet radiation lamps, hollow cathode lamps, pen-</p>	<p>Food production lines, water sterilizers, tanning machines, surface of glass plate for semiconductors and liquid-crystal displays, rinse</p>

Item	Product	Examples of products in which the products in the left column are used and assembled
	<p>ray lamps, and electrodeless discharge lamps)</p> <ul style="list-style-type: none"> <li>• Germicidal lamps</li> <li>• Low pressure ultraviolet lamps</li> </ul>   <ul style="list-style-type: none"> <li>• Ultraviolet radiation lamps</li> <li>• Hollow cathode lamps</li> </ul>   <ul style="list-style-type: none"> <li>• Pen-ray lamps</li> </ul>	<p>water recycling equipment, ultrapure water making machines, ultraviolet curing apparatus, sterilizers, cleaners for decontamination of equipment, mercury measuring devices, atomic absorption photometry, atomic fluorospectro-photometers, TOC meters, measuring devices for the environmental monitoring (including total nitrogen meters, total phosphorus meters, ultraviolet absorption spectrophotometers, water contamination analyzers, and ozone concentration meters), emission spectrophotometric analyzers, high-performance liquid chromatography, ultraviolet visible spectrophotometry</p>

Item	Product	Examples of products in which the products in the left column are used and assembled
		
	Neon tubes	aeronautical lights
Batteries	Standard mercury batteries	—
Switches and relays	Temperature switches	Temperature sensors for petrochemical plants
	Inclination switches	Medical devices (equipment for peritoneal dialysis)
	Electronic acceleration switches (G sensors)	Seismoscopes
	<p>Overcurrent protection switches</p> 	Large-scale industrial equipment including railway vehicles, air-conditioners in commercial facilities, outdoor fan heaters, ultraviolet medical treatment devices, and mercury rectifiers
	Switches and relays for measurement, control, and transmission	Electronic measuring instruments, monitoring and control equipment, noise simulators, signal generators, signal switches, medical devices (such as laser surgery devices, sterilizers, and dental units), modem, remote control and supervisory equipment, automatic system switching equipment, automatic train stop

Item	Product	Examples of products in which the products in the left column are used and assembled
		devices, railroad crossing obstacle detection devices
Pesticide, biocide, topical antiseptics	Pesticide and biocide containing mercury	—
Measuring devices (except for medical and household use)	Mercury thermometers <ul style="list-style-type: none"> <li>• Double-pipe precision thermometers</li> </ul> 	Diesel engines, medical devices (gas sterilizers), pycnometers, flashing point testers
	Mercury hydrometers <ul style="list-style-type: none"> <li>• Assmann psychrometers</li> </ul> 	Assmann psychrometers
	Mercury-filled pressure thermometers	Diesel engines, machines for chemical fibers and chemical resin fibers, molding machines of gas generators

Item	Product	Examples of products in which the products in the left column are used and assembled
		
	<p>Mercury column manometers</p> 	—
	<p>Diaphragm manometers for high temperature</p> 	Machines for chemical fibers and chemical resin fibers, resin injection molding machines
	<p>Electric diaphragm transmitters for high temperature</p>	Machines for chemical fibers and chemical resin fibers, resin film and sheet manufacturing equipment, resin material and synthetic rubber manufacturing equipment

Item	Product	Examples of products in which the products in the left column are used and assembled
		
	Mercury column barometers	—
	Mercury vacuum gauges  (McLeod vacuum gauge)      (U-shape vacuumgauges)	Vacuum pumps, distillers, dryers, impregnating equipment
	Mercury coulometers	—
	Float type densitometers	—
Metal for dentistry	Dental amalgam	—
Pharmaceutical products	Pharmaceutical products containing thimerosal including vaccine and extracorporeal diagnostic medicines	—

Item	Product	Examples of products in which the products in the left column are used and assembled
	Pharmaceutical products containing mercury (II) chloride	—
Inorganic chemicals	Nessler reagents	—
	Millon reagents	—
Other	Mirrors for large telescopes	—
	Mercury alloy pellets and powder	—
	Triple point cells of mercury	—
	Rotary connectors	Production equipment, aeronautical lights
	Mercury ion frequency standards <sup>4</sup>	Electronic measuring devices (signal generators and frequency meters)
	Infrared detectors (those mercury, cadmium, and tellurium are mixed)	Electronic measuring devices including thermometers and densitometers, thermal image display devices, night vision devices, infrared spectrophotometers, Fourier transform infrared spectrophotometers
	Gyrocompasses	Ships
	Strain gauge sensors	Plethysmographs
	Cumulative energizing time indicators	Medical devices
	Mercury resistance standards	—
	Mercury boilers	—
	X-ray tubes	—
	Radiation detectors	X-ray sensors
Mercury diffusion pumps	Vacuum chambers	

<sup>4</sup> Mercury ion frequency standard is a stable oscillator whose frequency fluctuates very little and mainly used at standards organizations. Mercury and mercurous oxide are retained in sturdy vacuum containers and used less than 10mg for each oscillator.

Item	Product	Examples of products in which the products in the left column are used and assembled
	Dampers	Rockets
	Pressure relief devices	Pressure containers
	Vermillion (pigment)	Vermillion inkpads
	Paints containing mercury (II) chloride	Ships (bottom), woods

The following table shows the confirmed application of mercury compounds in Japan (including the application in the past)

Table 7 Name and the application of mercury compounds

Mercury compounds	Application	Example
Mercury (I) chloride and its formulations	Reference electrodes	Calomel electrodes
	Ceramics	-
	Color adjustment for fireworks	Fireworks
	Reagents for instrumental analysis	-
Mercury (II) oxide and its formulations	Electrode for mercury batteries	Mercury batteries
	Preservative and antifouling agents	Paintings for the bottom of a ship
	Reagents for instrumental analysis	Mercury analyzers, atomic absorption photometers, gas chromatography
	Adjustment for mercury salts	-
	Perfume	-
	Catalysts	-
	Cosmetics	Skin conditioner
Mercury (II) sulfate and its formulations	Manufacturing of mercury chloride and other mercuric salts	-
	Metallurgy of gold and silver	-
	Reagents for chemical analysis	Barbital-cystine detection, wine-coloring tests, COD analysis (chromium method)
Mercury (II) nitrate and its formulations	Oxidant	-
	Preservatives	-
	Carroting for the felt production in the hat manufacturing	-
	Textile processing	-
	Nitrating agents	-
	Catalysts in organic synthesis	-
	Production of mercury fulminate or mercury oxide	-
	Plating	Construction, production, creation, replication, imitation, repair, and restoration of cultural properties
	Syphilis treatment	
	Density and temperature measurements of liquid	Hydrometers

Mercury compounds	Application	Example
	Calibration of measuring devices	-
Mercury (II) sulfide (vermilion) and its formulations	Pigment	Paintings (drawings, craft products, etc.), vermilion inks, red-ink stick, pigment for cultural properties, lacquer art, sealing wax, colored paper, indelible ink
	Reference standards for instrumental analysis	Energy dispersive X-ray fluorescence spectrometers
Mercury (I) sulfate and its formulations	Reference electrodes	Mercury sulfate electrodes
Mercury (II) chloride and its formulations	Lamps	-
	Electrodes of manganite batteries	-
	Bronzing of iron	-
	Tanning	-
	Ink for mercurigraphy	-
	Sterilization	Pharmaceuticals, seed processing, lawn germicide
	Pharmaceuticals	Drug for allergy check
	Fireproofing agents for wood	-
	Photo intensifiers	-
	Reagents for instrumental analysis	-
	Detection of hydrogen sulfide	-
	Production of mercury (II) oxide and mercury (I) chloride	-
	Catalysts for the production of vinyl chloride	-
	Coloring of metals	Construction, production, creation, replication, imitation, repair, and restoration of cultural properties
Reagents for the tap water quality check	Reference standards for the tap water quality check	
Ethylmercury (II) chloride and its formulations	Polymerization initiators	-
	Germicide and antifouling agents	-
	Catalysts	-
	Reagents for instrumental analysis	Gas chromatography
Mercury (II) ammonium chloride and its formulations	Color adjustment for fireworks	-

Mercury compounds	Application	Example
Mercury (II) bromide and its formulations	Lamps	-
	Chemical analysis (arsenic)	-
	Semiconductors	-
Mercury (I) nitrate and its formulations	Carroting for the felt production in the hat manufacturing	-
	Pharmaceuticals	-
	Production of mercury (I) acetate	-
	Plating	Construction, production, creation, replication, imitation, repair, and restoration of cultural properties
	Chemical analysis (protein)	— -
Phenylmercury (II) nitrate and its formulations	Germicide	-
Mercury (II) thiocyanate and its formulations	Photo intensifiers	-
	Special analysis	-
Mercury (I) iodide and its formulations	Lamps	-
	Organic synthesis	-
	Thermos paint	-
Mercury (II) iodide and its formulations	Lamps	-
	Photo thickeners	-
	Calibration of measuring devices	-
	Density and temperature measurements of liquid	Hydrometers
	Chemical analysis (ammonia)	Nessler reagents
	Reagents for instrumental analysis	Nuclear molecule detectors
Copper mercury iodide and its formulations	Production of thermoscopes	-
Mercury (I) acetate and its formulations	Catalysts	-
	Reagents for experiment and research	-
Mercury (II) acetate and its formulations	Alkaloid oxidizing agents	-
	Synthesis of organomercury compounds	
Phenylmercury (II) acetate and its formulations	Preservatives	-
	Production of other phenyl mercury compounds	-
	Germicide	Lawn germicide, anti-mold agents

Mercury compounds	Application	Example
		for latex paint
	Tanning	-
	Paper production	-
	Textile softners	-
	Lustering agents	Seals and floor wax, lustering agents for furniture
	Cosmetics	-
	Pharmaceuticals	Spermicide, antiseptics
Mercury (I) oxide its formulations	Electrodes of mercury batteries	Mercury batteries
	Reagents for experiment and research	-
Mercury (II) oxycyanide and its formulations	Special analysis	-
Mercury (II) cyanide and its formulations	Pharmaceuticals	-
	Reagents for experiment and research	-
Cyano mercury potassium acid and its formulations	Production of silver mirrors	-
Mercury (II) perchlorate and its formulations	Oxidant	-
	Reagents for experiment and research	-
Dimethylmercury and its formulations	Reagents for instrumental analysis	-
Mercury selenide and its formulations	Production of semiconductors	-
Mercury (II) amid acid and its formulations	Color adjustment for fireworks	-
	Reagents for experiment and research	-
Mercury (II) orthoarsenate and its formulations	Antifouling agents	Antifouling paint
Mercury fulminate and its formulations	Detonators of blasting caps	Bullets and shells
Methylmercury (II) chloride and its formulations	Reagents for instrumental analysis	Gas chromatography
	Reagents for experiment and research	-
Formulations containing 4-(hydroxymercuri)	Reagents for experiment and research	-

Mercury compounds	Application	Example
benzoic acid sodium		
Ethylmercurithiosalicylate sodium salt and its formulations (thimerosal)	Pharmaceuticals	Drugs for allergy check
	Preservatives for pharmaceuticals including vaccine and in vitro diagnostic reagents	
	Reagents for experiment and research	-
Merbromin (organomercury disodium salt compounds) and its formulations	Antiseptics	Mercurochrome
Formulations containing (diphenylthiocarbazonato) phenylmercury	Reagents for experiment and research	-
Potassium tetraidomercurate	Reagents for experiment and research	-
Sodium chloro (4-sulfophenyl) mercury	Reagents for experiment and research	-
Phenylmercury oleate, borate, and propionic and their formulations Phenylmercury and its formulations	Preservatives, sterilization, and pesticides	Anti-mold for paint
	Pharmaceuticals	-
Dicyanodiamide methylmercury and its formulations	Anti-nitrification of seed	-
Chlorophenylmercury (II) and its formulations	Seed disinfectant	-
Mercury salicylate and its formulations	Germicide	-
Ethylmercuric chloride and its formulations	Seed disinfectant	-
Mercury trifluoroacetate mercury and its formulations	Catalysts	Synthesis of anti-cancer drug (7-deoxypancratistantin)
4-chloromercuribenzoic acid	Reagents for biochemistry experiments	Appraisal

## 2. Management of mining wastes

In Japan, mining wastes are managed in accordance with "Mine Safety Act". The definition of mining wastes under this Act is provided in Article 1, Paragraph 2, item 33 of the Ministerial Ordinance of the Mine Safety Act.

Hazardous mining wastes are defined as I, II, III, IV and V below (limited to those generated at metal mines and their affiliated facilities) and mining wastes of those treated to be disposed (Article 1, Paragraph 2, item 34 of the Ministerial Ordinance of the Mine Safety Act).

The following additional measures are required for the management of hazardous mining wastes, in addition to the general measures for the management of mining wastes. Thresholds for hazardous mining wastes are equivalent to those of specially-controlled industrial wastes under the Waste Management and Public Cleansing Act\*.

\*Note : The provision on mercury:

- Those containing alkyl mercury compounds
- Those exceeding 0.005mg-Hg/L of test solution as a result of the leaching test

### I. Waste rock (excluding those below)

- Waste rock generated as a result of the excavation of land other than coal layers in coal mines
- Waste rock mainly consisting of rockstones generated as a result of the excavation of coal layers (those waste rock generated as a result of coal cleaning whose composition of materials other than coal (excluding ash) is approximately below 70% of said waste rock)
- Waste rock at oil mines
- Following waste rock at metal mines and others
  - Waste rock at the mining gallery provided for the excavation of minerals other than metallic minerals, affiliated ore dressing, refinery and other businesses and waste rock at the storage space of waste rock or tailings
  - Waste rock at the storage space exclusive for waste rock generated as a result of the excavation of land other than an ore deposit of metallic minerals and others

II. Tailings

III. Sediment (including muddy sediment generated at wet scrubbers, desulfurization facilities and others as well as said muddy sediment solidified by drying)

IV. Soot and dust generated at metallurgical facilities or incineration facilities for waste oil, waste plastics, scrap papers or scrap metals (those contaminated with PCB), which collected by dust collectors or other equipment

V. Cinders generated at incineration facilities for waste oil, waste plastics, scrap papers and scrap metals as well as soot and dust collected by dust collectors which contain particular substances including mercury

Necessary measures that mining right holders should take for the treatment/disposal of mining wastes are provided in Article 18 of the Ministerial Ordinance of the Mine Safety Act. The additional requirements for hazardous mining wastes in particular are as follows:

- Hazardous mining wastes shall not be disposed of in a mineshaft/mining gallery.
- The monthly amount of hazardous mining wastes generated by type and transported and treated/disposed of by method with a date of transportation/treatment shall be recorded. If transportation/disposal of hazardous mining wastes is contract out to other parties, the date of contract, name, address and the permit number of the contractor shall be also recorded. The record shall be closed by one year and kept for five years after the closure.
- When contracting out the transport or the disposal of hazardous mining wastes, employ transporters or treaters of specially-controlled industrial wastes under the Waste Management and Public Cleansing Act and whose business permit covers the transportation or the disposal of hazardous mining wastes.

### 3. Useful sampling and analysis methods for verifying wastes thresholds

#### A) Example of sampling method

A sampling method of industrial wastes is stipulated in JIS K0060-1992<sup>5</sup>.

#### B) Example of analysis methods on the concentration of mercury in soot and dust, cinders, sludge and tailings

In Japan, the Sediment Analysis Methods are used by many analysis institutions to determine the concentration of mercury. The methods employ cold vapor atomic absorption spectrometry that can measure more samples at one time than heating vaporization atomic absorption spectrometry. Since the original intention of the Sediment Analysis Methods is to determine the concentration of chemical substances present in sediment, when determining the concentration of mercury in soot and dust, cinders, sludge and tailings whose properties are different from sediment and which contain many different substances, more precise test results can be obtained by conducting other analysis in addition to the Sediment Analysis.

- When applying the nitric acid - sulfuric acid - potassium permanganate decomposition method, it should be confirmed in advance that the test results by such method do not differ from the results by the nitric acid-potassium permanganate decomposition method.
- To accurately ascertain the end of sample decomposition, the presence of sulfurous acid gas emission should be visually confirmed, or the results should be compared with those obtained from the analysis method whose heating time is extended for few hours to identify the difference in test results.
- Since the cold vapor atomic absorption spectrometry adopted in the Sediment Analysis Methods is subject to interference by iodine, silver, selenium and other substances, the presence thereof should be identified through Waste Data Sheet or other means. When such interference is suspected, conduct a spike and recovery test to sample solution after the decomposition. If such interference is confirmed, try suggested measures to prevent it in literatures. For addressing interference by iodine and silver, conducting reduction vaporization by tin in alkali and using zinc potassium cyanide as a masking material of silver have been reported to be effective. For addressing interference by selenium, so has been covering samples by tin powder or extracting and separating with dithizone-carbon tetrachloride.
- To confirm the preciseness of the test results, analyze the existing certified reference materials and confirm that there is no difference in the results.

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<sup>5</sup> <http://kikakurui.com/k0/K0060-1992-01.html>

Table 8 Overview of Sediment Analysis Methods

	<u>Nitric acid-potassium permanganate reflux decomposition</u>	<u>Nitric acid-sulfuric acid-potassium permanganate decomposition</u>
What to be analyzed	Sediment	
What to be measured	Total mercury *applicable to samples containing relatively higher concentration of organics and sulfides.	Total mercury *applicable to samples in which organics easily decompose and the color of potassium permanganate added during the heating process does not vanish.
Sample amount	Approximately 10g	Approximately 10g
Overview	<ul style="list-style-type: none"> <li>Pre-processing with nitric acid and potassium permanganate, using a decomposition flask with a reflux condenser</li> <li>Determination by atomic absorption spectrometry</li> </ul>	<ul style="list-style-type: none"> <li>Decomposition in warm bath with nitric acid, sulfuric acid, and potassium permanganate, using an Erlenmeyer flask or a Kjeldahl flask</li> <li>Determination by atomic absorption spectrometry</li> </ul>
Detection limit	0.01mg/kg	
Tools and equipment	Decomposition flask with a reflux condenser, atomic absorption spectrometer, reducing vaporization equipment for mercury, mercury lamp, reduction vessel, absorption cell, air-pump, flow meter, dry tube, connecting tube	Same as on the left, but change the decomposition flask with a reflux condenser to an Erlenmeyer flask or a Kjeldahl flask.
Reagents	Water, nitric acid, sulfuric acid (1+1), potassium permanganate solution (30g/L), urea solution (100g/L), hydroxyammonium chloride solution, tin (II) chloride solution, mercury standard solution	Same as on the left + potassium persulfate solution
Pre-processing and measurement	<ul style="list-style-type: none"> <li>Place 10g of sample (wet) into the decomposition flask with a reflux condenser, add nitric acid and heat up to decompose organic substances.</li> </ul>	<ul style="list-style-type: none"> <li>Place 10g of sample (wet) into the decomposition flask and add water until the total volume becomes 50ml.</li> <li>Add sulfuric acid after adding</li> </ul>

	<u>Nitric acid-potassium permanganate reflux decomposition</u>	<u>Nitric acid-sulfuric acid-potassium permanganate decomposition</u>
	<ul style="list-style-type: none"> <li>• After cool down the flask to the room temperature, add potassium permanganate solution and continue heating it up. When the color of potassium permanganate vanishes during the heating, cool down the flask to the room temperature, add potassium permanganate solution, and heat it up again.</li> <li>• Continue the operation above until the color of potassium permanganate lasts for approximately 10 minutes.</li> <li>• Add urea solution when the temperature of the solution in the flask is 40 degrees Celsius, drop hydroxylammonium chloride solution to decompose the excessive potassium permanganate.</li> <li>• The solution in the flask that passes through the filter paper is to be used as test solution</li> <li>• Determine by atomic absorption spectrometry</li> </ul>	<p>20ml of nitric acid.</p> <ul style="list-style-type: none"> <li>• After leaving the flask until the reaction stops, add potassium permanganate solution, stir it, and leave it for 15 minutes.</li> <li>• When the color of potassium permanganate vanishes, add potassium permanganate solution until the purple-pink color of the solution lasts for at least 15 minutes.</li> <li>• Add 10ml of potassium peroxodisulfate solution, and heat up for two hours by soaking the solution containing part of the decomposition flask into hot water of at least 95 degrees Celsius.</li> <li>• After adjusting the solution temperature to approximately 40 degrees Celsius, the process is same as nitric acid-potassium permanganate reduction reflux decomposition method.</li> </ul>
Features	There is no worry about loss of mercury due to its volatilization during the thermal decomposition because of strong oxidizability of reagents.	J This method conforms to the test method of wastewater stipulated in JIS K0102 and has been added for the purpose of simplifying nitric acid-potassium permanganate reflux decomposition method.
Analysis time	At least three hours	