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Item 4 (f) of the provisional agenda*

Matters for consideration or action by the Conference of the Parties: mercury waste: consideration of the relevant thresholds

Technical information for the work of the expert group on mercury waste thresholds

Note by the secretariat

1. Paragraph 2 of article 11 of the Minamata Convention on Mercury defines mercury wastes as substances or objects:

(a) Consisting of mercury or mercury compounds;

(b) Containing mercury or mercury compounds; or

(c) Contaminated with mercury or mercury compounds,

in a quantity above the relevant thresholds defined by the Conference of the Parties to the Minamata Convention, that are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law or the Convention.

2. The Conference of the Parties, in its decision MC-3/5:

(a) Decided that no threshold needed to be established for mercury waste falling under subparagraph 2 (a) of article 11, and that waste listed in table 1 of the annex to the decision should be regarded as such mercury waste;

(b) Also decided that no threshold needed to be established for mercury waste falling under subparagraph 2 (b) of article 11, and that mercury-added products that were disposed of, were intended to be disposed of or were required to be disposed of would be regarded as such mercury waste.

3. In the process of establishing mercury waste thresholds, the Conference of the Parties considered the reports[1] developed by the group of technical experts established by decision MC-2/2.

4. In decision MC-4/6, the Conference of the Parties extended the mandate of the group to develop and consider new information and opportunities to be presented in a report to the Conference, with the goal of recommending and facilitating a decision on waste falling under subparagraph 2 (c) of article 11 at the fifth meeting of the Conference of the Parties or as soon as possible thereafter.

* UNEP/MC/COP.5/1.

[1] UNEP/MC/COP.3/7 and UNEP/MC/COP.4/8.

5. The Conference of the Parties, in the same decision:

(a) Invited parties to share information and data on the waste categories listed in the indicative list contained in table 3 of the annex to decision MC-3/5, including with respect to any relevant national or local thresholds and their establishment, and requested the secretariat to compile such information and distribute it to the group of technical experts as soon as possible and make it available electronically;

(b) Requested interested parties to submit information, when appropriate or at the request of the group of technical experts, on approaches other than the total mercury concentration approach to the secretariat for consideration by the group of technical experts.

6. In response to the Executive Secretary's letter of 13 April 2022 following up on the invitation described in paragraph 5 (a) above and setting a deadline of 30 June 2022 for submissions (later extended to 15 July 2022), six parties submitted information.[2]

7. As advised by the group of technical experts, the secretariat, in the Executive Secretary's letter dated 28 October 2022, invited parties to submit information on approaches other than a total mercury concentration approach, including risk-based considerations, as described in paragraph 5 (b) above, by 24 November 2022. The eight submissions received have been posted on the Convention website.[3]

8. The group of technical experts, at its in-person meeting, considered thresholds for waste falling under subcategory 2 (c) of article 11, taking into account the submissions referred to in paragraphs 6 and 7 above , as well as other available information, including the following:

(a) A proposal submitted by a party to establish a threshold of 25 mg/kg total concentration of mercury, and another proposal submitted by a stakeholder to establish a threshold of 1 mg/kg total concentration of mercury, both setting out the technical rationale for the proposal;

(b) Submissions from parties on approaches other than the total concentration approach;

(c) The secretariat's overview of existing thresholds related to mercury waste as submitted by parties and experts, which includes thresholds for total concentration of mercury ranging from 0.3 to 10,000 mg/kg and thresholds for leachate ranging from 0.001 to 8 mg/L.

9. This note presents the technical information that the group of technical experts took into account in its consideration of a report to recommend and facilitate a decision by the Conference of the Parties on waste falling under subcategory 2 (c) of article 11. The information is set out in the annexes to the note, as follows:

(a) Annex I: proposals submitted as described in paragraph 8 (a) above;

(b) Annex II: overview of submissions from parties on approaches other than the total concentration approach, as described in paragraph 8 (b) above;

(c) Annex III: list of existing waste thresholds related to mercury waste used by parties, as described in paragraph 8 (c) above;

(d) Annex IV: compilation of information and data on mercury waste submitted by parties, including the information submitted as described in paragraph 6 above, as well as information submitted in other occasions.

[2] Submissions received from Brazil, Canada, the European Union, Japan, Uganda and the United States of America are available at https://mercuryconvention.org/en/intersessional-work-and-submissions-cop-5#sec1564.

[3] Submissions received from Brazil, from Burkina Faso and Botswana on behalf of the African States, and from Canada, the Dominican Republic, the European Union, Japan and Kuwait are available at https://mercuryconvention.org/en/intersessional-work-and-submissions-cop-5#sec1564.

Annex I*

Proposals submitted by a party and a stakeholder on the establishment of thresholds

Written submission from the European Union on a threshold for waste contaminated with mercury or mercury compounds

By means of Decision MC-4/6 (‘*Mercury waste thresholds’*), Parties to the Minamata Convention on Mercury (hereafter, ‘the Convention’) agreed to extend the mandate of the group of technical experts to carry out intersessional work between the fourth and fifth meeting of the Conference of the Parties with the goal of recommending and facilitating a decision on waste contaminated with mercury or mercury compounds at the fifth meeting of the Conference of the Parties.

With a view to contributing to the discussions within the group of technical expert, the European Union is pleased to provide a written submission (in Annex) to the Secretariat of the Convention, containing a 2019 peer-reviewed publication from M. P. HENNEBERT (expert from the French National Institute for Industrial Environment and Risks - INERIS)[1], explaining the rationale supporting the establishment of a threshold of 25 mg mercury/kg of waste (25 ppm or 0.0025%) for waste contaminated with mercury or mercury compounds.

* The annex has not been formally edited.

[1] *Proposition of threshold for waste contaminated with mercury (compounds) in application of the Minamata Convention on Mercury and Impact Assessment,* Pierre Hennebert, DETRITUS / Volume 06 – 2019, pp. 25-31. Publication is also available electronically: https://doi.org/10.31025/2611-4135/2019.13822.

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PROPOSITION OF THRESHOLD FOR WASTE CONTAMINATED WITH MERCURY (COMPOUNDS) IN APPLICATION OF THE MINAMATA CONVENTION ON MERCURY AND IMPACT ASSESSMENT

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ABSTRACT

The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury. Environmentally sound management of waste is under discussion. This note proposes a threshold for waste of category c) *Contaminated with mercury or mercury compounds* to be disposed of (Article 11 of the Convention), using the Globally Harmonized System of classification and labelling of chemicals of the United Nations (GHS - UNEP, 2017). Mercury and mercury compounds are classified as substances for the physical, health and environmental hazards categories. The thresholds of mercury and mercury compounds classifying a mixture as hazardous for the different hazard categories (physical, health, environmental) are "Presence", >0.3% and >0.0025% (25 mg mercury/kg of waste) respectively. For impact assessment, this threshold is then compared with large data set of hazardous (793 data), potentially hazardous (depending on the concentration of hazardous substances) (55 data), as well as natural or non-polluted anthropized media (composts, sediments, agricultural soils) (21 784 data) from France. This demonstrates that 75% of the hazardous waste have higher total mercury concentration, that potentially hazardous waste samples have lower concentrations, and that all composts, agricultural soils and marine sediments and 99% of the fluvial sediments have lower concentrations. So, this threshold will not classify common industrial waste or natural media as requiring special treatment for safe disposal, but well a large part of industrial hazardous waste.

1. INTRODUCTION

The Minamata Convention on Mercury (UNEP 2017) is a global treaty to protect human health and the environment from the adverse effects of mercury. Regular conference of the parties progress in technical recommendations to "make mercury history". Environmentally sound management of waste is one point under discussion.

The Convention defines in Article 11 "Mercury wastes":

"...2. For the purposes of this Convention, mercury wastes means substances or objects:
(a) Consisting of mercury or mercury compounds;
(b) Containing mercury or mercury compounds; or
(c) Contaminated with mercury or mercury compounds,
in a quantity above the relevant thresholds defined by the Conference of the Parties, in collaboration with the relevant bodies of the Basel Convention in a harmonized manner, that are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law or this Convention. This definition excludes overburden, waste rock and tailings from mining, except from primary mercury mining, unless they contain mercury or mercury compounds above thresholds defined by the Conference of the Parties..."

The scope of the paper is to provide a reliable concentration limit to the Minamata Convention. This paper uses the Globally Harmonized System (GHS) of classification and labelling of chemicals of the United Nations to propose a threshold and compare it with concentrations observed in waste and natural media. The method is explained in detail in the paper, with a focus on ecotoxicity, which appears to be the property with the lowest dangerous ranking.

In this paper, the "concentration limit" used in the GHS is the equivalent of "threshold" of the Minamata Convention on Mercury, and "substance" used in the GHS is the equivalent of "compound" of the Minamata Convention on Mercury.

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2. MATERIAL AND METHODS

2.1 Properties of mercury and mercury substances in the GHS

It is proposed to use the Globally Harmonized System (GHS) of classification and labelling of chemicals of the United Nations (last version: UNEP, 2017). The European Union has adopted the GHS system in 2008 (CLP, 2008) and has developed an official list of the hazard properties of 4 249 substances, as well as a registration and self-classification system for producers and importers of chemical products (REACh system). This list is an Annex of the CLP regulation and can be downloaded in a spreadsheet template (CLP, 2018) and is used here. These "harmonized" (at EU level) data were built by working group of experts and have been used to collect consistent data on mercury and mercury compounds and to propose threshold consistent with the regulation.

2.2 Particular case: ecotoxicity in the GHS

The different categories of ecotoxicity are attributed to substances from experimental laboratory ecotoxicological standardized tests. Organisms are submitted to different concentration of the substance in their living medium, and the concentration producing 50% (or x %) of mortality or effect after a given time (called LC_{50} or EC_{50} or EC_x depending on test), or the highest concentration producing no observed effect (called NOEC) is measured. These concentrations expressed in mg of substance per liter of living medium are compared to concentrations of Table 1, and a category is attributed to the substance.

For substances with experimental results < 1 mg/l, the GHS uses multiplying factors called "M factors" to fine tune the classification of substances and mixtures with these substances. M factors are determined by the lowest $L(E)C_{50}$ and NOEC experimental values (Table 2). Mercury and mercury compounds are non-rapidly degradable compounds.

Experimental ecotoxicity data of mercury and mercuric substances were taken from a reference UE publication (UE 2005), to determine M-factors for mercury and mercury compounds.

The ecotoxicity of mixtures with ecotoxic substances at a given concentration can be assessed by the calculation rules presented at Table 3 (copy of Table 4.1.3 of the GHS).

The European Union updated criteria on Ecotoxicity classification of waste (Regulation 997/2017, EU 2017). For simplicity of classification of waste with most of the time unknown mineral substances composition, this regulation does not use the multiplying factors M-factors (that are attributes of substances). M-factors were developed in the GHS to fine tune the ecotoxicity of ecotoxic substances (EC_{50} or NOEC < 1 mg/L), and to avoid the creation of multiple hazard statement codes to reflect the different grades of ecotoxicity. The resulting concentration limit for waste by calculation method as proposed by the 997/2017 Regulation for chronic ecotoxicity for mercury and mercury compounds is 0.25% or 2500 mg/kg, hundred times higher than the concentration calculated here (see Results). Many experts believe that the abandonment of M factors for waste is irrelevant. This method has not been used here.

2.3 Data of concentration of mercury in waste and natural media

Data of hazardous waste, potentially hazardous waste

TABLE 1: Categories for substances hazardous to the aquatic environment for short-term (acute) and long-term (chronic) aquatic hazard (extract of Table 4.1.1 of GHS).

(a) Short-term (acute) aquatic hazard
- Category Acute 1: $L(E)C_{50}$ fish, crustacea, algae ≤ 1 mg/l
- Category Acute 2: $L(E)C_{50}$ fish, crustacea, algae > 1 but ≤ 10 mg/l
- Category Acute 3: $L(E)C_{50}$ fish, crustacea, algae > 10 but ≤ 100 mg/l

(b) Long-term (chronic) aquatic hazard

(i) Non-rapidly degradable substances for which there are adequate chronic toxicity data available
- Category Chronic 1: Chronic NOEC or EC_x fish, crustacea, algae ≤ 0.1 mg/l
- Category Chronic 2: Chronic NOEC or EC_x fish, crustacea, algae ≤ 1 mg/l

(ii) Rapidly degradable substances for which there are adequate chronic toxicity data available
- Category Chronic 1: Chronic NOEC or EC_x fish, crustacea, algae ≤ 0.01 mg/l
- Category Chronic 2: Chronic NOEC or EC_x fish, crustacea, algae ≤ 0.1 mg/l
- Category Chronic 3: Chronic NOEC or EC_x fish, crustacea, algae ≤ 1 mg/l

TABLE 2: Multiplying factors (M factors) for substances for highly toxic ingredients or mixture (categories Acute 1 and Chronic 1) (Table 4.1.5 of GHS).

Acute toxicity	M factor	Chronic toxicity	M factor	
$L(E)C_{50}$ value (mg/l)		NOEC value (mg/l)	Non-rapidly degradable ingredients	Rapidly degradable ingredients
0.1 < $CL(E)_{50}$ ≤ 1	1	0.01 < NOEC ≤ 0.1	1	-
0.01 < $CL(E)_{50}$ ≤ 0.1	10	0.001 < NOEC ≤ 0.01	10	1
0.001 < $CL(E)_{50}$ ≤ 0.01	100	0.0001 < NOEC ≤ 0.001	100	10
0.0001 < $CL(E)_{50}$ ≤ 0.001	1000	0.00001 < NOEC ≤ 0.0001	1000	100
0.00001 < $CL(E)_{50}$ ≤ 0.0001	10000	0.000001 < NOEC ≤ 0.00001	10000	1000
(continue in factor 10 intervals)		(continue in factor 10 intervals)		

and non-hazardous waste and natural media have been gathered:

- The concentrations of mercury, cadmium and lead in 793 hazardous waste (data from a hazardous waste management company) (Hennebert, 2012);
- The 55 available data concentrations from an INERIS database for the following waste: car shredding residue (11), epoxy powder (1), excavated soil underlying a road (3), excavated soil (11), foundry sand (1), municipal solid waste incinerator bottom ash - MSWI BA (20) , paint residue (1), phosphogypsum (2), sand blasting residue (1) and sand from incineration fluidized bed (4);
- The heavy metals in different composts (379 samples) from organic fraction of municipal wastes (separately collected or mechanically sorted) of 30 sites in France (Zdanevitch 2012);
- The results of routine quality monitoring of sediments (11 791 samples of fluvial sediments and 816 samples of marine sediments) of France by the Water Agencies (Padox and Hennebert 2010a, b);
- The data from routine analysis of agricultural soils (8 798 samples) are gathered at the French level by soil scientists (Gissol, 2018).

3. RESULTS AND DISCUSSION

3.1 Properties of mercury and mercury substances in the GHS

The mercury and nine mercury substances from the list are presented at Table 6. Two "generic entries" are also listed. Most frequently in waste, field measurement with fluorimeter and routine laboratory analysis will deliver total mercury concentrations (metallic or not) rather than mercury substances concentrations. If the exact mercury substances present in the waste is not known, which is frequently the case in waste, these "generic entries" are used in the EU (line 2 and 3 of the substances list in Table 6: "inorganic compounds of mercury with the exception of mercuric sulphide and those specified elsewhere in this Annex" and "organic compounds of mercury with the exception of those specified elsewhere in this Annex"). In total twelve entries are used for mercury and mercury substances, with their hazard statement codes (Hxxx).

Mercury and mercury substances are all classified Acute Toxic when the three routes (oral, dermal and inhalation) are considered, classified Specific Target Organ Toxic Single Exposure (1 substance: calomel) or Repeated Exposure (11 other substances), Ecotoxic Aquatic Acute Level 1 and Ecotoxic Aquatic Chronic Level 1. Additionally, mercury dichloride is classified mutagenic and reprotoxic, and elemental mercury is reprotoxic. Mercury difulminates and dimercury dicyanide dioxide are explosive (Table 6).

3.1.1 Classification of mercury and mercury substances (GHS, EU data) for ecotoxicity

Experimental ecotoxicity data of mercury and mercuric substances from a reference UE publication (UE 2005) are presented at Table 4. A summary can be found on the INERIS portal (INERIS 2018). The resulting M factors are

TABLE 3: Classification of a mixture for short-term (acute) and long-term (chronic) hazard based on summation of the concentrations of classified ingredients (Tables 4.1.3 and 4.1.4 of GHS).

Category	Sum of the concentrations (in %) of ingredients classified as:	Mixture is classified as:
Short-term (acute) hazard	Acute 1 * M ≥ 25%	Acute 1
	(M*10*Acute 1) + Acute 2 ≥ 25%	Acute 2
	(M*100*Acute 1) + (10*Acute 2) + Acute 3 ≥ 25%	Acute 3
Long-term (acute) hazard	Chronic 1 * M ≥ 25%	Chronic 1
	(M*10*Chronic 1) + Chronic 2 ≥ 25%	Chronic 2
	(M*100*Chronic 1) + (10*Chronic 2) + Chronic 3 ≥ 25%	Chronic 3
	Chronic 1 + Chronic 2 + Chronic 3 + Chronic 4 ≥ 25%	Chronic 4

TABLE 4: Experimental $L(E)C_{50}$ and NOEC of mercury and mercury substances (UE 2005) and corresponding ecotoxicity level and multiplying factors (M factors).

Water	Fresh			Marine			Classification	
Ecotoxicity Organisms	Tests results (mg/L)	Ecotoxicity category (Table 2)	M-factor (Table 3)	Tests results (mg/L)	Ecotoxicity category (Table 2)	M-factor (Table 3)	Category	Proposed M factor
Acute	$L(E)C_{50}$			$L(E)C_{50}$			Acute 1	100
Algae	0.010000	Acute 1	100	0.010000	Acute 1	100		
Invertebrate	0.010000	Acute 1	100	0.003500	Acute 1	100		
Fish	0.000700	Acute 1	1000	0.070000	Acute 1	10		
Chronic	NOEC			NOEC			Chronic 1	100
Algae	0.000200	Chronic 1	100	0.000900	Chronic 1	100		
Invertebrate	0.000290	Chronic 1	100	0.000100	Chronic 1	1000		
Fish	0.000620	Chronic 1	100	0.005000	Chronic 1	10		

most of the time 100 (with two values of 10 and two values of 1000 in a set of 12 values). It is proposed here to use M = 100 for acute and chronic ecotoxicity.

Using the calculation rules of Table 3 and the M factors obtained in Table 4, the concentration limits classifying a mixture containing mercury or mercury substances as ecotoxic acute and chronic are presented at Table 5. For full classification of mixtures, all the other ecotoxic substances must also be used, but this is not the question here. The level 3 has the lowest concentration: a mixture is hazardous if the concentration of mercury and/or mercury substances is greater than 0.0025% (mass/mass), or 25 mg/kg (sometimes expressed as 25 parts per million - ppm). These concentrations are reported as concentration limit for Environmental hazard in Table 6.

3.1.2 Proposed concentration limits for waste containing mercury or mercury compounds for physical, health and environmental hazard classification

The concentration limits are presented in the last row of Table 6, with the lowest by category of hazard in color. For human acute toxicity, concentration limits are derived from acute toxicity estimates for mixtures of the GHS. Some substances have specific concentration limits for some hazard class category in the EU list of substances, but they were not used here. For physical hazard, the requirement is "presence". For health hazards, the lowest concentration is 0.3% of mercury or mercury substances in the mixture (reproductive toxicity). For environmental hazard, the concentration limit is 0.0025% or 25 mg/kg.

3.2 Impact assessment of proposed threshold

Numerous data (> 22 000) from France, for different waste streams were collected to perform impact assessment of the proposed threshold:

- Hazardous waste (according to the EU List of Waste);
- Potentially hazardous waste (depending on the concentration of hazardous substances in it) (so-called "mirror entries" in the EU List of Waste), including municipal solid waste incinerator (MSWI) bottom ash;
- Composts, sediments and agricultural soils.

Regulatory considerations on municipal sewage sludge (biosolids) and waste intended to be used as fertilizers are also presented.

More than 75% of the hazardous wastes have more than 25 mg Hg/kg. Data of Cd and Pb are presented, to illustrate that other hazardous elements are most of the time also present in these wastes (Table 7).

The Hg concentration for 55 potentially hazardous waste are presented at Figure 1 (left) and for MSWI BA at Figure 1 (right).

All the reported concentrations are lower than 25 mg/kg. For the MSWI BA, 8 samples have concentrations lower than the quantification limits of the laboratory (between 0.175 mg/kg and 5 mg/kg).

The distributions of Hg in different composts from organic fraction of municipal wastes (separately collected or mechanically sorted) of 30 sites in France (Zdanevitch, 2012) are presented in Table 8.

The results of routine quality monitoring of sediments are joined to the table. The network aims to monitor pollution and hot spots are more intensively sampled. The regulatory concentration limits of Hg for these sediments for reuse in natural environment are 1 mg/kg and 0.8 mg/kg respectively. One percent of the fluvial sediments should be specifically managed for mercury, with the threshold of 25 mg/kg, and no marine sediment. These samples are contaminated by other heavy-metals (As, Cu, Cd, Pb, Zn - result not shown) and are in all the case identified in survey and separated during dredging.

Data from routine analysis of agricultural soils are presented (Gissol 2018). A detailed analysis is available (Baize et al 2007). Another publication deals among others with local geological "anomaly" of heavy metals (Baize 2000). According to the authors, the higher concentrations originates from the parent material of the soil (most of the case) or from industrial inputs. All the concentrations are lower than 25 mg/kg (Table 8).

For municipal sewage sludge, the EEC Council Directive on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (EEC 1986) (updated) states in its Annex I B the limit values for heavy-metal concentrations in sludge for use in agriculture for mercury: 16 to 25 mg/kg of dry matter. In France, the corresponding decree sets a concentration limit of 10 mg/kg of dry matter (RF 1998).

For reuse of waste as fertilizing products in the Circular Economy package (EC 2016), the EC has confirmed the concentrations of Hg in fertilizers, culture medium and soils improvers of 1 mg/kg and in one case 2 mg/kg, that

TABLE 5: Classification of a mixture for acute and chronic aquatic ecotoxicity based on summation of the concentrations of classified ingredients (source: UNEP 2017), containing mercury or mercury substances (M factor Acute and M factor Chronic = 100). In green: the lowest concentration limit.

Level of ecotoxicity	Ecotoxic Acute if sum of	Ecotoxic Acute (M=100) if sum of mercury and mercury substances	Ecotoxic Chronic if sum of	Ecotoxic Chronic (M=100) if sum of mercury and mercury substances
1	Acute 1 * M ≥25%	≥ 0.25%	Chronic 1 * M ≥25%	≥ 0.25%
2	(M*10*Acute 1) + Acute 2 ≥ 25%	≥ 0.025%	(M*10*Chronic 1) + Chronic 2 ≥ 25%	≥ 0.025%
3	(M*100*Acute 1) + (10*Acute 2) + Acute 3 ≥ 25%	≥ 0.0025% = 25 mg/kg	(M*100*Chronic 1) + (10*Chronic 2) + Chronic 3 ≥ 25%	≥ 0.0025% = 25 mg/kg
4	-	-	Chronic 1 + Chronic 2 + Chronic 3 + Chronic 4 ≥ 25%	≥ 25%

TABLE 6: Classification of mercury and mercury substances with the GHS in the EU, and corresponding concentration limits classifying a mixture containing mercury or mercury substances as hazardous. In color: the lowest concentration limits for physical (brown), health (blue) and environmental (green) hazards.

Hazard group		Physical		Health																Environmental	
Hazard Property		Explosive		Acute toxicity							Irritant			STOT*			Muta-genicity	Repro-ductive toxicity		Acute M=100	Chronic M=100
				Oral			Dermal		Inhal.					SE*	RE*						
Substances and hazard statement codes	CAS	H200	H201	H300 Cat 2	H301	H302	H310 Cat 1	H311	H330 Cat 2	H331	H314	H315	H319	H335	H372	H373	H341	H360	H361	Cat 1 H400	Cat 1 H410
Mercury	7439-97-6								X						X			X		X	X
Inorganic compounds of mercury with the exception of mercuric sulphide and those specified elsewhere in this Annex	-			X			X		X							X				X	X
Organic compounds of mercury with the exception of those specified elsewhere in this Annex	-			X			X		X							X				X	X
Dimethylmercury [1]; diethylmercury [2]	593-74-8 [1]; 627-44-1 [2]			X			X		X							X				X	X
Dimercury dicyanide oxide; mercuric oxycyanide	1335-31-5		X		X			X		X						X				X	X
Dimercury dichloride; mercurous chloride; calomel	10112-91-1					X						X	X	X						X	X
Mercury dichloride; mercuric chloride	7487-94-7			X							X				X		X		X	X	X
2-methoxyethylmercury chloride	123-88-6				X						X				X					X	X
Phenylmercury acetate	62-38-4				X						X				X					X	X
Phenylmercury nitrate [1]; phenylmercury hydroxide [2]; basic phenylmercury nitrate [3]	55-68-5 [1]; 100-57-2 [2]; 8003-05-2 [3]				X						X				X					X	X
Mercury difulminate; mercuric fulminate; fulminate of mercury	628-86-4	X			X			X		X						X				X	X
Mercury difulminate; mercuric fulminate; fulminate of mercury [≥ 20 % phlegmatiser]	628-86-4		X		X			X		X						X				X	X
Concentration limits = tresholds	Hazardous if	Presence	Presence	≥ 0.25%	≥ 5%	≥ 25%	≥ 0.25%	≥ 15%	≥ 0.5%	≥ 10%	≥ 1%	≥ 10%	≥ 10%	≥ 20%	≥ 1%	10%	≥ 1%	≥ 0.3% lowest	≥ 3%	≥ 0.0025%	≥ 0.0025%

* *STOT SE = specific target organ toxicity – single exposure, STOT RE = specific target organ toxicity – repeated exposure*

TABLE 7: Distribution of Hg (in red: > proposed threshold of 25 mg Hg/kg), Cd and Pb in hazardous waste in France.

Element	Hg	Cd	Pb
Number of data	793	2266	2856
Mean	7121	1272	6961
Min	0.1	0.0	1.1
1%	0.3	0.5	6.3
5%	10	2	40
10%	10	4	69
25%	190	14	162
50% = median	836	55	1758
75%	5336	129	3464
90%	12228	394	8907
95%	16835	2481	29192
99%	121368*	9725	101794*
Max	544018*	728708*	550423*

** Probable analytical bias (X ray fluorescence analysis)*

TABLE 8: Concentration of Hg (mg/kg) in compost, fluvial and marine sediments, and agricultural soils (21 784 data) (in red: > proposed threshold of 25 mg Hg/kg).

Element	Compost	Fluvial sediments	Marine sediments	Agricultural soils
N samples	379	11 791	816	8798
Mean	0.39	1.22	0.50	0.08
Min	0.00	0.002	0.01	0.01
1%	0.02	0.005	0.02	
10%	0.09	0.03	0.05	0.02
25%	0.20	0.05	0.08	0.03
50% = median	0.30	0.13	0.13	0.05
75%	0.50	0.40	0.26	0.07
90%	0.80	1.30	0.53	0.11
99%	1.68	31.0	2.47	
Max	2.40	200	112	11.6

are in the Regulation relating to fertilizers (EC 2003).

4. CONCLUSION

The Globally Harmonized System of the UN classifies mixtures with concentration of mercury and mercury substances as hazardous (aquatic acute and chronic ecotoxicity of level 3) if their concentration is greater than or equal to 0.0025%, or 25 mg/kg. This concentration limit could be used as threshold for disposal of waste of category "c" according to the Minamata Convention.

The impact assessment shows that this concentration will not classify any of the common industrial waste or composts, sediments of soils to be managed specifically for mercury, but well the hazardous waste, that are already stabilized or solidified before landfilling in special landfills for hazardous waste, and very few (1%) contaminated fluvial sediments (that in all the case are also contaminated with other heavy metals), according to French data. It is also consistent with the present concentration limits set in the EU for reuse of municipal sewage sludge and other waste as fertilizing products.

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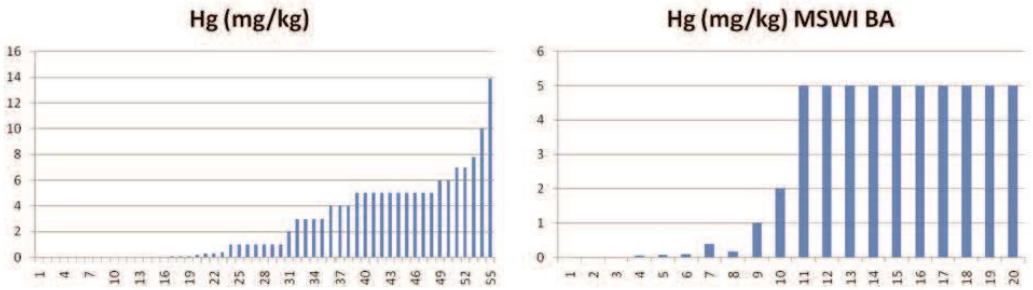

FIGURE 1: Distribution of total Hg concentration in 55 potentially hazardous waste (left), among which 20 samples of Municipal Solid Waste Incinerator Bottom Ash (right).

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6 May 2021

IPEN proposal to establish a Class C mercury waste threshold at 1 mg/kg (1 ppm)

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Dear Secretariat to the Minamata Convention,

Since the lead up to COP 3, IPEN has been proposing a threshold concentration limit of 1 mg/kg (1 ppm) to define Category C mercury waste (waste contaminated with mercury) under Article 11 paragraph 2 c. This has also been communicated to the Mercury Waste Expert group conducting intersessional work on threshold approaches and values for consideration by the COP.

This correspondence is intended to formalise IPEN's proposal for a 1 mg/kg threshold concentration level for Category C waste. After significant and protracted debate within the expert group on hazard, risk and exposure scenario approaches to establish a threshold concentration level to recommend to the COP, there has been no consensus on the issue. A proposal was made by an observer to establish a threshold limit of 25 mg/kg for Category C mercury waste based on an aquatic toxicity threshold of the GHS of chemical classification . However, there has been no consensus to support that level as some members of the expert group, including IPEN, are of the view that it is inadequate to protect human health from exposure to mercury waste.

It has been argued that a level of 25 mg/kg is protective of human health when environmentally sound management of Category C mercury waste takes place and engineered landfill has been suggested as one such ESM technique. However, when considering what some countries have already established in terms of threshold limits for mercury waste in landfill there can be little confidence that a limit of 25 mg/kg is suitable. For example, Switzerland has a limit of 2-5 mg/kg for landfill of mercury waste. Most soil screening levels and waste to soil application levels fall between 1 mg/kg and 20 mg/kg (Japan, Denmark, Germany, Australia, United States). These are developed countries with high levels analytical, enforcement and regulatory capability as well as established waste collection, categorisation and processing ability. So, under these best practice conditions of ESM in developed countries with established regulatory models and waste management systems these threshold levels (all below 25 mg/kg) are considered sufficient to protect human health as exposure is virtually nil.

In the scenarios most prevalent in developing countries this is not the case. Waste management systems are often rudimentary, waste is commonly mismanaged due to lack of infrastructure and resources resulting in open dumping, open burning and other practices that do not approach ESM. Large numbers of people are exposed to wastes including those living near or on open dumps, working among waste without personal protective equipment or indirectly exposed through air emissions, vapors and contaminated soil (and potentially produce grown in that soil).

Given that a large proportion of the world's population live in countries where ESM for waste management has not been achieved, it is necessary to take a precautionary approach to establishing a mercury waste threshold concentration limit. That limit must be protective of human health in

those countries most vulnerable to exposure and not based on the low exposure scenarios of developed countries with advanced waste management systems.

High volumes of waste are contaminated with mercury.

For this reason, IPEN is proposing a 1 mg/kg limit based on exposure scenarios most applicable to developed countries with limit waste management, regulatory and enforcement capacity. Adopting a weak threshold limit such as 25 mg/kg will exclude large volumes of mercury contaminated waste from regulation under the Minamata Convention including sewage sludge/biosolid residue often spread on farmland, industrial wastes such as incinerator bottom ash (often used as soil amendment and landscaping fill in Europe) and a range of other potentially hazardous waste. The widespread contamination of wastes and ash with mercury at levels lower 25 mg/kg is noted in Hennebert 2019[1].

These are wastes with potential for high exposure in developing countries where waste management can be poor and exposures high.

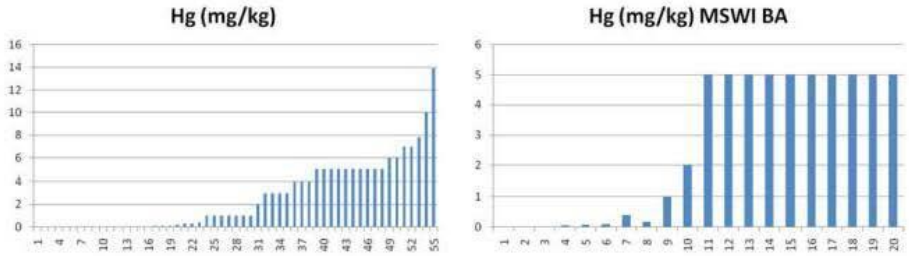


FIGURE 1: Distribution of total Hg concentration in 55 potentially hazardous waste (left), among which 20 samples of Municipal Solid Waste Incinerator Bottom Ash (right).

(source: Hennebert 2019)

Waste incineration is being heavily promoted in Africa as waste management infrastructure including:

- Ethiopia: The US$120 million Reppie waste to energy project in Addis Ababa, Ethiopia,
- Ghana: Armech Africa Limited is to construct a US$300 million waste to energy power plant in Tema, Ghana to generate 60MW of energy. The project will be pre-financed by the Armech Group via Industrial and Commercial Bank of China but is yet to start construction.
- Kenya: The sustainable Energy Fund for Africa has approved a grant of US$995,000 to support the planning stages of the construction of a 10 MW grid-connected municipal waste to energy plant in Nairobi, Kenya.
- Kenya: The Nairobi City County Government has published an Expression of Interest notice to establish a waste to energy facility in Dandora, which we understand has received submissions but is yet to be awarded to a developer.
- Zambia: The Government of Zambia has expressed interest in establishing an EfW facility and has been looking for a private partner to take forward this project.

The establishment of this industry will see the generation of millions of tonnes of bottom ash in circumstances where the management of bottom ash is uncertain at best. Waste incineration is also

[1] Hennebert, P (2019) Proposition of Threshold for Waste Contaminated With Mercury (Compounds) In Application Of The Minamata Convention On Mercury And Impact Assessment. ***Detritus, Vol 6 June*** 2019.

being promoted heavily in south-east Asia, Latin America and other regions where environmentally sound management of the residual bottom ash (and highly contaminated fly ash) varies between countries.

Sewage sludge/ biosolids

Sewage sludge and human biosolids are known to be a mercury contaminated waste and yet are applied as a soil amendment to agricultural land in Africa, south east Asia and other regions. Some countries require extensive pre-treatment and some do not. Often there is no regulation at all yet the government encourages its use as soil amendment and fertiliser. Mercury in the biosolids can contaminate the soil and is a direct exposure source to agricultural workers and their families. Exposure should be considered in terms of the most sensitive sub-group of receptors - children.

This article confirms the widespread practice of soil application in developing countries with limited controls: https://www.sciencedirect.com/science/article/pii/S0306919218301520

This article confirms elevated mercury levels in biosolids (and notes the Australian risk based limit for this waste - 5mg/kg)

https://www.researchgate.net/publication/248881797_Assessment_of_the_pollution_potential_of_mercury_contaminated_biosolids

The FAO provides a risk-based assessment of the maximum concentration of mercury that should remain in soil after biosolid application to prevent human exposure impacts and soil accumulation at **1mg/kg** - see Table 29 at this link. http://www.fao.org/3/t0551e/t0551e08.htm)

Establishing a Category C waste threshold of 25 mg/kg would effectively prevent these wastes being declared as mercury contaminated wastes, thereby avoiding regulatory scrutiny and precautionary measures and infers there is no significant mercury risks associated with the wastes. This is not a precautionary approach protective of the most vulnerable populations known to be exposed to these wastes through agriculture and waste mismanagement.

Soil exposure and chronic risks

Mismanaged mercury contaminated wastes are generally the precursor to mercury contaminated sites. Mercury contaminated wastes applied to land can result in significant human exposure and soil contamination. In most developed countries screening levels and other soil guidance thresholds have been established for mercury in soil. Concentrations above these levels can lead to deleterious health impacts with prolonged exposure and require investigation and assessment.

In the UK DEFRA uses a **1 mg/kg limit** in soil for residential use (again based on human exposure risk assessment)[2].

While we understand clearly that soil guideline levels for contaminated sites are not intended as waste definitions, there is an overlap where exposure is considered. For people living adjacent to or even on areas where mercury waste has been applied to soil, the exposure scenario and risks are very similar to a site that has been deemed 'contaminated'. That is long term exposure via dermal contact, inhalation, and possibly ingestion (pica behaviour in children is a very high risk). In residential occupation or other long term exposure scenarios (such as working as a waste picker on a

[2] http://residus.gencat.cat/web/.content/home/ambits_dactuacio/sols_contaminats/Cercasols_recursos_sol/Soil-Guideline-Values-for-mercury-in-soil-UK-Environment-Agency-March-2009.pdf

landfill, or agricultural worker spreading biosolids) long-term low-level exposure can lead to chronic health effects for sensitive sub-populations such as women, children and health impaired individuals. That is why protective levels must be established that reflect precautionary thresholds such as that suggested in the UK DEFRA soil guidance.

Article 12 does not address mercury contaminated waste mismanaged or applied to land.

It has been argued by some members of the expert group that Article 12 of the Convention deals with this issue. As a member of the group that contributed to the guidance development, I can confirm that is does not address this issue. Neither the Convention text nor the Convention Guidance on contaminated sites addresses or provides screening levels or limit thresholds for mercury in soil. It is a guide for identification and assessment processes. In addition, many developing countries have no framework for the identification, management and assessment of contaminated sites meaning that sites subject to dumping of waste containing mercury may not now or in the foreseeable future, be identified and declared as mercury contaminated sites and managed appropriately to mitigate human health risks. So it is not accurate to say that Article 12 will take care human health risks associated with mercury contaminated waste that are mismanaged or applied to land in a reuse scenario.

Given that Article 12 and associated guidance provides no direction on threshold concentrations in soil, Article 11 must fill the gap with thresholds for waste that are informed by risk and exposure assumptions that are protective of human health. It should also be noted that even 'protective' limits derived by health risk assessment are not 'safe' levels they are 'tolerable' levels for most of the population.

When further considering 'tolerable' levels of mercury exposure for humans it may be worth considering cosmetics. The maximum permissible content of mercury in cosmetic products such as skin lightening cream is **1 mg/kg** based on human exposure assessment (Annex A Part 1 Minamata Convention) . The assessment being based on the maximum tolerable concentration of mercury you could apply to human skin without deleterious health effects.

It should also be noted that risk assessment tolerable values do not define an 'inert' material as some in the group have suggested, but the maximum exposure that human can *tolerate* with an implied one in a million adverse effect health endpoint such as cancer. Sometimes it is one in one hundred thousand. This implies in the first instance that the tolerable threshold derived by risk assessment protects all but 1 in a million of the population. If the population is 20 million, then 20 people are projected to develop cancer or the relevant health endpoint using the threshold over a lifetime. This certainly does not imply that such a risk-based limit denotes an 'inert', 'safe' or 'risk free' substance. No level of mercury is 'safe'.

It is clear that many countries continue to apply different forms of waste to land as a soil amendment including biosolids and industrial residues such as incineration bottom ash, coal fly ash, flue gas desulphurisation residue and so on. Many do not have testing and control regimes to characterise the material and it is safe to assume this leads to human exposure and mercury releases.

By establishing a **1 mg/kg** mercury threshold limit for Category C waste, such waste is 'red flagged' to regulators as a potentially contaminating substance that must be managed differently from 'inert' waste with additional controls as it has significant health implications.

Analysis and practical measures

Some in the expert group argue that 1 mg/kg is too low a level to allow for easy analytical detection especially in developing countries. However handheld X-ray fluorescence spectroscopy (XRF) devices can detect mercury in soil and waste at 1 mg/kg and above. The XRF device is used widely in the waste management, contaminated soil and mining industry to detect heavy metals at low concentrations. This tool can be used as a screening device to check suspect wastes and if uncertainty remains on the mercury concentration, then lab analysis can be applied to samples to confirm accuracy. Other hand-held screening devices (e.g. Lumex systems) can also provide similar data. For those who have an opinion that developing countries will not be able to analyse mercury concentrations at 1 mg/kg then they wish to reflect how they will analyse 25 mg/kg Hg or above.

Conclusion

In conclusion, IPEN proposes a precautionary, risk and exposure-based threshold concentration of 1 mg/kg for Category C wastes in order to protect sensitive populations in countries where environmentally sound management of mercury waste and other waste has not yet developed sufficiently to prevent exposure.

Annex II*

Overview of submissions from parties on approaches other than the total concentration approach

1. Pursuant to COP decision MC-4/6, the Secretariat invited Parties to submit information on approaches other than the total mercury concentration approach, including risk-based considerations, to be considered by the group of technical experts on mercury waste thresholds in discussing the thresholds for waste falling under subcategory 2 (c) of article 11.

2. Following submissions were received:

(a) **Brazil**, in its submission in July 2022, suggested that the solution would be to determine the limits for different type of destinations intended for mercury-contaminated waste, between 1 and 50 ppm, with 25 ppm as a cire value. In its submission in December 2022, Brazil restated that limits must be determined for each type of destination intended for mercury-contaminated waste.

(b) **Burkina Faso and Botswana** on behalf of the African region expressed their concern on the issue of setting the 25 mg/kg limits, recalling that the issue of mercury waste thresholds is of concern to the African region due to the weakness of the technical infrastructure for analysis and control.

(c) **Canada** submitted information on the National Classification System for Contaminated Sites (NCSCS), a risk-based framework that has been used to assess the need for action in contaminated sites in Canada. The NCSCS is a tool that helps assess and classify the risk posed by substances by evaluating the hazard potential of the site. The system classifies sites into various levels of risk in using a scoring system on a number of factors addressing contaminant characteristics, migration potential and exposure. Canada proposed that a similar framework could be used by the expert group to develop an approach that assesses the risk posed by mercury waste not only at its source, but where relevant, during transportation and at its final destination to provide a risk score value to help determine when environmentally sound management (ESM) is needed.

(d) **European Union and its member states** recalled that they already put forward at COP4 a mercury threshold set at 25 ppm as a basis to start the discussions and that they are ready to engage and display flexibility on this figure. They believed that, during this first step, priority should be given to establishing a threshold and lengthy discussions on waste management should be avoided. As a second step, the group of technical experts could work on developing complementary guidance on the management of mercury wastes that would take into account the information regarding risk-based approaches.

(e) **Japan** expressed the view that a total concentration approach is the most appropriate way to identify Category C wastes, and that a threshold with a risk-based approach is not realistic. If Parties cannot agree to a uniform total mercury content as a threshold and wish to explore a threshold with a risk-based approach, each Party should have flexibilities to set their thresholds to ensure the environmentally sound management of Category C wastes depending on their typical waste streams, disposal operations and associated exposure pathways. However, this would result in not being able to establish uniform “thresholds defined by the Conference of the Parties” required by the Convention.

(f) **Kuwait** provided information on relationship between leachate concentration and total concentration.

3. The submissions are available on the Convention website.[1]

* The annex has not been formally edited.

[1] https://minamataconvention.org/en/meetings/cop5#sec1564.

Annex III*

Existing thresholds on the quantity of mercury used by parties for waste management

1. Decision MC-4/6, invited Parties to share information and data on the waste categories listed in the indicative list contained in table 3 of the annex to decision MC-3/5, including with respect to any relevant national or local thresholds and their establishment, and requested the Secretariat to compile such information and distribute it to the group of technical experts as soon as possible and make it available electronically.

2. The following table presents information on existing thresholds used by Parties based on total mercury concentration in waste or mercury concentration in leachate. The submitted information, together with information made available during the previous intersessional period, has been compiled and circulated to the group of technical experts.

Country	*Waste/media type*	*Value*	*Approach*	*Test method*
Thresholds based on mercury concentration				
Brazil	Soil - agricultural soil	12 mg/kg	Total concentration	
Brazil	residential area soil	36 mg/kg	Total concentration	
Brazil	industrial area soil	70 mg/kg	Total concentration	
Brazil	biosolids Class 1	17 mg/kg	Total concentration	
Brazil	biosolids Class 2	57 mg/kg	Total concentration	
Canada (Saskatchewan)	Waste dangerous goods	0.01%	Total concentration	
Canada (Yukon)	Soil - agricultural, parks and residential	15 µg/g	Total concentration	
Canada (Yukon)	Soil - commercial	40 µg/g	Total concentration	USEPA method 1311 (TCLP)
Indonesia	Quality Standards of wastes from non-specific sources containing mercury	0.3 ppm 10 ppm	Total concentration	
Indonesia	Soil - hazardous waste management category 1	300 mg/kg	Total concentration	
Indonesia	Soil - hazardous waste management category 2	75 mg/kg	Total concentration	
Indonesia	Soil - non-hazardous waste management	0.3 mg/kg	Total concentration	
Iran (Islamic Republic of)	National soil standard (pH<7, natural lands, agriculture, parks, residential)	5 mg/kg	Total concentration	
Iran (Islamic Republic of)	National soil standard (pH<7, industrial)	30 mg/kg	Total concentration	
Iran (Islamic Republic of)	National soil standard (pH>7, agriculture)	7 mg/kg	Total concentration	
Iran (Islamic Republic of)	National soil standard (pH>7, groundwater protection)	10 mg/kg	Total concentration	
Iran (Islamic Republic of)	National soil standard (pH>7, food safety)	12 mg/kg	Total concentration	

* The annex has not been formally edited.

Country	*Waste/media type*	*Value*	*Approach*	*Test method*
Iran (Islamic Republic of)	National soil standard (pH>7, residential)	15 mg/kg	Total concentration	
Iran (Islamic Republic of)	National soil standard (pH<7, natural lands, parks, industrial)	55 mg/kg	Total concentration	
Iran (Islamic Republic of)	Threshold of mercury waste in agricultural land use	16 ppm	Total concentration	
Iran (Islamic Republic of)	Threshold of mercury waste in forest land use	20 ppm	Total concentration	
Iran (Islamic Republic of)	Threshold of mercury waste in contact public places	16 ppm	Total concentration	
Iran (Islamic Republic of)	Threshold of mercury waste in Soil Reclamation	20 ppm	Total concentration	
Iran (Islamic Republic of)	Threshold of mercury waste in industrial land use	23 ppm	Total concentration	
Iran (Islamic Republic of)	Threshold of mercury waste in landfill site	23 ppm	Total concentration	
Japan	Dust and others contaminated with mercury or mercury compounds	15 ppm	Total concentration	
Japan	Recyclable material containing mercury (non-waste)	0.1%	Total concentration	
Republic of Korea	Slag from the process of smelting metal or non-metal is used for cement manufacturing	2 mg/kg	Total concentration	
Republic of Korea	Recycling of incineration and bauxite residues as raw materials in ceramic industries	16 mg/kg	Total concentration	
Republic of Korea	Recycling general waste as an alternative material for cement	2 mg/kg	Total concentration	
Republic of Korea	Recycling waste organic solvents, waste paints, etc. as recycled organic solvents excluding waste isopropyl alcohol	1 mg/kg	Total concentration	
Republic of Korea	Artificial soil used for ecological restoration and greening, use as filling materials for land and cover materials in landfill site	4-20 mg/kg	Total concentration	
Republic of Korea	Auxiliary fuel for cement kiln (waste excluding hazardous waste)	1.2 mg/kg	Total concentration	
Republic of Korea	Auxiliary fuel for cement kiln (Woody waste)	1 mg/kg	Total concentration	
Republic of Korea	Reclaimed fuel oil	1 mg/kg	Total concentration	
Republic of Korea	Organic sludge recycled as fuel	1.2 mg/kg	Total concentration	
Republic of Korea	Solid Refuse Fuel (SRF) from waste	1 mg/kg	Total concentration	

Country	*Waste/media type*	*Value*	*Approach*	*Test method*
Republic of Korea	Bio-SRF	1.2 mg/kg	Total concentration	
Republic of Korea	Guideline on transboundary movement	0.1%	Total concentration	
Switzerland	demolition and excavation material (unpolluted)	0.5 mg/kg	Total concentration (dry matter)	
Switzerland	demolition and excavation material (subject to further use in construction materials)	1 mg/kg	Total concentration (dry matter)	
Switzerland	Use of waste as raw material and raw mix corrective in cement clinker production	1 mg/kg	Total concentration (dry matter)	
Switzerland	Use of waste as alternative fuel in cement clinker production	1 mg/kg	Total concentration (dry matter)	
Switzerland	Type B landfill (inert waste)	2 mg/kg	Total concentration (dry matter)	
Switzerland	Type C landfill (solidified fly ashes of MSWI)	5 mg/kg	Total concentration (dry matter)	
Switzerland	Type D landfill (slag of MSWI)	5 mg/kg	Total concentration (dry matter)	
Switzerland	Type E landfill (other waste, slightly reactive)	5 mg/kg	Total concentration (dry matter)	
Thailand	Hazardous waste (mercury-contaminated sewage or unused material)	20 mg/kg	Total concentration	
Uganda	waste containing mercury or mercury compound	0.1%	Concentration of elemental mercury and/or certain mercury compounds	
Uganda	waste containing mercury or mercury compound	1%	Concentration of certain mercury compounds (e.g. mercury nucleate)	
United States of America	Hazardous waste (thermal treatment)	260 mg/kg	Total concentration	
United States of America	Biosolids (concentration in sludge applied to land)	57 mg/kg	Total concentration	
United States of America	Biosolids (cumulative loading)	17kg/hectare	Total concentration	
United States of America	Biosolids (monthly average concentration)	17 mg/kg	Total concentration	
United States of America	Biosolids (annual loading rate)	0.85kg/hectare	Total concentration	
Thresholds based on leachate				
Brazil	Hazardous waste	0.1 mg/L	Leachate	
Brazil	Standards for the test of solubilization	0.001 mg/L	Leachate	
Canada (Federal)	Hazardous waste	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)

Country	*Waste/media type*	*Value*	*Approach*	*Test method*
Canada (British Columbia)	Hazardous waste	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)
Canada (Alberta)	Hazardous waste	0.2 mg/L	Leachate	USEPA method 1311 (TCLP)
Canada (Saskatchewan)	Landfill acceptance	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)
Canada (Manitoba)	Hazardous waste	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)
Canada (Ontario)	Hazardous waste	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)
Canada (Quebec)	Hazardous waste	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)
Canada (Newfoundland)	Hazardous waste	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)
Canada (Northwest territories)	Hazardous waste	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)
Canada (Nunavut)	Hazardous waste	0.1 mg/L	Leachate	USEPA method 1311 (TCLP)
China	Hazardous characteristic of leaching toxicity	0.1 mg/L	Leachate	Extraction procedure for leaching toxicity-sulphuric acid and nitric acid method (HJ/T299-2007)
China	Municipal solid waste landfill	0.05 mg/L	Leachate	Extraction procedure for leaching toxicity-sulphuric acid and nitric acid method (HJ/T299-2007)
Colombia	Hazardous waste	0.2 mg/L	Leachate	USEPA method 1311 (TCLP)
Ethiopia	Sewage sludge	8 mg/kg	Leachate?	
Ethiopia	Soil	1 mg/kg	Leachate?	
Ethiopia	Landfill Class 0	0.001 mg/L	Leachate?	
Indonesia	Soil - hazardous waste management category 1	0.3 mg/L	Leachate	TCLP
Indonesia	Soil - hazardous waste management category 2	0.05 mg/L	Leachate	TCLP
Indonesia	Soil - non-hazardous waste management	0.02 mg/L	Leachate	TCLP
Japan	Specifically-controlled industrial waste (slag, soot and dust, sludge, treated substances or objects thereof and treated waste acid and waste alkali)	0.005 mg/L	Leachate	Official leaching test (JLT-13)
Japan	Specifically-controlled industrial waste (waste acid and waste alkali)	0.05 mg/L	Leachate	Official leaching test (JLT-13)
Republic of Korea	Mercury waste	0.005 mg/L	Leachate	
Republic of Korea	Slag from the process of smelting metal or non-metal is used for cement manufacturing	0.003 mg/L	Leachate	

Country	*Waste/media type*	*Value*	*Approach*	*Test method*
Switzerland	Type B landfill (inert waste)	0.01 mg/L	Leachate	
Thailand	Hazardous waste (extracted using wet extraction test)	0.2 mg/L	Leachate	
United States of America	Hazardous waste (landfill acceptance)	0.2 mg/L	Leachate	USEPA method 1311 (TCLP)

Annex IV*

Compilation of information and data on mercury waste submitted by parties

1. COP decision MC-4/6, invited Parties to share information and data on the waste categories listed in the indicative list contained in table 3 of the annex to decision MC-3/5 (waste falling under subparagraph 2 (c) of article 11), including with respect to any relevant national or local thresholds and their establishment, and requested the Secretariat to compile such information and distribute it to the group of technical experts as soon as possible and make it available electronically. The Secretariat, in its letter dated 13 April 2022, invited Parties to submit such information by 30 June, later extended to 15 July, noting that information already submitted and compiled in UNEP/MC/COP.2/INF/10 need not be resubmitted.

2. Submission was received from Brazil, Canada, the European Union, Japan, Thailand, Uganda and the United States of America. The information was posted on the Convention website. Indonesia submitted information at the meeting of the expert group on 16-18 February 2023.

3. This document compiles the information submitted by Parties, with reference to information that had already been submitted during the previous intersessional work.

Brazil

(Para 1-5 on mercury releases are not reproduced here.)

6. On the issue of mercury waste limits, we remind that during the Conference of the Parties, the discussion of mercury limits took place on the proposal for a single value of 25 ppm for the definition of section c) of Article 11 - Mercury wastes, the text of the Convention, which reads:

"2. For the purposes of this Convention, mercury waste means substances or objects: (...)

(c) Contaminated with mercury or mercury compounds"

7. In the Brazilian national legislation, the management of mercury waste is not based solely on a single pre-determined limit. The establishment of limits for the management of mercury wastes should be based on the environmentally appropriate destination to be given to the waste. Examples of this can be found in the following CONAMA Resolutions:

I- Number 316 of 2002: not to surpass 8 mg/Nm³ of gaseous emissions;

II- Number 358, of 2005: Wastes from Group B, section b) containing or contaminated with heavy metals, including mercury: final disposal in landfill of hazardous waste - Class I (Category D5 of Annex IV-A - Basel Convention);

III- Number 420, 2009: presence in soils:

a) agricultural soil: 12 mg/kg;

b) residential area soil: 36 mg/kg;

c) industrial area soil: 70 mg/kg.

IV- Number 498 of 2020: possibility of use as biosolids:

a) biosolids Class 1: 17 mg/kg

b) biosolids Class 2: 57 mg/kg

V- Number 499, of 2020: 0.05 mg/Nm³ for gas emission in clinker furnaces.

8. Therefore, the solution would be to determine a larger scope of limits, between 1 and 50 ppm, with the limit of 25 ppm as a core value, as follows:

1ppm<25ppm<50ppm

* The annex has not been formally edited.

9. From this scope, the limits should be determined for each type of destination intended to give to mercury-contaminated wastes. Such discussions may occur in the intersessional discussions of the technical group of experts and representatives of other countries Party.

10. We also emphasize that the waste standards of Minamata Convention was based on the pillars of (a) environmentally sound management and disposition based on the provisions of the Basel Convention and on parameters to be set out in an additional Annex to be developed in the future by the Conference of the Parties; (b) recovery, recycling or re-use only for uses permitted by the Convention or environmentally sound provision; (c) sealing to the Parties also signatory to the Basel Convention on the Transboundary Transport of mercury wastes, subject to the purpose of an environmentally appropriate final provision.

11. In addition, it is important to confirm that Brazil is a signatory to the Basel Convention and that it has already been duly internalized by Brazilian law, which was promulgated by Decree number 875/1993 and amended to its Annex I and the adoption of Annexes VIII and IX promulgated by Decree number 4.581/2003.

12. That is the Opinion. Subject to approval by higher authority.

Canada

General

Exceedance of the thresholds triggers requirements for environmentally sound management as a hazardous waste in the relevant jurisdiction.

Jurisdiction	*Legislation/ Regulation/ Guideline*	*Leachate Limit*	*Content Limit*	*Notes*
Federal				
Canada	Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations	0.1mg/L	N/A	Substance thresholds in Schedule 6 of the regulations are used to classify waste as hazardous, or as hazardous recyclable material. Leachate concentration is determined using US EPA Method 1311, Toxicity Characteristic Leaching Procedure.
Provincial and Territorial				
British Columbia	Hazardous Waste Regulation	0.1mg/L	N/A	Leachable toxic waste that exceeds the leachate quality standards specified in Table 1, Schedule 4 of the regulations is defined as hazardous waste. Leachate concentration is determined using US EPA Method 1311, TCLP.
Alberta	Alberta User Guide for Waste Managers	0.2mg/L	N/A	Waste is hazardous and a recyclable is a hazardous recyclable waste if its leachate contains any substance listed in Table 2 of the Schedule in excess of the concentrations listed in that Table Leachate concentration is determined using US EPA Method 1311, TCLP.
Saskatchewan	Hazardous Substances and Waste Dangerous Goods Regulations	0.1mg/L*	0.01% (100ppm)	Mercury and mercury compounds are designated as hazardous substances under the Hazardous Substances and Waste Dangerous Good Regulations. If a hazardous substance is present in waste above 0.01%, the waste is considered a waste dangerous good. *Industrial waste landfills in Saskatchewan can accept mercury waste only if the mercury in the leachate is below 0.1mg/L. Any waste generating leachate with

Jurisdiction	*Legislation/ Regulation/ Guideline*	*Leachate Limit*	*Content Limit*	*Notes*
				mercury above this cannot be accept at non-hazardous waste landfills. Leachate concentration is determined using US EPA Method 1311, TCLP.
Manitoba	Hazardous Waste Regulation	0.1mg/L	N/A	Depending on the substance being considered, the regulation defines hazardous waste according to waste type, concentration limit or leachate limit. The leachate limit for mercury is included in Schedule C, Category 4 – Hazardous Waste. Leachate concentration is determined using US EPA Method 1311, TCLP.
Ontario	General Waste Management Regulation	0.1mg/L	N/A	A waste which produces a leachate that meets or exceeds the leachate limits in Schedule 4, Leachate Quality Criteria, is defined as a leachate toxic waste. Leachate concentration is determined using US EPA Method 1311, TCLP.
Quebec	Regulation respecting hazardous materials	0.1mg/L	N/A	Any material which produces a leachate that exceeds the maximum leachate concentrations specified in the regulations is defined as leachable material. The test method is prescribed in the Liste des méthodes d'analyses relatives à l'application des règlements découlant de la Loi sur la qualité de l'environnement (available in French only), which includes US EPA Method 1311, TCLP.
Newfoundland	Guidance Document – Leachable Toxic Waste	0.1mg/L	N/A	A waste which generates leachate concentrations that exceed the standards in Attachment 3 is defined as leachable toxic waste. Leachate concentration is determined using US EPA Method 1311, TCLP.
Northwest Territories	Guideline for Hazardous Waste Management	0.1mg/L	N/A	A waste which generates leachate concentrations that exceed the leachate disposal standards in Schedule I is defined as hazardous leachable waste. Leachate concentration can be determined using both US EPA Method 1311, TCLP or Leachate Extraction Procedure 164-GP-1-MP Canadian General Standards Board.
Yukon	Contaminated Sites Regulation	N/A	15ug/g 40ug/g	Contaminate concentrations in soil are compared to Schedules 1 and 2 of the regulations to determine if is to be managed as a hazardous waste. 15ug/g applies for soil for Agricultural, Parks and Residential land uses. 40ug/g applies soil for Commercial land use. The type of analysis required is not specific in the regulations.
Nunavut	Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and	0.1mg/L	N/A	A waste which generates leachate concentrations that exceed the criteria in Table 1 is considered to be a hazardous waste. The recommend leachate testing procedure is US EPA Method 1311, TCLP.

Jurisdiction	*Legislation/ Regulation/ Guideline*	*Leachate Limit*	*Content Limit*	*Notes*
	Sewage Treatment Facilities			

Metal Mining Effluent

The Environmental Code of Practice for Metal Mines published by the Government of Canada contains recommendations on best practices throughout the mine lifecycle, including tailings management. In Canada, tailings from metal mines undergo disposal in an environmentally sound manner in dedicated tailings management facilities. These facilities include tailings ponds to allow for settling of suspended solids. Tailings disposal under a water cover is also a recommended practice to prevent or control metal leaching.

Any effluent that is released from a metal mine is subject to the federal Metal and Diamond Mining Effluent Regulations. Due to the Canadian climate, water levels in a tailings pond can increase resulting from melting snow and precipitation. To maintain a tailings pond at the required water level, effluent may be released into the environment, but only through a final discharge point that is monitored and reported in accordance with the Regulations. Schedule 4 of the Regulations prescribes effluent limits for certain substances. Effluent must also be within a prescribed pH range and not be acutely lethal to fish.

In Schedule 5 of the Regulations, metal mines are obligated to conduct effluent and water quality monitoring studies, which consist of effluent characterization, sub-lethal toxicity testing and water quality monitoring. Effluent characterization includes a requirement to measure mercury concentration in the effluent. Water quality monitoring includes a requirement to measure mercury concentrations in water samples taken from the area of exposure near the mine. Schedule 5 also requires a study on mercury in fish tissue to determine any effects of the mine effluent on fish populations.

European Union

By means of Decision MC-4/6 ('Mercury waste thresholds'), Parties to the Minamata Convention on Mercury (hereafter, 'the Convention') agreed to extend the mandate of the group of technical experts to carry out intersessional work between the fourth and fifth meeting of the Conference of the Parties with the goal of recommending and facilitating a decision on waste contaminated with mercury or mercury compounds at the fifth meeting of the Conference of the Parties.

With a view to contributing to the discussions within the group of technical experts, the European Union is pleased to provide a written submission (Posted on the website. The abstract is copied below.) to the Secretariat of the Convention, containing a 2019 peer-reviewed publication from M. P. HENNEBERT (expert from the French National Institute for Industrial Environment and Risks - INERIS)[1], explaining the rationale supporting the establishment of a threshold of 25 mg mercury/kg of waste (25 ppm or 0.0025%) for waste contaminated with mercury or mercury compounds.

<Abstract of the submitted publication>

The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury. Environmentally sound management of waste is under discussion. This note proposes a threshold for waste of category c) Contaminated with mercury or mercury compounds to be disposed of (Article 11 of the Convention), using the Globally Harmonized System of classification and labelling of chemicals of the United Nations (GHS - UNEP, 2017). Mercury and mercury compounds are classified as substances for the physical, health and environmental hazards categories. The thresholds of mercury and mercury compounds classifying a mixture as hazardous for the different hazard categories (physical, health, environmental) are "Presence", >0.3% and >0.0025% (25 mg mercury/kg of waste) respectively. For impact assessment, this threshold is then compared with large data set of hazardous (793 data), potentially hazardous (depending on the concentration of hazardous substances) (55 data), as well as natural or non-polluted anthropized media (composts, sediments, agricultural soils) (21 784 data) from France. This demonstrates that 75% of the hazardous waste have higher total mercury

[1] *Proposition of threshold for waste contaminated with mercury (compounds) in application of the Minamata Convention on Mercury and Impact Assessment,* Pierre Hennebert, DETRITUS / Volume 06 – 2019, pp. 25-31. Publication is also available electronically: https://doi.org/10.31025/2611-4135/2019.13822.

concentration, that potentially hazardous waste samples have lower concentrations, and that all composts, agricultural soils and marine sediments and 99% of the fluvial sediments have lower concentrations. So, this threshold will not classify common industrial waste or natural media as requiring special treatment for safe disposal, but well a large part of industrial hazardous waste.

Indonesia

Indonesia realizes the importance of setting thresholds in managing mercury waste to create a safe environment. Indonesia understands the importance of a framework for identifying, managing, and assessing mercury waste and mercury-contaminated soil with the principle of environmentally safe management

Indonesia has made efforts to overcome mercury waste by drafting regulations and building facilities to support the safe management of mercury waste. Indonesia already has good waste management and accredited laboratory facilities for testing the mercury content in waste, both privately owned and government-owned laboratories such as the Mercury and Environmental Metrology Laboratory in Serpong, Banten owned by the Ministry of Environment and Forestry (MOEF)

Currently, Indonesia has regulations for hazardous waste management through the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 6 of 2021 concerning Procedures and Requirements for the Management of Hazardous Wastes. Indonesia still needs to set national guidelines for managing mercury waste and is still adopting best practices from other countries.

Indonesia has set up thresholds for the management of mercury waste as follows.

1. Quality Standards of Toxic Characteristic through Toxicity Characteristic Leaching Procedure (TCLP) for the determination of the hazardous waste category:
    a. TCLP-A: 0.3 mg/L
    b. TCLP-B: 0.05 mg/L
2. Quality Standards of Total Concentration (TK) for wastes from non-specific sources containing mercury:
    a. Waste and/or product waste that is contaminated and/or contains mercury (Hg) and/or its compounds if the concentration is greater than 10 ppm;
    b. Waste and/or product waste that is contaminated and/or contains mercury (Hg) and/or its compounds if the concentration is less than 10 ppm and greater than 0.3 ppm;
3. Quality Standards for Toxic Characteristics through TCLP to stipulate standards for hazardous waste treatment before being placed in landfill facilities: 0.05 mg/L;
4. Quality Standards for Toxic Characteristics through TCLP for management of hazardous waste contaminated soil:
    a. TCLP-A: 0.3 mg/L;
    b. TCLP-B: 0.05 mg/L;
    c. TCLP-C: 0.02 mg/L;

Below the TCLP- C is considered as non-hazardous waste;

5. Toxic characteristic standard value through Total Concentration (TK) to determine the management of hazardous waste contaminated soil:
    a. TK-A: 300 mg/kg;
    b. TK-B: 75 mg/kg;
    c. TK-C: 0.3 mg/kg;

Below the TK-C is considered as non-hazardous waste;

6. Quality standard of wastewater at waste pile and waste impoundment facilities: 0.002 mg/L;
7. Quality standard of gold mining wastewater for mining and processing: 0.005 mg/L;
8. Quality standard of copper mining wastewater for mining and processing: 0.005 mg/L.

Currently, the Indonesian government has made efforts to reduce and eliminate mercury through Presidential Regulation No 21 of 2019 concerning the National Action Plan for Mercury Reduction and Elimination. Priority sectors including manufacturing, energy, ASGM, and health. These sectors are a priority because there are still products that use mercury, such as the use of mercury for auxiliary materials in manufacturing batteries and the use of mercury in the lamp production process.

In terms of mercury waste management, Indonesia only has landfill facilities. With the unavailability of other environmentally sound technologies, eradicating mercury can only be done by treating the waste in other countries with those technologies. With cross-border movement, it is essential to establish a universal threshold for mercury-contaminated waste. The threshold is necessary because mercury-contaminated waste will be easier to accept and manage when every country has the same perception.

Indonesia also has already develop a technical guidance on mercury contaminate site remediation (Final Draft) in terms of handling site contamination by mercury especially from artisanal gold mining activities.

In this regard, Indonesia considered the necessary to establish universal thresholds for category C waste. However, a further expert discussion is required to determine the appropriate threshold value. Furthermore, improvement on countries capability how to identify the mercury concentration in the waste thresholds (laboratory, regional guideline, etc.) is needed.

Japan

Introduction

Japan welcomes a decision MC-4/6 on mercury waste thresholds, particularly on the adoption of the decision on thresholds for tailings from artisanal and small-scale gold mining and relevant thresholds on tailings from mining other than primary mining that are not excluded from the dentition of mercury wastes under Article 11.

We would like to hereby share information and data on the waste categories listed in the indicative list contained in table 3 of decision MC-3/5, including with respect to any relevant national or local thresholds and their establishment. However, Japan has already submitted relevant information on waste categories as reflected in UNEP/MC/COP/2/INF/10. Therefore, a submission below is information on the establishment of relevant thresholds that have not been submitted in the inter-sessional period by the government of Japan. Please be noted that further information may be submitted by a technical expert potentially nominated by the government of Japan during the inter-sessional period leading up to the COP5.

Categorization of wastes contaminated with mercury or mercury compounds in Japan

Under the Waste Management and Public Cleansing Act, Japan categorizes industrial wastes contaminated with mercury or mercury compounds as either "*Specially-controlled industrial wastes*", "*Dust and others contaminated with mercury*" or other industrial wastes (see Figure 1). Necessary measures to ensure environmentally sound management vary by category[2].

Specially-controlled industrial wastes are the following wastes generated at designated facilities relevant to specific types of waste stream:

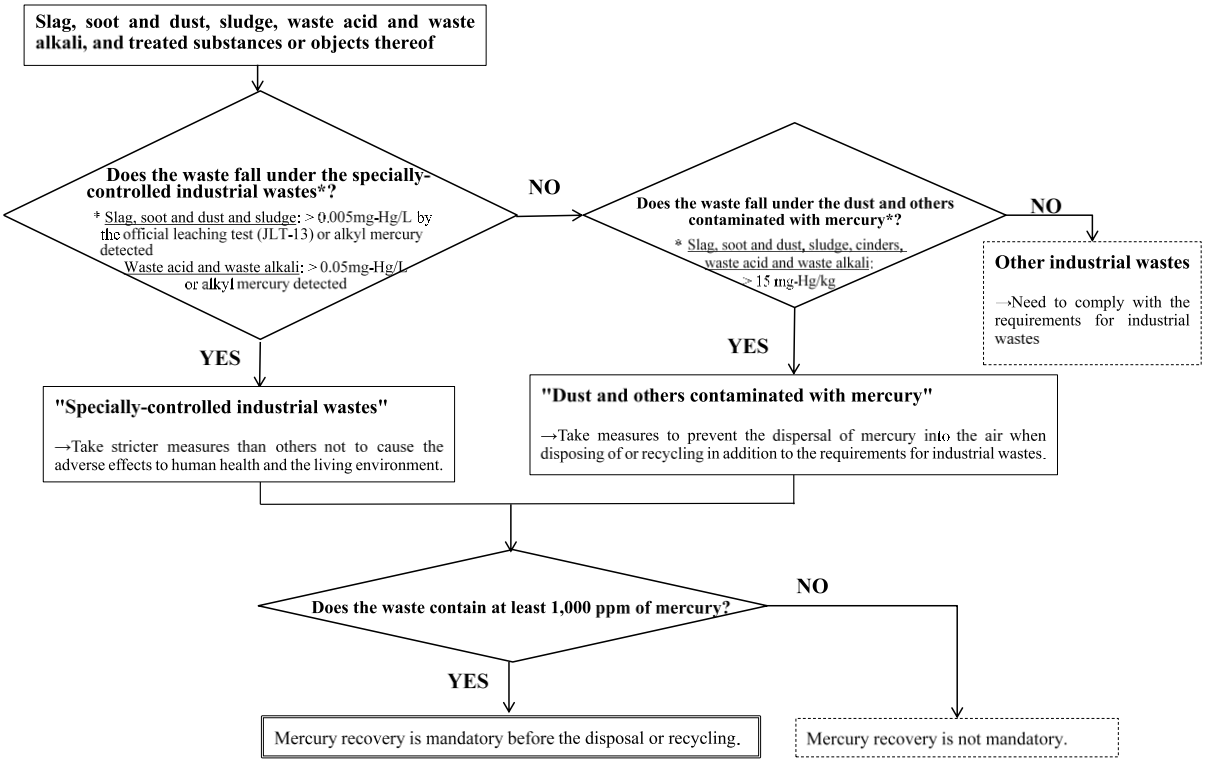
- slag, soot and dust, sludge, treated substances or objects thereof and treated waste acid and waste alkali that leach more than 0.005 mg-Hg/L; or
- waste acid and waste alkali which contain more than 0.05 mg-Hg/L.

Dust and others contaminated with mercury or mercury compounds are slag, soot and dust, sludge, waste acid and waste alkali that do not fall under "*Specially-controlled industrial wastes*" but contain more than **15 ppm** of mercury.

Remaining wastes contaminated with mercury or mercury compounds are categorized as industrial wastes in general.

[2] In Japan, soot and dust captured by dust collectors of municipal waste incineration facilities whose incineration capacity is at least 200kg/h or grate area is at least 2m^2 are categorized as "*Specially-controlled municipal wastes*". Soot and dust contaminated with mercury or mercury compounds generated from waste incinerators fall into this category.

Figure 1
Flow chart to categorize industrial wastes contaminated with mercury or mercury compounds in Japan



Japan applies two-tiered approaches to classify (mercury) wastes. First-tier is to judge whether wastes fall under **hazardous wastes (called "*Specially-controlled wastes*") based on a leaching potential**. Under the Act, stricter measures shall be put in place for the management of "Specially-controlled wastes". Criteria to judge whether the waste in question falls under "*Specially-controlled wastes*" are set for different hazardous substances (e.g., lead, cadmium, arsenic) based on their leaching potential, and those values (leaching thresholds) are equivalent to acceptance criteria at leachate control-type landfills. This would mean that if wastes exceed one of the leaching thresholds, they cannot be disposed of in leachate-controlled-type landfills. In summary, Japan uses a leaching potential as one of the ways to control wastes to be disposed of at leachate control-type landfills to protect the surface water and groundwater from leachate from landfill sites (and eventually source of drinking water). The leaching threshold for mercury and its compounds (0.005 mg-Hg/L) has been set as tenfold of the Environmental Quality Standard for surface water and groundwater (0.0005 mg-Hg/L).

Wastes that do not fall under "*Specially-controlled wastes"* undergo a second tier to judge whether the wastes fall under **"*Dust and others contaminated with mercury"* based on mercury concentration**. In Japan, some slag, soot and dust, sludge, waste acid and waste alkali are treated with thermal processes while most of them are likely to be treated with physico-chemical processes. In order to minimize mercury emissions from thermal treatment of wastes contaminated with mercury or mercury compounds, mercury concentration is used for identifying wastes with relatively higher mercury emission potential. If the mercury concentration of the waste is more than 15 ppm, it falls under "*Dust and others contaminated with mercury or mercury compounds*" for which additional measures shall be taken to prevent the emission of mercury.

Steps to have established the national threshold for wastes contaminated with mercury or mercury compounds

As noted above, the threshold for "Dust and others contaminated with mercury or mercury compounds" in Japan is **15 ppm**. This standard was derived so that standards for mercury emission from waste incineration facilities* could be satisfied. The following steps show how Japan derived this value.

*Note: 0.03/Nm^3 for new facilities and 0.05 mg/Nm^3 for existing facilities (draft, at that time).

Step 1: Identified the average mercury concentration in wastes to be incinerated

The national government conducted an on-site survey to identify the average mercury concentration in wastes to be incinerated. The survey found that the average mercury concentration of mixed industrial wastes was 0.33 mg/kg without an outlier (The average of all samples was 12.7 mg-Hg/kg (n=33) including one outlier whose mercury concentration was 410 mg-Hg/kg, while mercury concentrations for most of the samples were 1.0mg /kg or less).

Step 2: Specified the average mercury removal rates of air pollution control systems

The on-site survey found that about 60 % of incineration facilities for industrial wastes employed bag filters or the combination of bag filters and other treatment equipment to abate the emissions of air pollutants. Based on the mercury removal rate of such techniques obtained through the on-site measurement and those described in the Guidance on Best Available Techniques and Best Environmental Practices developed pursuant to Article 8 of the Convention, the average mercury removal rate for incineration facilities for industrial wastes was set as 85 %.

Step 3: Calculated the limit of mercury concentration to satisfy the emission standards for waste incineration facilities under the condition of mixed incineration

The maximum mercury concentration of wastes to be incinerated while satisfying the emission standards for waste incineration facilities (0.03 mg/Nm^3 for new facilities and 0.05 mg/Nm^3 for existing ones, as of June 2016) was calculated under the condition below.

(i) the average mercury concentration in wastes is 0.33 mg/kg

(ii) the average mercury removal rate for incineration facilities for industrial wastes is 85 %, and

(iii) the ratio of ordinary wastes (those not supposed to be contaminated with mercury) to wastes contaminated with mercury to be incinerated is 9 to 1[3].

The result of the calculation showed that incineration of wastes with 18 mg/kg of mercury could satisfy the emission standards for existing facilities (0.05 mg/Nm^3) with a mercury removal rate of 85 %. A result of a similar calculation with an assumption that mercury could be removed by 90% at new facilities showed that incineration of wastes with 16 mg/kg of mercury could satisfy the emission standard for new facilities (0.03 mg/Nm^3).

Based on these results, Japan concluded that the maximum mercury concentration of wastes to satisfy the emission standards for waste incineration facilities should be 15 ppm. This value was designated as the threshold for "*Dust and others containing mercury*".

Thailand

Thailand has defined the mercury-contaminated sewage or unused material as hazardous waste if the total concentration of the mercury or mercury compounds in the hazardous inorganic substances and organic substances are **equal to or more than 20 mg/ kg**. In case of waste which is extracted by the **Waste Extraction Test (WET) and the Analytical Method of Extracted Water** having mercury and mercury compound is **equal to or greater than 0.2 mg / l**, according to the Notification of the Ministry of Industry B.E. 2548 (2005) on Disposal of Waste or Non-usable Materials issued pursuant to the Factory Act B.E. 2535(1992). For this hazardous waste management, the waste must be collected, transported, treated and disposed by the persons authorized from the Department of Industrial Works. Also, the management must comply with the rules and procedures prescribed by the Department of Industrial Works (DIW). In addition, there must have movement document (Manifest System) when hazardous waste is moved from the factories or brought into other factories. The Department of Industrial Works (DIW) must be usually keeping inform on the industrial waste management.

[3] The interviews with waste treatment business operators found that all facilities incinerate mercury wastes together with other wastes.

Uganda

10. Table 1 below details information and data on the waste categories listed in the indicative list contained in Table 3 of decision MC – 3/5 including relevant national or local thresholds and their establishment.

Table 1
Indicative list of waste contaminated with mercury or mercury compounds

S/N	*Type of waste*	*Waste source*[b]	*Data on estimated Mercury Releases (MIA study of 2018)*	*Relevant national or local thresholds*	*Comment/remarks*
1	Waste from industrial pollution control devices or cleaning of industrial off-gases[c]	Flue gas from sources such as:		1 µg/m^3 (annual ambient air limit)	The draft air quality standard does not provide emission limits for Hg, but rather the annual ambient air quality value, not source specific No thresholds are defined by source. Waste management regulations only provide a threshold to guide the characterization and management e.g. Y49 - Waste containing mercury and/or mercury compounds listed as follows (a) Waste containing 0.1% or more by weight of any of the following mercury and/or mercury compounds listed as follows – mercury, mercury benzoate, ethylmercury chloride, mercurous chloride, mercuric chloride, mercury ammonium chloride, methylmercuric chloride, mercuric oxycyanide, mercury oleate, mercury gluconate, mercury acetate, mercury salicylate, mercuric oxide, mercury cyanide, mercuric potassium cyanide, diethyl mercury, dimethyl mercury, mercury (II) bromide, mercurous nitrate, mercuric nitrate, phenyl mercuric hydroxide, mercuric thiocyanate, mercuricarsenate, mercury (II) iodide, mercury potassium iodide, mercury
		Extraction and use of fuels/energy sources	Yes (Other coal use, Other fossil fuels - extraction and use & Biomass fired power and heat production) Air 948		
		Smelting and roasting processes in the production of non-ferrous metals	No		
		Production processes with mercury impurities	Yes (cement) Air 165; by-products 71		
		Recovery of precious metals from waste electrical and electronic equipment	source not part of the tool kit		
		Coal combustion			
		Waste incineration and co-incineration			
		Crematoria			
2	Bottom ash	Coal combustion	No information		
		Biomass fired power	No information		
		heat generation	No information		
		Waste incineration	No information		
3	Wastewater treatment residues/slurries[d]	Treatment of wastewater from:	Yes Water 193; Land 77; Bu-products 58; General waste 58	0.01 mg/l (effluent discharge limit irrespective of sources)	
		Extraction and use of fuels/energy	Data not specific to source		
		Production of mercury-added products	Data not specific to source		
		Manufacturing processes in which mercury or mercury compounds are used	Data not specific to source		
		Primary non-ferrous metals production	Data not specific to source		
		Production processes with mercury impurities	Data not specific to source		

S/N	*Type of waste*	*Waste source*[b]	*Data on estimated Mercury Releases (MIA study of 2018)*	*Relevant national or local thresholds*	*Comment/remarks*
		Recovery of precious metals from waste electrical and electronic equipment	Data not specific to source		fulminate, mercury sulphide, mercurous , mercuric; (b) Waste containing 1% or more by weight of any of the following mercury and/or mercury compounds – mercury nucleate, mercurous acetate, phenylmercury acetate, phenylmercuric nitrate, thimerosal (schedules adopted from the Basel Convention)
		Waste incineration, co-incineration and other thermal treatment	Data not specific to source		
		Crematoria	Data not specific to source		
		Healthcare facilities	Data not specific to source		
		Controlled landfills	Data not specific to source		
		leachate	Data not specific to source		
		Uncontrolled dumping of wastes	Data not specific to source		
		Agricultural facilities	Data not specific to source		
4	Sludge	Separator tanks and sedimentary sand tanks for refining of crude oil, natural gas production and processing, drilling, ship cleaning, chemical processes, etc.	No information		
		Treatment of wastes contaminated with mercury (e.g., chemical precipitation and chemical oxidation)	No information		
5	Oil and gas refining catalyst	Refining of crude oil	No source		
		Processing of natural gas	No source		
6	Tailings and extraction process residues	Primary mercury mining	No source		
		Artisanal and small-scale gold mining	Yes - **Primary (virgin) metal production** (Gold and silver extraction with the mercury-amalgamation process) Air 12,136; water 3333; Land 3027		
7	Rubble, debris and soil[e]	Construction/demolition Remediation of contaminated sites	No study		
8	Other waste from manufacturing processes using mercury or mercury compounds[f]	Chlor-alkali production with mercury technology Production of alcoholates (e.g., sodium or potassium methylate or ethylate)	No		

S/N	*Type of waste*	*Waste source*[b]	*Data on estimated Mercury Releases (MIA study of 2018)*	*Relevant national or local thresholds*	*Comment/remarks*
		Dithionite and ultrapure potassium hydroxide solution Vinyl chloride monomer (VCM) production with mercuric chloride ($HgCl_2$) catalyst	No		
		Acetaldehyde production with mercury sulphate ($HgSO_4$) catalyst, etc.	No		
9	Other waste from the manufacturing of mercury-added products[g]	Manufacturing of mercury-added products	Yes (Waste incineration - Incineration of hazardous waste, Incineration of medical waste & Informal waste burning) Air 5308; Sector specific 14		
10	Other waste from natural gas cleaning[h]	Natural gas cleaning	No		
11	Wastes from waste treatment facilities[i]	Waste treatment facilities	Yes (Controlled landfills/deposits, Informal local disposal of industrial production waste, Informal dumping of general waste, Waste water system/treatment) Air 114; water 301; Land 939; General waste 58; Sector specific 58		

[a] Wastes listed in this table are regarded as mercury waste when they exceed thresholds. Waste exceeding the established threshold but not listed here would also be considered mercury waste.

[b] A facility or activity where waste is likely to be generated or accumulated.

[c] Includes filters and activated carbon.

[d] Include filters and resins.

[e] Contaminated soil transported off-site is regarded as waste.

[f] Mercury cells, mercury recovery units (retort), waste catalysts, decommissioning or demolition waste, personal protective equipment, elements used to contain mercury spills, etc.

[g] Process residues, demolition waste, etc.

[h] Scale removed from pipework and pipe cleaning equipment, etc.

[i] Waste treated to stabilize/solidify mercury in the waste, fluorescent coatings, metal and glass.

Challenge

No sorting including categorization of hazardous waste including waste that may be suspected to contain mercury or mercury compound is carried out at the point of generation/primary collection. Therefore chemical content quantification of this waste is not possible and is not carried out. In addition, during the disposal of hazardous waste, the byproducts and final waste product are not categorized. The method of final disposal of hazardous waste including waste containing mercury is incineration in most cases where flue gas is not condensed and sludge stabilized.

United States of America

Background

Article 11, Paragraph 2 of the Minamata Convention defines mercury wastes as substances or objects:

(a) Consisting of mercury or mercury compounds;

(b) Containing mercury or mercury compounds; or

(c) Contaminated with mercury of mercury compounds

in a quantity above the relevant thresholds defined by the Conference of the Parties, in collaboration with the relevant bodies of the Basel Convention in a harmonized manner, that are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law or this Convention. This definition excludes overburden, waste rock and tailings from mining, except from primary mercury mining, unless they contain mercury or mercury compounds above thresholds defined by the Conference of the Parties.

To assist with reaching agreement on thresholds for each of the three categories, the Conference of the Parties, in Decision 2/2, established a group of technical experts. At its 3rd meeting, the Conference of the Parties took note of the work of the group of experts and adopted Decision 3/5, which states that:

- No threshold needs to be established for mercury waste falling under subparagraph 2 (a) of Article 1. Waste listed in Table 1 of the Annex to decision MC 3/5 shall be regarded as such mercury waste.
- No threshold needs to be established for mercury waste falling under subparagraph 2 (b) of Article 11, and that mercury-added products that are disposed of, are intended to be disposed of, or are required to be disposed of, including those listed in Table 2 of the Annex to decision MC 3/5, shall be regarded as such mercury waste.

The Conference of the Parties did not reach a decision on thresholds for subparagraph 2 (c). Instead, the Conference of the Parties extended the mandate of the group of technical experts until the fourth meeting of the Conference of the Parties and requested that the group continue its work and further substantiate that a total concentration threshold may be appropriate for mercury wastes falling under subparagraph 2 (c) of Article 11, including a technical analysis of options and the consideration of possible impacts. However, neither the group of experts nor the Conference of the Parties at its fourth meeting were able to reach a consensus on threshold values for subparagraph 2 (c) mercury wastes. The Conference of the Parties adopted Decision 4/6, which extended the mandate of the group of technical experts to undertake further work for consideration at the fifth meeting of the Conference of the Parties.

The decision also invited Parties to:

"*Share information and data on the waste categories listed in the indicative list contained in Table 3 of the Annex to Decision MC-3/5, including with respect any relevant national or local thresholds and their establishment, and requests the Secretariat to compile such information and distribute it to the group of technical experts as soon as possible and make it available electronically."*

The information in the appendix to this annex represents the contribution of the United States of America in support of the work of the group of technical experts.

Appendix

Relevant National Regulations and Standards Submission by the United States of America – July 2022

As indicated in its 2021 National Report, the United States has a broad, effective system of environmental management that provides for high levels of environmental protection, including through a set of media-specific environmental laws and regulations. These environmental laws and regulations are carefully designed, effectively implemented, and enforced. They are complemented by transparency and public participation requirements, and an independent judiciary, which further underscore their effectiveness. The relevant regulations and standards are as follows:

- **Waste containing or contaminated with mercury that is not hazardous waste** which does not leach more than 0.2 mg/L mercury in the Toxic Characteristic Leaching Procedure Test[1] (TCLP) can be sent for final disposal in a municipal solid waste landfill (MSWLF) or an industrial non-hazardous waste landfill. In addition, hazardous waste containing or contaminated with less than 260 mg/kg total mercury may, after treatment to control leaching, be land disposed in a MSWLF, an industrial non-hazardous landfill, or a hazardous waste landfill. These are considered final disposal in the United States.
- **Hazardous waste containing or contaminated with 260 mg/kg or more total mercury** must undergo thermal treatment (retort) to separate and recover the mercury from the waste. The recovered elemental mercury may be considered a product (for domestic use only), or if it is not used, a waste.
- **Storage, transport, treatment, and disposal (or recycling) of hazardous wastes**, **including mercury** is regulated under the Resource Conservation and Recovery Act (RCRA). RCRA describes a comprehensive waste management program that requires different levels of management for waste depending on the hazards it poses. Under applicable regulations, waste containing mercury may be regulated as hazardous based on the concentration of leachable mercury in the waste, or if it exhibits another hazardous "characteristic."[2] (Part 261 under Title 40 of the Code of Federal Regulations (40 C.F.R. Part 261)). **Mercury-containing hazardous waste** is regulated under RCRA must meet specific treatment standards before land disposal. High concentration mercury wastes generally must be roasted or chemically retorted (*i.e.*, thermally treated or distilled) to recover mercury for reuse before the wastes may be land-disposed. Low concentration mercury wastes may undergo stabilization treatment (to reduce mercury leaching) before it can be land-disposed, although recycling to recover the mercury is allowed as an option. (40 C.F.R. Part 268).
- **Industrial or commercial mercury-containing wastes** that are not regulated as hazardous waste under RCRA may be disposed of in non-hazardous waste landfills, which are regulated by the 50 U.S. states and subject to federal minimum criteria. (40 C.F.R. Parts 257-58).

[1] Toxicity characteristics (40 CFR 161.24)

- A solid waste (except manufactured gas plant waste) exhibits the characteristic of toxicity if, using the Toxicity Characteristic Leaching Procedure, test Method 1311 in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, as incorporated by reference in §260.11 of this chapter, the extract from a representative sample of the waste contains any of the contaminants listed in table 1 at the concentration equal to or greater than the respective value given in that table. Where the waste contains less than 0.5 percent filterable solids, the waste itself, after filtering using the methodology outlined in Method 1311, is considered to be the extract for the purpose of this section.
- D009 mercury, CAS 7439-97-6, the regulatory level is 0.2 mg/L TCLP
- Hazardous wastes from specific sources – expected to be hazardous due to mercury content based on the narrative description (40 CFR 261.32).
- K071 Brine purification muds from the mercury cell process in chlorine production, where separately pre-purified brine is not used
- K106 Wastewater treatment sludge from the mercury cell process in chlorine production
- K175 Wastewater treatment sludges from the production of vinyl chloride monomer using mercuric chloride catalyst in an acetylene-based process

[2] A RCRA characteristic hazardous waste is a solid waste that exhibits at least one of four characteristics defined in 40 CFR Part 261 subpart C — ignitability, corrosivity, reactivity, and toxicity.

Household wastes, including those that may contain mercury (e.g., spent mercury lamps), must be disposed in municipal solid waste landfills. (40 C.F.R. Part 258).

- **Sewage sludge (biosolids)** are regulated under the Clean Water Act may be used for application to land, to condition the soil or to fertilize crops or other vegetation if specified pollutant limits for mercury and other pollutants are met. The following four conditions, expressed as dry weight concentrations of mercury in the sludge, must be met before mercury-containing sludge may be used for land application: (1) the maximum concentration of mercury in the applied sludge must not exceed 57 mg/kg, (2) the cumulative pollutant loading rate must not exceed 17 kg/hectare, (3) the monthly average concentration must not exceed 17 mg/kg, and (4) the annual pollutant loading rate must not exceed 0.85 kg/hectare per 365-day period. There are also restrictions on where and how biosolids, including sewage sludge, can be applied. (40 CFR 503.13).
- In general, **export of hazardous wastes** from the United States is prohibited unless the exporter has submitted a notification with details of the proposed shipments and received confirmation that the receiving country and any transit countries have approved the export. (Part 6938 (a) of Title 42 of the United States Code (42 U.S.C. § 6938(a))). Where an international agreement exists addressing notice, export, and enforcement procedures for the transportation, treatment, storage, and disposal of hazardous wastes, U.S. law allows exports in compliance with such an agreement. (42 U.S.C. § 6938(a)(2) and (1)). In addition, the U.S. Department of Transportation hazardous materials regulations have been harmonized with international recommendations on transport of dangerous goods. (49 C.F.R. Part 172).

Mercury Treatment Standards for Hazardous Wastes (40 CFR 268.40)[3]

- **Nonwastewaters** that exhibit, or are expected to exhibit, the characteristic of toxicity for mercury based on the Toxicity Characteristic Leaching Procedure (TCLP) in SW846; and contain greater than or equal to 260 mg/kg total mercury that also contain **organics** and are not incinerator residues (High Mercury-Organic Subcategory). Applicable treatment standards: IMERC; OR RMERC
- **Nonwastewaters** that exhibit, or are expected to exhibit, the characteristic of toxicity for mercury based on the toxicity characteristic leaching procedure (TCLP) in SW846; and contain greater than or equal to 260 mg/kg total mercury that are **inorganic**, including incinerator residues and residues from RMERC (High Mercury-Inorganic Subcategory) Applicable treatment standard: RMERC
- **Nonwastewaters** that exhibit, or are expected to exhibit, the characteristic of toxicity for mercury based on the toxicity characteristic leaching procedure (TCLP) in SW846; and contain less than 260 mg/kg total mercury and that are residues from RMERC only (Low Mercury Subcategory). 0.20 mg/L TCLP and meet § 268.48 standards
- **All other non-wastewaters** that exhibit, or are expected to exhibit, the characteristic of toxicity for mercury based on the toxicity characteristic leaching procedure (TCLP) in SW846; and contain less than 260 mg/kg total mercury and that are not residues from RMERC (Low Mercury Subcategory). 0.20 mg/L TCLP and meet § 268.48 standards

[3] **Applicable treatment standards, technology codes and description of technology-based standards (40 CFR 268.42)**

- IMERC: Incineration of wastes containing organics and mercury in units operated in accordance with the technical operating requirements of 40 CFR part 264 subpart 0 and part 265 subpart 0. All wastewater and nonwastewater residues derived from this process must then comply with the corresponding treatment standards per waste code with consideration of any applicable subcategories (e.g., High or Low Mercury Subcategories).
- RMERC: Retorting or roasting in a thermal processing unit capable of volatilizing mercury and subsequently condensing the volatilized mercury for recovery. The retorting or roasting unit (or facility) must be subject to one or more of the following: (a) a National Emissions Standard for Hazardous Air Pollutants (NESHAP) for mercury; (b) a Best Available Control Technology (BACT) or a Lowest Achievable Emission Rate (LAER) standard for mercury imposed pursuant to a Prevention of Significant Deterioration (PSD) permit; or (c) a state permit that establishes emission limitations (within meaning of section 302 of the Clean Air Act) for mercury. All wastewater and non-wastewater residues derived from this process must then comply with the corresponding treatment standards per waste code with consideration of any applicable subcategories (e.g., High or Low Mercury Subcategories).

Universal Treatment Standards from 40 CFR 268.48

- Mercury – Non-wastewater from Retort 0.20 mg/l TCLP
- Mercury – All Others – Wastewater standard 0.15 mg/l
- Mercury – All Others – Non-wastewater standard 0.025 mg/l TCLP

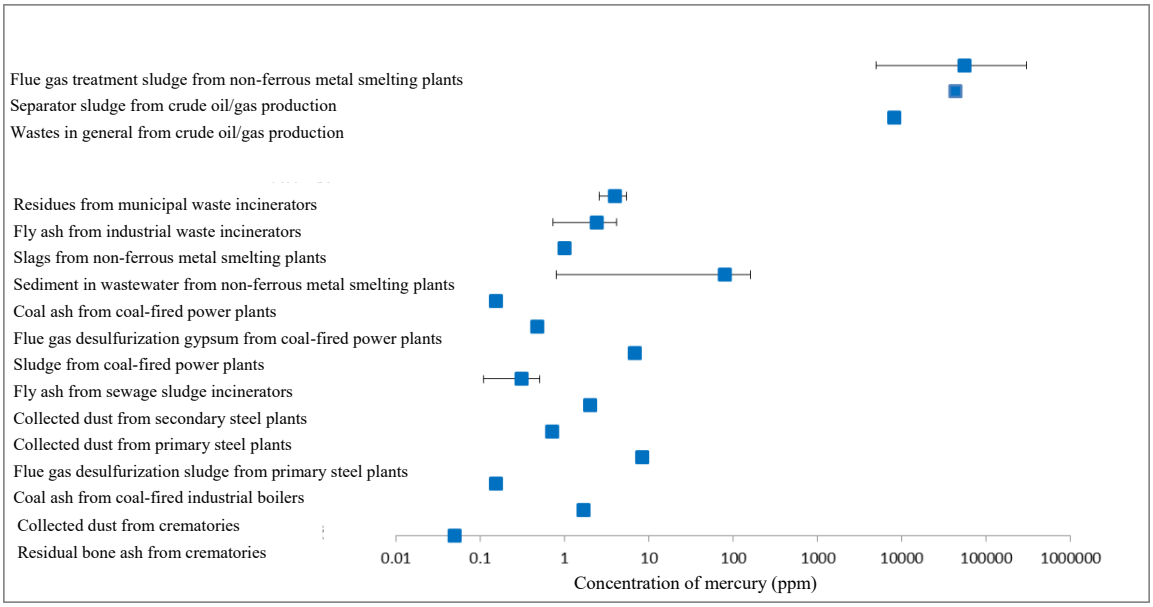
- **All wastewaters** that exhibit, or are expected to exhibit, the characteristic of toxicity for mercury. 0.15 mg/L TCLP and meet § 268.48 standards

Data on mercury in waste from Document UNEP/MC/COP.2/INF/10 and past submissions

Document UNEP/MC/COP.2/INF/10 includes data from Japan, the Republic of Korea and Sweden as follows.

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).

Figure 2

Mercury concentrations of the industrial wastes generated in ROK

(Blue squares are the mean values and error bars are the standard deviations)

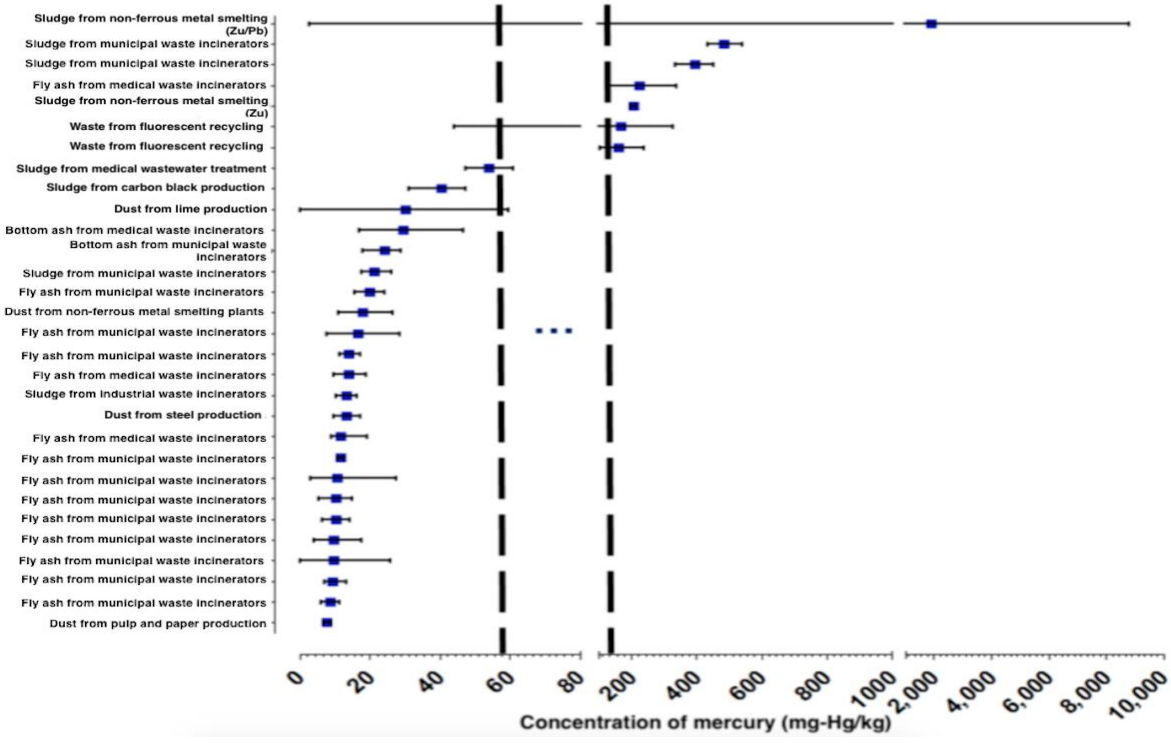


Figure 3
Inventory of Swedish mercury waste (modified from SEPA 1997). The diagram shows cumulative amounts in descending order

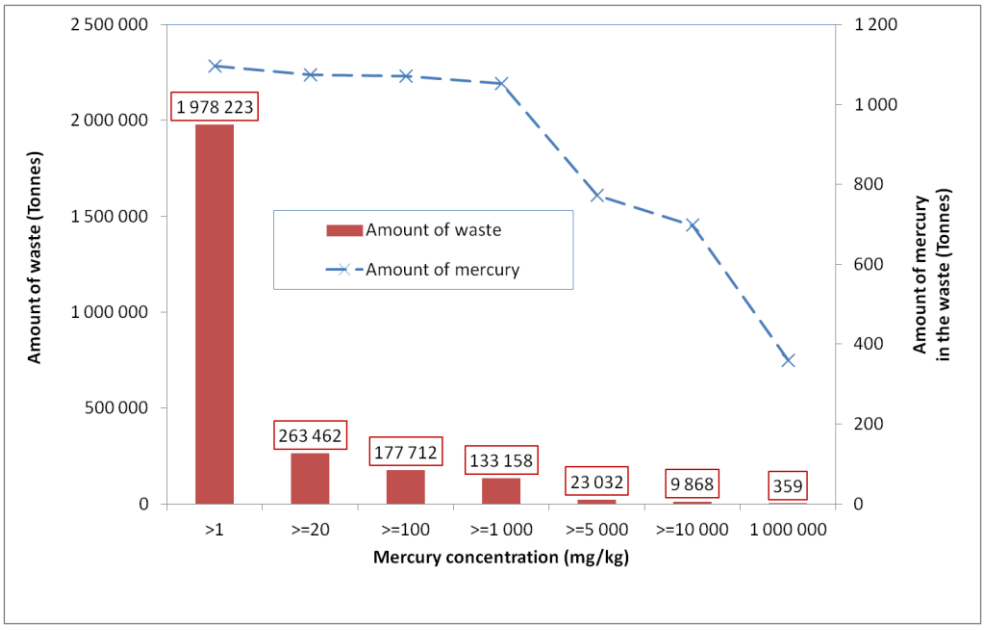
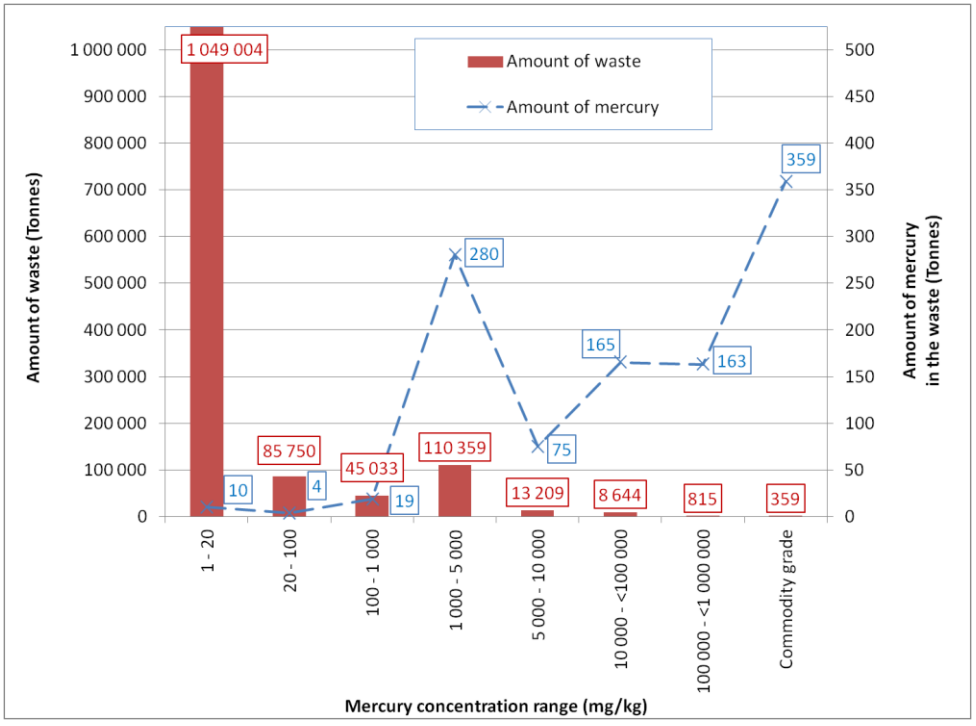


Figure 4
Inventory of Swedish mercury waste (modified from SEPA 1997). The diagram shows the amounts within specific mercury concentration ranges.



An expert from Confederation of European Waste-to-Energy Plants (CEWEP) presented the following data.

After a survey among CEWEP members I can now send you some examples of typical content of mercury in European bottom ash from waste incineration:

Example	*Average*	*90th percentile*
1	0.047 mg/kg	0.099 mg/kg
2	0.042 mg/kg	0.082 mg/kg
3	0.330 mg/kg	0.669 mg/kg

Example	*Average*	*90th percentile*
4	0.078 mg/kg	0.090 mg/kg
5	0.1 mg/kg	0.230 mg/kg

This is also to show why we have some doubts on whether it is appropriate to consider bottom ash in the list of potentially contaminated waste, since the concentration is normally close or below the detection limit.

Existing thresholds in selected from Document UNEP/MC/COP.2/INF/10 and past submissions

Document UNEP/MC/COP.2/INF/10 includes reference to existing mercury thresholds in the waste ordinance in Switzerland[4] and regulations in China as follows.

Mercury waste thresholds in Switzerland

Annex 3 (ref. in article 17)	Requirement for demolition and excavation material (unpolluted)	0,5 mg Mercury / kg dry matter
Annex 3 (ref. in article 17)	Requirement for demolition and excavation material (subject to further use in construction materials)	1 mg Mercury / kg dry matter
Annex 4 (ref. in article 24)	Requirement for waste, used as raw material in cement and concrete production 1) Use of waste as raw material and raw mix corrective in cement clinker production	1 mg Mercury / kg dry matter
	2) Use of waste as alternative fuel in cement clinker production	1 mg Mercury / kg dry matter
Annex 5	Requirement for waste put in a landfill 1) Type B landfill (inert waste)	2 mg Mercury / kg dry matter 0,01 mg Mercury / Litre dry matter (leaching)
	2) Type C landfill (solidified fly ashes of MSWI1)	The total content of mercury may not exceed 5 mg / kg dry matter for metal-containing, inorganic and badly soluble waste
	3) Type D landfill (slag of MSWI)	5 mg Mercury / kg dry matter
	4) Type E landfill (other waste, slightly reactive)	5 mg Mercury / kg dry matter

The method of identifying hazardous waste in China

According to *《Identification standards for hazardous wastes General specifications》*（GB5085.7-2007）, the hazardous wastes are those wastes that are listed on national hazardous waste list, or the ones that are identified having one or more hazardous characteristics, including corrosivity, toxicity, flammability, reactivity and infectivity based on national hazardous waste identification criteria and methods, and those solid wastes that could not find proof to prove they had none of above mentioned hazardous characteristics, also might be identified as a hazardous waste.

For the identification of hazardous wastes that containing mercury, leaching toxicity and total content toxic substances are usually used, in addition to the identification of corrosivity, reactivity and flammability.

(1) Identification method of leaching toxicity and the threshold

According to the requirement of the standard methods of *Solid waste- Extraction procedure for leaching toxicity- sulphuric acid and nitric acid method（HJ/T299-2007）*, preparation methods of the leaching test solution for mercury and other metals are as follows: Prepare the extracting solution by adding the mixture of concentrated sulfuric acid and concentrated nitric acid in a 2:1 ratio (w/w) into reagent water, to adjust the pH value to 3.20±0.05. Weigh the waste samples that going to extract, and calculate the volume of extract required according to a liquid-solid ratio of 10:1. If the total mercury concentration in the leachate does not exceed the threshold limit (0.1mg/L), and no alkyl mercury is detected (i.e. Methyl mercury <10ng/L; ethyl mercury <20ng/L), then the solid waste will be regarded as having no hazardous characteristics of leaching toxicity.

(2) Identification method for total toxic substances and its threshold

According to *Identification standards for hazardous wastes-Identification for toxic substance content（GB 5085.6-2007）*, there are five annexes of chemical compounds with different toxicity, in the five annexes,

[4] https://www.admin.ch/opc/fr/classified-compilation/20141858/index.html

there is only in annex A and Annex B that can find the mercury compound, but none in others. In annex A we can find mercuric iodide, thiocyanate mercury, mercuric chloride, mercuric cyanide and mercury nitrate, etc, and the threshold 0.1% is applies for the total content of above mentioned mercury compound. In annex B, only can found mercurous bromide, and the threshold is 3%. For mixtures, the sum of the toxicity of all the components in all annexes is taken into account. If a mercury waste meet any of such three situations, it can be identified as a (mercury) hazardous waste.

4.2 The relevant regulations of mercury content or waste mercury related to waste management and disposal in China

(1) the criteria for entering the municipal solid waste (MSW) landfills

According to *Standard for Pollution Control on the Landfill Site of Municipal Solid Waste（GB18485-2014）*, if the concentration of hazardous ingredients in the leachate obtained according to *The Solid waste – Extraction procedure for leaching toxicity – Acetic acid buffer solution method (HJ / T300-2007)* are lower than the thresholds setting in *GB18485-2014* , municipal solid waste incineration (MSWI) fly ash, medical waste incineration residue, and general industrial solid waste, can be disposed in MSW landfills in a separated space. Among them, the threshold of mercury is 0.05mg/L.

(2) co-processing waste in Cement kiln

Wastes containing mercury are prohibited from being co-processed in cement kilns based on the requirements of *Standard for pollution control on co-processing of solid wastes in Cement kiln（GB30485-2013）*. The solid waste prohibited from entering cement kilns and which is related to mercury waste are as follows:

（a）spent batteries, used household appliances and electronic devices that are not dismantled;

（b）Thermometers, sphygmomanometers, fluorescent tubes and switches containing mercury;

（c）wastes unidentified wastes and with unknown characteristics.\

(3) regulation related to identification of Contaminated Soil

According to the requirement of *Identification standards for solid wastes-General rules（GB34330-2017）*, in the activities of contaminated site remediation and disposal, contaminated soil will be managed as solid wastes if it is handled, disposed or utilized in the following ways: (a) landfill; (b) incineration; (c) cement kiln co-processing; (d) used to produce construction materials, such as bricks, tiles and road materials, etc.

Document UNEP/MC/COP.1/INF/10 includes the following table summarizing thresholds in different jurisdictions.

Country	*Total content threshold*	*Leaching threshold*	*Others*
Japan	15 Hg-mg/kg (Threshold to determine whether they are recognized as mercury wastes or not in Japan) 0.05 Hg-mg/L for liquid wastes (Threshold to determine whether they are hazardous wastes	0.005 Hg-mg/L (Threshold to determine whether they are hazardous wastes and can be landfilled or not)	Another threshold (e.g. 0.1 % of mercury content) exist, which is a common threshold for wastes that are subject to trade restrictions under the Basel Convention and for recyclable materials containing mercury. Specific mercury-added products are designated as industrial wastes of mercury-added products which require specific handling/treatment.
United States of America		0.2 Hg-mg/L (Threshold to determine whether they are hazardous wastes or not) 0.025 Hg-mg/L (Threshold to determine whether they can be landfilled or not)	The U.S. hazardous waste regulations also categorically classify surplus elemental mercury being discarded as hazardous waste.
European Union	17 Hg-mg/kg (dry) (Threshold to determine non-hazardous sediments by the Spanish Inter-ministry Commission for Marine Strategies)	0.2 Hg-mg/kg (L/S = 10 l/kg) (Threshold to determine whether they can be accepted in landfills for inert or non-hazardous waste) 2 Hg-mg/kg (L/S = 10 l/kg)	

Country	*Total content threshold*	*Leaching threshold*	*Others*
		(Threshold to determine whether they can be accepted in landfills for hazardous waste)	
Brazil		0.1 Hg-mg/L (Target of this threshold is unavailable) 0.001 Hg-mg/L (Threshold to determine whether they are inert or not)	There are no thresholds to determine whether mercury wastes are hazardous or not, as all mercury wastes are classified as hazardous wastes.
China	0.1 % for mercury iodide, mercury thiocyanate, mercuric chloride, mercuric cyanide, and mercury bromide (All substances subject to the threshold are prescribed in the National Hazardous Wastes List)	Methylmercury: 0.01 Hg-µg/L Ethyl mercury: 0.02 Hg-µg/L Total mercury: 0.1 Hg-mg/L Threshold for landfill disposal is 0.05 Hg-mg/L (All substances subject to the threshold are prescribed in the National Hazardous Wastes List)	
Norway	0.1 % (Threshold to determine whether they are hazardous wastes or not)	None	
Mexico	None	0.2 Hg-mg /L (Threshold to determine whether they are hazardous wastes or not)	
Switzerland	0.01 Hg-mg/L (for liquid wastes) 5 Hg-mg/kg (for wastes other than liquid wastes) (Thresholds to determine whether they are hazardous wastes or not)		
Republic of Korea		0.005 Hg-mg/L (Threshold to determine whether they are hazardous wastes or not)	Disposed mercury-added products are recycled after mercury is recovered and the residuals are disposed in waste landfill if the mercury content is less than 0.005 mg/L by the leaching test.
Thailand	20 Hg-mg/kg (Threshold to determine whether they are hazardous wastes or not)	0.2 Hg-mg/l (Threshold to determine whether they are hazardous wastes or not)	

During the previous intersessional period, experts submitted the following information.

Indonesia

Based on Government Regulation of the Republic of Indonesia Number 101 Year 2014 on Hazardous and Toxic Waste Management

Quality Standards based on Government Regulation No. 101 of 2014

Pollutant	*TCLP-A*	*TK-A*	*TCLP-B*	*TK-B*	*TCLP-C*	*TK-C*
Unit (dry weight)	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg
Total mercury (Hg)	0.3	300	0.05	75	0.02	0.3

a. If the concentration of pollutant is bigger than TCLP-A and / or the total concentration of A, the soil is referred to be managed in accordance with the hazardous waste management category 1

b. If the concentration of pollutant is equal to or less than TCLP-A and / or the total concentration of A and bigger than TCLP-B and / or total concentration of B, the soil is referred to be managed in accordance with the hazardous waste management category 2

c. If the concentration of pollutant is equal to or less than TCLP-B and / or the total concentration of B and bigger than TCLP-C and / or total concentration of C, the soil is referred to be managed in accordance with non- hazardous waste management

d. If the concentration of pollutant is equal to or less than TCLP-C and the total concentration of C, the soil referred to can be used as soil base coat

Minister of Environment Decree No. 19 of 2010 tentang Quality Standards of Wastewater in Business and/or Oil and Gas and Geothermal Activities

Wastewater Item	*Parameters*	*Unit*	*Maximum Concentration*	*Analysis Method*
Produced water	Mercury	mg/L	0.005	SNI 06-2462-1991 or SNI 06-2912-1992 or APHA 3500-Hg

Minister of Environment Decree No. 202 of 2004 concerning Quality Standards for Wastewater in Business and/or Mining Activities of Gold Ore and/or Copper

1) Mining Activities

Parameters	*Unit*	*Maximum Concentration*	*Analysis Method*
Hg (Dissolved mercury)	mg/L	0.005	SNI 06-2462-1991

2) Processing Activities

Parameters	*Unit*	*Maximum Concentration*	*Analysis Method*
Hg (Dissolved mercury)	mg/L	0.005	SNI 06-2462-1991

*SNI= Indonesian National Standard

Iran (Islamic Republic of)

National soil standards of Iran

The soil standards and soil clean-up values have been calculated for five different land-use exposure scenarios. The land-use scenarios were residential, parks and recreation, commercial/industrial, agricultural, and natural lands. The potential pathways of exposure to contaminants in soil are direct ingestion, ingestion of contaminated ground water caused by migration of chemicals through soil to an underlying potable aquifer, dermal absorption, ingestion of produce that has been contaminated via plant uptake All the standards were calculated for alkaline, pH>7, and acidic, pH<7, soils.

National soil standards for mercury in Iran (pH<7)					
Land use	natural lands	agriculture	parks and recreation	industrial	residential
(Hg) (mg/kg)	5	5	5	30	5

National soil standards for mercury in Iran (pH<7)							
Land use/ purpose	natural lands	agriculture	parks and recreation	industrial	residential	Food safety	Ground water protection
(Hg) (mg/kg)	55	7	55	55	15	12	10

Instruction for determining the threshold of mercury waste added into Soil in Iran

Many toxic materials and pollutants that are added to soils are serious threat for human animals and plants. Department of Environment of Iran in a project the maximum allowable discharge of pollutants added into the soil via different kinds of wastes have been determined. Risk assessments for discharge of wastes into agricultural and non-agricultural lands (forests, land can be restored, contact public places, industrial) were calculated. Risk assessments for nine exposure pathways were identified for agricultural and non-agricultural land uses. The pathways included consumers ingesting plants grown in waste-amended soils (pathway one), children ingesting waste materials directly (pathway two), farms producing animal products that consumed eat plants grown in waste-amended soils (pathway three), human consumption of livestock that ingest soil directly from waste material directly while grazing (pathway four), livestock ingesting crops grown on waste-amended soils (pathway five), grazing livestock ingesting waste-amended soils (pathway six), plant grown in waste-amended soils (pathway seven), soil biota living in waste-amended soil (pathway eight), and hanuman consuming groundwater that are directly located under waste disposal site (pathway nine). The limit concentration of the pollutant that is allowable to be applied to the soil is lowest amounts that have been calculated among the nine pathways. In this project the threshold of mercury were calculated for waste added into soil in the following:

1-Threshold of mercury waste in agricultural land use= 16 ppm

2- Threshold of mercury waste in forest land use= 20 ppm

3- Threshold of mercury waste in contact public places = 16 ppm

4- Threshold of mercury waste in Soil Reclamation=20 ppm

5- Threshold of mercury waste in industrial land use= 23 ppm

6- Threshold of mercury waste in landfill site= 23 ppm

Republic of Korea

1. Regulation on mercury waste in the Republic of Korea

In the Republic of Korea, the Waste Control Act has been revised for environmentally sound management of mercury waste, and the revised the Waste Control Act is expected to enforced from July 2021.

In the Republic of Korea, legal legislation for Category A and B waste were prepared last year. The regulation on Category C waste will be prepared by considering the decision of the Minamata Convention and the situation of the domestic industry.

- Classification of mercury waste (Article 3, Enforcement decree of Waste Control Act)
  - Mercury waste:

(a) Mercury containing waste: It refers to waste lamps containing mercury and its compounds (excluding fluorescent lamps), waste measuring devices (thermometer, blood pressure monitor, thermometer, etc.), waste batteries, and other waste products notified by the Minister of Environment.

(b) Mercury consisting waste: limited to mercury separated from mercury-containing waste and its compounds

(c) Residue from mercury containing waste treatment: It includes those generated in the process of treating mercury containing wastes and those generated in the process of recycling fluorescent lamps, and limited to those containing mercury and its compounds of 0.005 mg/L or more as a result of leaching test.

  - Treatment: In the case of mercury waste, it must be disposed of in one of the following ways:

(a) Mercury containing waste is collected and disposed of, but mercury containing waste generated as a result of the treatment must contain less than 0.005 mg/L of mercury and its compounds as a result of leaching test.

(b) Mercury consisting waste must be stored permanently in exclusive container. In this case, the standards for the storage location shall be in accordance with the Chemical Substance Control Act.

(c) Residue from treatment of mercury containing waste must be double-packed with high-density water-resistant materials such as polyethylene, or stabilized or solidified and disposed of to be landfilled.

- Installation standards for mercury recovery facility (Article 35 Enforcement Regulation of Waste Control Act)

(a) A heating device must be provided so that mercury waste can be roasted at a temperature of 600 ˚C or higher (if equipped with a pressure control device capable of maintaining a depressurized state during the mercury recovery process, a heating device capable of roasting at a temperature of 450 ˚C or higher).

(b) A condensing system should be installed to recover mercury in the vaporized state.

(c) A device that can measure the temperature and pressure inside the mercury recovery process should be installed.

(d) The structure should be able to prevent the mercury vapor from being leaked to the outside during the mercury recovery process.

- Management standards for mercury recovery facility (Article 42 Enforcement Regulation of Waste Control Act)

(a) The supply of mercury containing waste must be adjusted and put in order to match the capacity of the mercury recovery facility.

(b) Temperature and pressure must be adjusted so that mercury recovery can be properly performed.

(c) Mercury vapors generated during the mercury recovery process must be prevented from leaking to the outside.

2. Regulatory levels on mercury in waste management

In the Republic of Korean waste management sector, there are regulatory levels that apply to the classification of hazardous or non-hazardous wastes, recycling (purpose and use of recycled materials), and the transboundary movement of waste under the Basel Convention.

In the classification of hazardous or non-hazardous waste, leaching concentration is used, and the value for mercury and its compounds is set at 0.005 mg/L.

Regulatory levels applied to recycling (purpose and use of recycled materials) are set differently according to the type of waste or the source of the waste generation. Therefore, there are various type of wastes, and the regulatory levels on the type of recycling applies either total concentration of mercury or leaching concentration.

In addition, guidelines for waste subject to transboundary movement of waste under the Basel Convention are prepared. In the guideline, mercury containing 0.1% or more is classified as subject to control under the Basel Convention.

The regulatory levels applicable to the classification of hazardous or non-hazardous waste, recycling and transboundary movement of waste in the Republic of Korea are shown in Table 1.

Table 1
Regulatory levels on mercury in waste management in the Republic of Korea

Application	*Approach*	*Regulatory level*	*Standards[a)]*
Identification of hazardous and non-hazardous wastes	Leaching concentration	– Mercury and its compounds: 0.005 mg/L	Korean official test method on waste
Slag from the process of smelting metal or non-metal is used for cement manufacturing	Total concentration of Hg	– Total mercury: 2.0 mg/kg (from copper, zinc and other smelting process)	
	Leaching concentration	– Mercury and its compounds: 0.003 mg/L (from other smelting process	
Recycling of incineration and bauxite residues as raw materials in ceramic industries	Total concentration of Hg	– Total mercury: 16.0 mg/kg	
	Leaching concentration	– Mercury and its compounds: 0.001 mg/L	

Application	*Approach*	*Regulatory level*	*Standards[a)]*
Recycling general waste as an alternative material for cement	Total concentration of Hg	– Total mercury: 2.0 mg/kg (alternative material of iron, slag from copper and zinc smelting process, dust collected at air pollution prevention facilities among wastes of steel mills)	
Recycling waste organic solvents, waste paints, etc. as recycled organic solvents excluding waste isopropyl alcohol	Total concentration of Hg	– Mercury and its compounds: 1.0 mg/L (Liquid waste)	
Manufacture of liquid waste generated from food waste treatment as an organic carbon source in water pollution prevention facilities	Total concentration of Hg	– Mercury and its compounds: 0.005 mg/L (Liquid waste) (Applying the regulatory level of the Water Environment Conservation Act)	Korean official test method on water pollution process
Produce artificial soil used for ecological restoration and greening, Use as filling materials for land and Cover materials in landfill site	Total concentration of Hg	– 1 area[b)]: 4 mg/kg – 2 area[c)]: 10 mg/kg – 3 area[d)]: 20 mg/kg (Applying Concern standards for soil pollution under the Soil Environment Conservation Act)	Korean official test method on soil
Auxiliary fuel for cement kiln	Total concentration of Hg	– Total mercury: 1.2 mg/kg (waste excluding hazardous waste) 1.0 mg/kg (woody waste)	Korean official test method on waste, SRF quality inspection method
Reclaimed fuel oil	Total concentration of Hg	– Total mercury: 1.0 mg/kg	
Organic sludge recycled as fuel	Total concentration of Hg	– Total mercury: 1.2 mg/kg (dry basis)	
Solid Refuse Fuel (SRF) from waste	Total concentration of Hg	– Total mercury: 1.0 mg/kg (SRF), 1.2 mg/kg (Bio-SRF)	
To decide control or not under the Basel Convention	Total concentration of Hg	– Total mercury: 0.1%	Korean official test method on waste

[a] Standards of Leaching procedure and total concentration of Hg are described in Section 3.

[b] 1 area: Orchard, ranch site, school site, fish farm, park, historic site, etc.

[c] 2 area: Forestry, salt field, Warehouse land, river, maintenance land, water supply land, sports land, amusement park, religious land, and hybrid land, etc.

[d] 3 area: Factory site, parking lot, gas station site, road, railroad site, embankment, defense, military facility site

3. Standards of Leaching procedure and total concentration of Hg in the Republic of Korea

In the Republic of Korea, the method for analysis of mercury concentration is summarized in Table 2. The major methods to analyze mercury are as follows:

- Total concentration of Hg (Waste and soil):
  - Analysis of Hg: Mercury in waste and soil is analyzed by “thermal decomposition, amalgamation-atomic absorption spectrophotometry”. This method is referred to US EPA method 7473 (so called gold amalgamation method in the Republic of Korea). The sample is prepared homogeneously by grinding to 500 μm or less, and 0.001-1 g of the analysis sample is injected into the sampler. When the sample is injected, drying and thermal decomposition are performed under oxygen conditions, and the decomposed material

reaches the gold amalgamator and only mercury is selectively separated. Then, it is heated again to high temperature to atomize mercury, and then the mercury is measured at a wavelength of 253.7 nm. Temperature of drying and thermal decomposition, and retention time in the gold amalgamator may vary depending on the manufacturer of the apparatus and the amount of sample.

  - Standards: ES 06906.1 (Metal Contents-Mercury-Thermal Decomposition Amalgamation Atomic Absorption Spectrophotometry); ES 07405.2 (mercury-thermal decomposition amalgamation atomic absorption spectrophotometry)
  - Reference standards: US EPA method 7473
  - Duration of one analysis: 2 weeks (analysis in accreditation institution)
  - Cost of one analysis: about 8 USD (analysis in accreditation institution)
  - Cost of apparatus: about 53,000 USD (Mainly use: Direct Mercury Analyzer; DMA-80, Milestone Inc.)

- Leaching concentration of Hg:
  - Leaching procedure of waste (ES 06150.c): For the leaching test of wastes, the sample is adjusted to less than 5mm, the leaching operation is performed with the ratio of the sample and the leaching solution to 1:10 (solid : leaching solution). The sample should be used at least 100g, and the leaching solution should be adjusted to pH 5.8 ~ 6.3 with HCl. Then, it is shaken for 6 hours using a horizontal shaker (rotation speed 200 rpm, amplitude 4-5 cm), filtered through 1.0 um glass fiber filter paper, and the filtrate is used as the test solution.
  - Analysis of Hg (Leaching solution, liquid waste, water): The sample is placed in a container and mercury is measured by moving the mercury vapor to the absorption cell of the AAS using a reducing-vaporization device.
- Standards: ES 06404.1a (Mercury-Cold Vapor-Atomic Absorption Spectrophotometry), ES 04408.1b (Mercury-Cold Vapor-Atomic Absorption Spectrometry)
- Reference standards: US EPA Method 7471A, US EPA Method 245.1, US EPA Method 245.2, US EPA Method 245.5, Standard Methods 3110, Standard Methods 3010 B
  - Duration: 2 – 3 weeks (analysis in accreditation institution)
  - Cost of one analysis: about 10 USD (analysis in accreditation institution) (Slightly higher than the cost of the total concentration of Hg by the Leaching procedure.)
  - Cost of apparatus: about 20,000 USD (AAS)

Table 2
Summary on standards on Hg in the Republic of Korea

Type		*Korean Standards*	*Limit of quantification*	*Reference standards*
Korean official test method on waste	Leaching procedure	ES 06150.c (Sample preparation)	–	–
	Analysis of mercury in Liquid from leaching procedure (incl. liquid waste)	ES 06404.1a (Mercury-Cold Vapor-Atomic Absorption Spectrophotometry)	0.0005 mg/L	US EPA Method 7471A, US EPA Method 245.5, US EPA Method 245.1, US EPA Method 245.2, Standard Methods 3110, Standard Methods 3010 B
		ES 06404.2 (Mercury-UV/Visible Spectrometry)	0.001 mg	US EPA Method 245.1
	Total concentration of Hg	ES 06906.1 (Metal Contents-Mercury-Thermal Decomposition Amalgamation Atomic Absorption Spectrophotometry)	0.01 mg/kg	US EPA method 7473

Type		*Korean Standards*	*Limit of quantification*	*Reference standards*
Korean official test method on water pollution process	Total concentration of Hg (Mercury in soil)	ES 07405.1a (mercury-cold vapor atomic absorption spectrophotometry)	0.05 mg/kg	US EPA Method 7471A, US EPA Method 245.5
		ES 07405.2 (mercury-thermal decomposition amalgamation atomic absorption spectrophotometry)	0.01 mg/kg	US EPA method 7473
Korean official test method on soil	Total concentration of Hg (Mercury in water)	ES 04408.1b (Mercury-Cold Vapor-Atomic Absorption Spectrometry)	0.0005 mg/L	US EPA Method 200.7, US EPA Method 245.2
		ES 04408.2b (Mercury-UV/Visible Spectrometry)	0.003 mg/L	US EPA Method 245.1, Standard method part 3500-Hg (APHA, AWWA, WEF)
		ES04408.3a (Mercury-Anodic Stripping Voltammetry)	0.0001 mg/L	EPA Method 7472
		ES 04408.4b (Mercury-Cold Vapor-Atomic Fluorescence Spectrometry)	0.0005 µg/L	US EPA Method 245.7, US EPA Method 1631

4. Other information on Hg management related to waste in the Republic of Korea

Other information on mercury management in relation to waste includes regulations on the emission of waste treatment facilities and regulations on the protection of workers' health. (Air Conservation Act and the Occupational Safety and Health Act are involved)

Regulations on the emission of facilities related to waste treatment can be divided into incineration facilities (including facilities using SRF from waste) and other facilities (pre-treatment, recycling facilities, etc.).

In addition, there are regulations for the health protection of workers in industries related to waste treatment. Acceptable standard for worker have been established for exposure concentration. In addition, special health checkup for workers must be performed, and items of mercury in blood and mercury in urine are set.

The regulatory levels established for these cases are shown in Table 3.

Table 3
Regulation related to mercury waste management in the Republic of Korea

Act	*Regulatory levels*
Clean Air Conservation Act	Emission (gas) – Wastewater, waste, waste gas incineration treatment facilities (including incineration boilers) and facilities using solid fuel product: 0.05 mg/Sm^3 – Power generation facility: 0.04 mg/Sm^3 – Sintering furnace among primary metal manufacturing facilities: 0.04 mg/Sm^3 – Cement kiln: 0.05 mg/Sm^3 – Other emission facilities: 0.1 mg/Sm^3
Occupational Safety and Health Act	Acceptable standard for worker exposure concentration – 0.025 mg/m^3 (8 hours of work) Special health checkup (Permissible concentration standards for hazardous substances in the working environment) – Mercury in blood: 3.5 µg/dL (inorganic mercury), 2 µg/dL (alkyl mercury) – Mercury in urine: 100 µg/dL (inorganic mercury), 20 µg/dL (alkyl mercury)