VICE PRESIDENT'S OFFICE

INVENTORY OF MERCURY RELEASES IN TANZANIA

[January, 2012]

INVENTORY OF MERCURY RELEASES IN

TANZANIA

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1 Executive summary

1.1 Introduction

The National Mercury Inventory for the United Republic of Tanzania has been developed by the Vice President's Office – Division of Environment through multi-stakeholders task force. Member of the task force were from: The Ministry of Energy and Mineral; The National Environment Management Council; and the Government Chemist Laboratory Agency.

The inventory was prepared in January, 2012. The inventory was carried out as the first step in taking measures for sound mercury management in the country.

The inventory was made with the use of the "Toolkit for identification and quantification of mercury releases" made available by the United Nations Environment Programme's Chemicals division (UNEP Chemicals). The Toolkit is available at UNEP Chemicals' website:

http://www.unep.org/hazardoussubstances/Mercury/MercuryPublications/GuidanceTrainingMaterialToolkits/MercuryToolkit/tabid/4566/language/en-US/Default.aspx.

This inventory was developed on the Toolkits Inventory Level 1. The Toolkit is based on mass balances for each mercury release source type. Inventory Level 1 works with pre-determined factors used in the calculation of mercury inputs to society and releases, the so-called default input factors and default output distribution factors. These factors were derived from data on mercury inputs and releases from such mercury source types from available literature and other relevant data sources.

1.2 Results and discussion

An aggregated presentation of the results for main groups of mercury release sources is presented in Table 1.1 below.

Table 1-1 Summary of mercury inventory results

Source category	Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y					
		Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
Coal combustion and other coal use	40.5	36.5	0.0	0.0	0.0	4.1	0.0
Other fossil fuel and biomass combustion	12,061.7	12,061.7	0.0	0.0	0.0	0.0	0.0
Oil and gas production	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Primary metal production (excl. gold production by amalgamation)	1,010,900.0	40,436.0	20,218.0	909,810.0	40,436.0	0.0	0.0
Gold extraction with mercury amalgamation	1,056.0	633.6	211.2	211.2	0.0	0.0	0.0
Other materials production	811.3	486.8	0.0	0.0	162.3	162.3	0.0
Chlor-alkali production with mercury-cells	-	-	-	-	-	-	-
Other production of chemicals and polymers	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Production of products with mercury content	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Use and disposal of dental amalgam fillings	-	-	-	-	-	-	-
Use and disposal of other products	61.2	6.1	18.4	0.0	0.0	36.7	0.0
Production of recycled metals	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste incineration and open waste burning	1.3	1.2	0.0	0.0	0.0	0.0	0.1
Waste deposition and waste water treatment	-	-	-	-	-	-	-
Informal dumping of general waste	2,010.3	201.0	201.0	1,608.2	-	-	-
Waste water system/treatment	174,134.0	0.0	156,720.6	0.0	0.0	17,413.4	0.0
Crematoria and cemeteries	8,205.7	0.0	0.0	8,205.7	0.0	0.0	0.0
TOTALS	**1,033,340.0**	**53,860.0**	**20,650.0**	**918,230.0**	**40,600.0**	**17,620.0**	**0.0**

Note *1: The estimated quantities include mercury in products which has also been accounted for under each product category. To avoid double counting these quantities have been subtracted automatically in the TOTALS.

As shown in the table, the following source groups contribute with the major mercury inputs: Primary metal production (excl. gold production by amalgamation); waste water system/treatment; other fossil fuel and biomass combustion; and crematoria and cemeteries; Informal dumping of general waste; Gold extraction with mercury amalgamation; and other materials production.

The individual mercury release sub-categories contributing with the highest mercury inputs were: Primary metal production (excl. gold production by Mercury amalgamation); waste water system/treatment; other fossil fuel and biomass combustion; and crematoria and cemeteries. The individual mercury release sub-categories contributing with the highest mercury releases to the atmosphere were: Primary metal production (excl. gold production by amalgamation); other fossil fuel and biomass combustion; Gold extraction with mercury amalgamation; and other materials production. Detailed presentation of mercury inputs and releases for all mercury release source types present in the country are shown in the following report sections.

2 Mercury release source types present

Table 2-1 shows which mercury release sources were identified as present and absent, respectively, in the country. Only source types positively identified as present are included in the quantitative assessment.

It should be noted however, that the presumably minor mercury release source types shown in Table 2-2 were not included in the detailed source identification and quantification work.

Table 2-1 Identification of mercury release sources in the country; sources present (Y), absent (N), and possible but not positively identified (?). [Overleaf]

Source category	Source present?
	Y/N/?
Energy consumption	
Coal combustion in large power plants	Y
Other coal uses	?
Combustion/use of petroleum coke and heavy oil	Y
Combustion/use of diesel, gasoil, petroleum, kerosene	Y
Use of raw or pre-cleaned natural gas	Y
Use of pipeline gas (consumer quality)	?
Biomass fired power and heat production	Y
Charcoal combustion	Y
Fuel production	
Oil extraction	N
Oil refining	N
Extraction and processing of natural gas	Y
Primary metal production	
Mercury (primary) extraction and initial processing	N
Production of zinc from concentrates	N
Production of copper from concentrates	N
Production of lead from concentrates	N
Gold extraction by methods other than mercury amalgamation	Y
Alumina production from bauxite (aluminium production)	N
Primary ferrous metal production (iron, steel production)	N
Gold extraction with mercury amalgamation - without use of retort	Y
Gold extraction with mercury amalgamation - with use of retorts	N
Other materials production	
Cement production	Y
Pulp and paper production	N
Production of chemicals	
Chlor-alkali production with mercury-cells	N
VCM production with mercury catalyst	N
Acetaldehyde production with mercury catalyst	N
Production of products with mercury content	
Hg thermometers (medical, air, lab, industrial etc.)	N

Electrical switches and relays with mercury	N
Light sources with mercury (fluorescent, compact, others: see guideline)	N
Batteries with mercury	N
Manometers and gauges with mercury	N
Biocides and pesticides with mercury	N
Paints with mercury	N
Skin lightening creams and soaps with mercury chemicals	N
Use and disposal of products with mercury content	
Dental amalgam fillings ("silver" fillings)	N
Thermometers	Y
Electrical switches and relays with mercury	N
Light sources with mercury	N
Batteries with mercury	N
Polyurethane (PU, PUR) produced with mercury catalyst	N
Paints with mercury preservatives	N
Skin lightening creams and soaps with mercury chemicals	N
Medical blood pressure gauges (mercury sphygmomanometers)	N
Other manometers and gauges with mercury	N
Laboratory chemicals	N
Other laboratory and medical equipment with mercury	N
Production of recycled of metals	
Production of recycled mercury ("secondary production")	N
Production of recycled ferrous metals (iron and steel)	N
Waste incineration	
Incineration of municipal/general waste	?
Incineration of hazardous waste	Y
Incineration of medical waste	Y
Sewage sludge incineration	N
Open fire waste burning (on landfills and informally)	N
Waste deposition/landfilling and waste water treatment	
Controlled landfills/deposits	N
Informal dumping of general waste *1	Y
Waste water system/treatment	Y
Crematoria and cemeteries	
Crematoria	N
Cemeteries	Y

Table 2-2 Miscellaneous potential mercury sources not included in the quantitative inventory; with preliminary indication of possible presence in the country.

Source category	Source present?
	Y/N/?
Combustion of oil shale	N
Combustion of peat	N
Geothermal power production	N
Production of other recycled metals	Y
Production of lime	Y
Production of light weight aggregates (burnt clay nuts for building purposes)	Y
Chloride and sodium hydroxide produced from mercury-cell technology	N
Polyurethane production with mercury catalysts	N
Seed dressing with mercury chemicals	N
Infra red detection semiconductors	N
Bougie tubes and Cantor tubes (medical)	N
Educational uses	Y
Gyroscopes with mercury	N
Vacuum pumps with mercury	N
Mercury used in religious rituals (amulets and other uses)	N
Mercury used in traditional medicines (ayurvedic and others) and homeopathic medicine	N
Use of mercury as a refrigerant in certain cooling systems	N
Light houses (levelling bearings in marine navigation lights)	N
Mercury in large bearings of rotating mechanic parts in for example older waste water treatment plants	N
Tanning	N
Pigments	N
Products for browning and etching steel	N
Certain colour photograph paper types	N
Recoil softeners in rifles	N
Explosives (mercury-fulminate a.o.)	N
Fireworks	N
Executive toys	N

3 Summary of mercury inputs to society

Mercury inputs to society should be understood here as the mercury amounts made available for potential releases through economic activity in the country. This includes mercury intentionally used in products such as thermometers, blood pressure gauges, fluorescent light bulbs, etc. It also includes mercury mobilised via extraction and use of raw materials which contains mercury in trace concentrations.

Table 3-1 Summary of mercury inputs to society

Source category	Source present?			Estimated Hg input, Kg Hg/y
	Y/N/?	Activity rate	Unit	Standard estimate
Energy consumption				
Coal combustion in large power plants	Y	150,000	t coal combusted/y	41
Other coal uses	?	0	t coal used/y	?
Combustion/use of petroleum coke and heavy oil	Y	520,641	t oil product combusted/y	29
Combustion/use of diesel, gasoil, petroleum, kerosene	Y	1,732,225	t oil product combusted/y	10
Use of raw or pre-cleaned natural gas	Y	234,329,261	Nm3 gas/y	23
Use of pipeline gas (consumer quality)	?	0	Nm3 gas/y	?
Biomass fired power and heat production	Y	2,000	t biomass combusted/y (dry weight)	0
Charcoal combustion	Y	100,000,000	t charcoal combusted/y	12,000
Fuel production				
Oil extraction	N	0	t crude oil produced/y	-
Oil refining	N	0	t oil refined/y	-
Extraction and processing of natural gas	Y	2,130	Nm3 gas/y	0
Primary metal production				
Mercury (primary) extraction and initial processing	N	0	t mercury produced/y	-
Production of zinc from concentrates	N	0	t concentrate used/y	-
Production of copper from concentrates	N	0	t concentrate used/y	-
Production of lead from concentrates	N	0	t concentrate used/y	-
Gold extraction by methods other than mercury amalgamation	Y	18,380,000	t gold ore used/y	1,010,900
Alumina production from bauxite (aluminium production)	N	0	t bauxit processed/y	-
Primary ferrous metal production (iron, steel production)	N	0	t pig iron produced/y	-

Gold extraction with mercury amalgamation - without use of retort	Y	528	kg gold produced/y	1,056
Gold extraction with mercury amalgamation - with use of retorts	N	0	kg gold produced/y	-
Other materials production				
Cement production	Y	2,950,000	t cement produced/y	811
Pulp and paper production	N	0	t biomass used in production/y	-
Production of chemicals				
Chlor-alkali production with mercury-cells	N	0	t Cl2 produced/y	-
VCM production with mercury catalyst	N	0	t VCM produced/y	-
Acetaldehyde production with mercury catalyst	N	0	t acetaldehyde produced/y	-
Production of products with mercury content				
Hg thermometers (medical, air, lab, industrial etc.)	N	0	kg mercury used for production/y	-
Electrical switches and relays with mercury	N	0	kg mercury used for production/y	-
Light sources with mercury (fluorescent, compact, others: see guideline)	N	0	kg mercury used for production/y	-
Batteries with mercury	N	0	kg mercury used for production/y	-
Manometers and gauges with mercury	N	0	kg mercury used for production/y	-
Biocides and pesticides with mercury	N	0	kg mercury used for production/y	-
Paints with mercury	N	0	kg mercury used for production/y	-
Skin lightening creams and soaps with mercury chemicals	N	0	kg mercury used for production/y	-
Use and disposal of products with mercury content				
Dental amalgam fillings ("silver" fillings)	N	43,188,000	number of inhabitants	-
Thermometers	Y	61,197	items sold/y	61

Electrical switches and relays with mercury	N	43,188,000	number of inhabitants	-
Light sources with mercury	N	0	items sold/y	-
Batteries with mercury	N	0	t batteries sold/y	-
Polyurethane (PU, PUR) produced with mercury catalyst	N	43,188,000	number of inhabitants	-
Paints with mercury preservatives	N	0	t paint sold/y	-
Skin lightening creams and soaps with mercury chemicals	N	0	t cream or soap sold/y	-
Medical blood pressure gauges (mercury sphygmomanometers)	N	0	items sold/y	-
Other manometers and gauges with mercury	N	43,188,000	number of inhabitants	-
Laboratory chemicals	N	43,188,000	number of inhabitants	-
Other laboratory and medical equipment with mercury	N	43,188,000	number of inhabitants	-
Production of recycled of metals				
Production of recycled mercury ("secondary production")	N	0	kg mercury produced/y	-
Production of recycled ferrous metals (iron and steel)	N	0	number of vehicles recycled/y	-
Waste incineration				
Incineration of municipal/general waste*1	?	0	t waste incinerated/y	?
Incineration of hazardous waste*1	Y	35	t waste incinerated/y	1
Incineration of medical waste*1	Y	20	t waste incinerated/y	0
Sewage sludge incineration*1	N	0	t waste incinerated/y	-
Open fire waste burning (on landfills and informally)*1	N	0	t waste burned/y	-
Waste deposition/landfilling and waste water treatment				
Controlled landfils/deposits *1	N	0	t waste landfilled/y	-
Informal dumping of general waste *1*2	Y	402,050	t waste dumped/y	2,010
Waste water system/treatment *3	Y	33,168,389,475	m3 waste water/y	174,134
Crematoria and cemeteries				
Crematoria	N	0	corpses cremated/y	-
Cemeteries	Y	3,282,288	corpses buried/y	8,206
TOTAL of quantified inputs				**1,033,340**

Notes to table:
*1: To avoid double counting of mercury inputs from waste and products in the input TOTAL, only 10% of the mercury input to waste incineration sources, waste deposition and informal dumping is included in the total for mercury inputs. These 10% represent approximately the mercury input to waste from materials which were not quantified individually in Inventory Level 1 of this Toolkit.
See Appendix 1 to the Inventory Level1 Guideline for more explanation.
*2: The estimated quantities include mercury in products which has also been accounted for under each product category.
To avoid double counting, the release to land from informal dumping of general waste has been subtracted automatically in the TOTALS.
*3: The estimated input and release to water include mercury amounts which have also been accounted for under each source category.
To avoid double counting, input to, and release to water from, waste water system/treatment have been subtracted automatically in the TOTALS.

Note that the following source sub-categories made the largest contributions to mercury inputs to society: gold extraction by methods other than mercury amalgamation; cemeteries; charcoal combustion; and gold extraction with mercury amalgamation - without use of retort.
Waste water system/treatment represented a significant flux of mercury. The origin of the mercury in waste water and solid waste is mercury in products and materials used in the society.

Summary of mercury releases

In the Table 4-1 below, a summary of mercury releases from all source categories present is given. The key mercury releases here are releases to air (the atmosphere), to water (marine and freshwater bodies, including via waste water systems), to land, to general waste, and to sectors specific waste. An additional output pathway is "by-products and impurities" which designate mercury flows back into the market with by-products and products where mercury does not play an intentional role. See Table 4-2 below for a more detailed description and definition of the output pathways.

Table 3-2 Summary of mercury releases

Source category	Estimated Hg releases, standard estimates, Kg Hg/y					
	Air	Water	Land	By-products and im-purities	General waste	Sector specif-ic waste treatment /disposal
Energy consumption						
Coal combustion in large power plants	36.5	0.0	0.0	0.0	4.1	0.0
Other coal uses	?	?	?	?	?	?
Combustion/use of petroleum coke and heavy oil	28.6	0.0	0.0	0.0	0.0	0.0
Combustion/use of diesel, gasoil, petroleum, kerosene	9.5	0.0	0.0	0.0	0.0	0.0
Use of raw or pre-cleaned natural gas	23.4	0.0	0.0	0.0	0.0	0.0
Use of pipeline gas (consumer quality)	?	?	?	?	?	?
Biomass fired power and heat production	0.1	0.0	0.0	0.0	0.0	0.0
Charcoal combustion	12,000.0	0.0	0.0	0.0	0.0	0.0
Fuel production						
Oil extraction	-	-	-	-	-	-
Oil refining	-	-	-	-	-	-
Extraction and processing of natural gas	0.0	0.0	0.0	0.0	0.0	0.0
Primary metal production						
Mercury (primary) extraction and initial processing	-	-	-	-	-	-
Production of zinc from concentrates	-	-	-	-	-	-
Production of copper from concentrates	-	-	-	-	-	-
Production of lead from concentrates	-	-	-	-	-	-
Gold extraction by methods other than mercury amalgamation	40,436.0	20,218.0	909,810.0	40,436.0	0.0	0.0
Alumina production from bauxite (aluminium production)	-	-	-	-	-	-
Primary ferrous metal production (iron, steel production)	-	-	-	-	-	-

Gold extraction with mercury amalgamation - without use of retort	633.6	211.2	211.2	0.0	0.0	0.0
Gold extraction with mercury amalgamation - with use of retorts	-	-	-	-	-	-
Other materials production						
Cement production	486.8	0.0	0.0	162.3	162.3	0.0
Pulp and paper production	-	-	-	-	-	-
Production of chemicals						
Chlor-alkali production with mercury-cells	-	-	-	-	-	-
VCM production with mercury catalyst	-	-	-	-	-	-
Acetaldehyde production with mercury catalyst	-	-	-	-	-	-
Production of products with mercury content						
Hg thermometers (medical, air, lab, industrial etc.)	-	-	-	-	-	-
Electrical switches and relays with mercury	-	-	-	-	-	-
Light sources with mercury (fluorescent, compact, others: see guideline)	-	-	-	-	-	-
Batteries with mercury	-	-	-	-	-	-
Manometers and gauges with mercury	-	-	-	-	-	-
Biocides and pesticides with mercury	-	-	-	-	-	-
Paints with mercury	-	-	-	-	-	-
Skin lightening creams and soaps with mercury chemicals	-	-	-	-	-	-
Use and disposal of products with mercury content						
Dental amalgam fillings ("silver" fillings)	-	-	-	-	-	-
Thermometers	6.1	18.4	0.0	0.0	36.7	0.0
Electrical switches and relays with mercury	-	-	-	-	-	-
Light sources with mercury	-	-	-	-	-	-
Batteries with mercury	-	-	-	-	-	-
Polyurethane (PU, PUR) produced with mercury catalyst	-	-	-	-	-	-
Paints with mercury preservatives	-	-	-	-	-	-

Skin lightening creams and soaps with mercury chemicals	-	-	-	-	-	-
Medical blood pressure gauges (mercury sphygmomanometers)	-	-	-	-	-	-
Other manometers and gauges with mercury	-	-	-	-	-	-
Laboratory chemicals	-	-	-	-	-	-
Other laboratory and medical equipment with mercury	-	-	-	-	-	-
Production of recycled of metals						
Production of recycled mercury ("secondary production")	-	-	-	-	-	-
Production of recycled ferrous metals (iron and steel)	-	-	-	-	-	-
Waste incineration						
Incineration of municipal/general waste	?	?	?	?	?	?
Incineration of hazardous waste	0.8	0.0	0.0	0.0	0.0	0.1
Incineration of medical waste	0.4	0.0	0.0	0.0	0.0	0.0
Sewage sludge incineration	-	-	-	-	-	-
Open fire waste burning (on landfills and informally)	-	-	-	-	-	-
Waste deposition/landfilling and waste water treatment						
Controlled landfills/deposits	-	-	-	-	-	-
Informal dumping of general waste *1	201.0	201.0	1,608.2	-	-	-
Waste water system/treatment *2	0.0	156,720.6	0.0	0.0	17,413.4	0.0
Crematoria and cemeteries						
Crematoria	-	-	-	-	-	-
Cemeteries	0.0	0.0	8,205.7	-	0.0	0.0
TOTAL of quantified releases	**53,860.0**	**20,650.0**	**918,230.0**	**40,600.0**	**17,620.0**	**0.0**

Notes to table:
*1: To avoid double counting of mercury inputs from waste and products in the input TOTAL, only 10% of the mercury input to waste incineration

sources, waste deposition and informal dumping is included
in the total for mercury inputs. These 10% represent approximately the mercury input to waste from materials which were not quantified individually in Inventory Level 1 of this Toolkit.
See Appendix 1 to the Inventory Level1 Guideline for more explanation.
*2: The estimated quantities include mercury in products which has also been accounted for under each product category.
To avoid double counting, the release to land from informal dumping of general waste has been subtracted automatically in the TOTALS.
*3: The estimated input and release to water include mercury amounts which have also been accounted for under each source category.
To avoid double counting, input to, and release to water from, waste water system/treatment have been subtracted automatically in the TOTALS.

Note that the following source sub-categories made the largest contributions to mercury releases to the atmosphere: gold extraction by methods other than mercury amalgamation; charcoal combustion; gold extraction with mercury amalgamation - without use of retort; cement production; and informal dumping of general waste.

Table 4-2 below provides general descriptions and definitions of the output pathways.

Table 3-3 Description of the types of results.

Calculation result type	**Description**
Estimated Hg input, Kg Hg/y	The standard estimate of the amount of mercury entering this source category with input materials, for example calculated mercury amount in the amount of coal used annually in the country for combustion in large power plants.
Air	Mercury emissions to the atmosphere from point sources and diffuse sources from which mercury may be spread locally or over long distances with air masses; for example from: • Point sources such as coal fired power plants, metal smelter, waste incineration; • Diffuse sources as small scale gold mining, informally burned waste with fluorescent lamps, batteries, thermometers..
Water	Mercury releases to aquatic environments and to waste water systems: Point sources and diffuse sources from which mercury will be spread to marine environments (oceans), and freshwaters (rivers, lakes, etc.). for example releases from: • Wet flue cleaning systems from coal fired power plants; • Industry, households, etc. to aquatic environments; • Surface run-off and leachate from mercury contaminated soil and waste dumps
Land	Mercury releases to soil, the terrestrial environment: General soil and ground water. For example releases from: • Solid residues from flue gas cleaning on coal fired power plants used for gravel road construction;. • Uncollected waste products dumped or buried informally • Local un-confined releases from industry such as on site hazardous waste storage/burial • Spreading of sewage sludge with mercury content on agricultural land (sludge used as fertilizer) • Application on land, seeds or seedlings of pesticides with mercury compounds

Calculation result type	Description
By-products and impurities	By-products that contain mercury, which are sent back into the market and cannot be directly allocated to environmental releases, for example: • Gypsum wallboard produced from solid residues from flue gas cleaning on coal fired power plants. • Sulphuric acid produced from desulphurization of flue gas (flue gas cleaning) in non-ferrous metal plants with mercury trace concentrations • Chlorine and sodium hydroxide produced with mercury-based chlor-alkali technology; with mercury trace concentrations • Metal mercury or calomel as by-product from non-ferrous metal mining (high mercury concentrations)
General waste	General waste: Also called municipal waste in some countries. Typically household and institution waste where the waste undergoes a general treatment, such as incineration, landfilling or informal dumping. The mercury sources to waste are consumer products with intentional mercury content (batteries, thermometers, fluorescent tubes, etc.) as well as high volume waste like printed paper, plastic, etc., with small trace concentrations of mercury.
Sector specific waste treatment /disposal	Waste from industry and consumers which is collected and treated in separate systems, and in some cases recycled; for example. • Confined deposition of solid residues from flue gas cleaning on coal fired power plants on dedicated sites. • Hazardous industrial waste with high mercury content which is deposited in dedicated, safe sites • Hazardous consumer waste with mercury content, mainly separately collected and safely treated batteries, thermometers, mercury switches, lost teeth with amalgam fillings etc. • Confined deposition of tailings and high volume rock/waste from extraction of non-ferrous metals

4 Data and inventory on energy consumption and fuel production

4.1 Data description

Source category	Source present?	Activity rate		Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y						
Energy consumption	**Y/N/?**	Annual consumption/production	Unit	Standard estimate	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal	Cat. no.
Coal combustion in large power plants	Y	150,000	t coal combusted/y	41	36.5	0.0	0.0	0.0	4.1	0.0	5.1.1
Other coal uses	?		t coal used/y	?	?	?	?	?	?	?	5.1.2
Combustion/use of petroleum coke and heavy oil	Y	520,641	t oil product combusted/y	29	28.6	0.0	0.0	0.0	0.0	0.0	5.1.3
Combustion/use of diesel, gasoil, petroleum, kerosene	Y	1,732,225	t oil product combusted/y	10	9.5	0.0	0.0	0.0	0.0	0.0	5.1.3
Use of raw or pre-cleaned nat-	Y	234,329,261	Nm3 gas/y	23	23.4	0.0	0.0	0.0	0.0	0.0	5.1.4

ural gas											
Use of pipeline gas (consumer quality)	?		Nm3 gas/y	?	?	?	?	?	?	?	5.1.4
Biomass fired power and heat production	Y	2,000	t biomass combusted/y (dry weight)	0	0.1	0.0	0.0	0.0	0.0	0.0	5.1.6
Charcoal com-bustion	Y	100,000,000	t charcoal combusted/y	12,000	12,000.0	0.0	0.0	0.0	0.0	0.0	5.1.6
Fuel produc-tion											
Oil extraction	N		t crude oil produced/y	-	-	-	-	-	-	-	5.1.3
Oil refining	N		t oil re-fined/y	-	-	-	-	-	-	-	5.1.3
Extraction and processing of natural gas	Y	2,130	Nm3 gas/y	0	0.0	0.0	0.0	0.0	0.0	0.0	5.1.4

Data presented in the table above were collected from the following sources:-

i. Energy and Water Utility Regulatory Authority (EWURA)
ii. Tanzania Electric Supply Company (TANESCO)
iii. Ministry of Energy and Minerals (MEM)
iv. Medical Store Department (MSD)
v. Local Government Authorities (LGAs)
vi. Hospitals Such as Regency ,Temeke District
vii. Kiwira coal mine
viii. Independent Power Tanzania Limited (IPTL)
ix. SONGAS
x. Artumas

4.2 Background calculations and approximations

Data from most point sources were provided in accordance with units indicated in the data collection questionnaire. Therefore, no additional calculations on such as unit conversions etc were made. However, data for petrol, diesel, heavy fuel and kerosene were received in volume (litres/year) and were converted in respective reporting units (tonnes/y). Moreover, data for biomass fired power and heat production were extrapolated from assumption that 10 tonnes of biomass (baggase) produces 1MWH of electricity.

4.3 Data gaps and priorities for potential follow up

Data gaps:

i. Other coal uses
ii. Use of pipeline gas (consumer quality)
iii. Biomass fired power and heat production

5 Data and inventory on domestic production of metals and raw materials

5.1 Data description

DOMESTIC PRODUCTS OF METALS AND RAW MATERIALS

Source category	Source present?	Activity rate		Esti-mated Hg in-put, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y						
	Y/N/?	Annual consump-tion/prod uction	Unit	Stand-ard es-timate	Air	Water	Land	By-products and im-purities	Gen-eral waste	Sector spe-cific waste treat-ment /dispo sal	Cat. no.
Primary metal pro-duction											
Mercury (primary) extraction and initial processing	N		t mercury pro-duced/y	-	-	-	-	-	-	-	5.2.1
Production of zinc from concentrates	N		t concen-trate used/y	-	-	-	-	-	-	-	5.2.3
Production of copper	N		t concen-	-	-	-	-	-	-	-	5.2.4

from concentrates			trate used/y								
Production of lead from concentrates	N		t concen-trate used/y	-	-	-	-	-	-	-	5.2.5
Gold extraction by methods other than mercury amalgama-tion	Y	18,380,000	t gold ore used/y	1,010,900	40,436.0	20,218.0	909,810.0	40,436.0	0.0	0.0	5.2.6
Alumina production from bauxite (aluminium production)	N		t bauxit pro-cessed/y	-	-	-	-	-	-	-	5.2.7
Primary ferrous metal production (iron, steel production)	N		t pig iron pro-duced/y	-	-	-	-	-	-	-	5.2.9
Gold extraction with mercury amalgama-tion - without use of retort	Y	528	kg gold pro-duced/y	1,056	633.6	211.2	211.2	0.0	0.0	0.0	5.2.2
Gold extraction with mercury amalgama-tion - with use of re-torts	N		kg gold pro-duced/y	-	-	-	-	-	-	-	5.2.2
Other materials production											
Cement production	Y	2,950,000	t cement pro-duced/y	811	486.8	0.0	0.0	162.3	162.3	0.0	5.3.1
Pulp and paper pro-duction	N		t biomass used in	-	-	-	-	-	-	-	5.3.2

			produc- tion/y								

Data presented in the table above were collected from the following sources:-

i. Large and small scale mining companies in the country;

ii. Cement factories: Tanzania Portland Cement; Mbeya Cement and Tanga Cement; and

iii. Ministry of Energy and Minerals (MEM)

5.2 Background calculations and approximations

Data from point sources were provided in accordance with units indicated in the data collection questionnaire**.**

5.3 Data gaps and priorities for potential follow up

i. Pulp and paper production

6 Data and inventory on domestic production and processing with intentional mercury use

6.1 Data description

Source category	Source pre-sent?	Activity rate		Esti-mated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y					
Production of chemicals	**Y/N/?**	Annual consump-tion/produ ction	Unit	Stand ard esti-mate	Air	Water	Land	By-products and im-purities	General waste	Sector specific waste treat-ment /disposal
Chlor-alkali production with mercury-cells	N		t Cl2 pro-duced/y	-	-	-	-	-	-	-
VCM production with mercury catalyst	N		t VCM pro-duced/y	-	-	-	-	-	-	-
Acetaldehyde production with mercury catalyst	N		t acetalde-hyde pro-duced/y	-	-	-	-	-	-	-
Production of products with mercury content										
Hg thermometers (medi-cal, air, lab, industrial etc.)	N		kg mercury used for production/y	-	-	-	-	-	-	-

Electrical switches and relays with mercury	N		kg mercury used for production/y	-	-	-	-	-	-	-
Light sources with mercury (fluorescent, compact, others: see guideline)	N		kg mercury used for production/y	-	-	-	-	-	-	-
Batteries with mercury	N		kg mercury used for production/y	-	-	-	-	-	-	-
Manometers and gauges with mercury	N		kg mercury used for production/y	-	-	-	-	-	-	-
Biocides and pesticides with mercury	N		kg mercury used for production/y	-	-	-	-	-	-	-
Paints with mercury	N		kg mercury used for production/y	-	-	-	-	-	-	-
Skin lightening creams and soaps with mercury chemicals	N		kg mercury used for production/y	-	-	-	-	-	-	-

6.2 Background calculations and approximations

Not applicable.

6.3 Data gaps and priorities for potential follow up

Not applicable.

7 Data and inventory on waste handling and recycling

7.1 Data description

How much of the waste is collected and treated under public control?	**Y/N**	Answer according to your best estimate (you may revise once you have more specific data)								
Is more than 2/3 (two thirds; 67%) of the waste collected and treated under public control?	Y									

WASTE HANDLING AND RECYCLING

Source category	Source present?	Activity rate		Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y						
Production of recycled of metals	**Y/N/?**	Annual production	Unit	Standard estimate	Air	Water	Land	By-products and	General waste	Sector specific	Cat. no.

		/waste disposal						impuri-ties		waste treat-ment /disposal	
Production of recycled mercury ("sec-ondary production")	N		kg mercury produced/y	-	-	-	-	-	-	-	5.7.1
Production of recycled ferrous metals (iron and steel)	N		number of vehicles re-cycled/y	-	-	-	-	-	-	-	5.7.2
Waste incineration											
Incineration of municipal/general waste	?		t waste in-cinerated/y	?	?	?	?	?	?	?	5.8.1
Incineration of hazardous waste	Y	35	t waste in-cinerated/y	1	0.8	0.0	0.0	0.0	0.0	0.1	5.8.2
Incineration of medical waste	Y	20	t waste in-cinerated/y	0	0.4	0.0	0.0	0.0	0.0	0.0	5.8.3
Sewage sludge incineration	N		t waste in-cinerated/y	-	-	-	-	-	-	-	5.8.4
Open fire waste burning (on landfills and informally)	?		t waste burned/y	?	?	?	?	?	?	?	5.8.5
Waste deposition/landfilling and waste water treatment											
Controlled landfills/deposits	N		t waste land-filled/y	-	-	-	-	-	-	-	5.9.1
Informal dumping of general waste *1	Y	402,050	t waste dumped/y	2,010	201.0	201.0	1,608.2	-	-	-	5.9.4

Waste water system/treatment	Y	33,168,389,475	m3 waste water/y	174,134	0.0	156,720.6	0.0	0.0	17,413.4	0.0	5.9.5

Data presented in the table above were collected from the following sources:-

i. Ministry of Energy and Minerals (MEM)

ii. Ministry of Water and Irrigation

iii. Local Government Authorities

iv. Hospitals

v. Energy Consuming industries

7.2 Background calculations and approximations

Data on waste water was extrapolated based on water consumed per person and population by assuming that: 80% of water consumed become waste and only 40% of population have an access to clean water.

7.3 Data gaps and priorities for potential follow up

i. Incineration of Municipal/general waste Incineration of hazardous waste

ii. Incineration of medical waste

iii. Open fire waste burning (on landfills and informally)

8 Data and inventory on general consumption of mercury in products, as metal mercury and as mercury containing substances

8.1 Data description

Source category	Source present?	Activity rate		Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y						
	Y/N/?	Annual consumption/population	Unit	Standard estimate	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal	Cat. no.
			NOTE: Selection regarding waste management:		More than 2/3 of the waste is collected and treated under public control						
Use and disposal of products with mercury content											
Dental amalgam fillings ("silver" fillings)	***?***			***?***	***?***	***?***	***?***	***?***	***?***	***?***	5.6.1
Preparations of fillings at dentist clinics		43,188,000	number of inhabitants		?	?	?	?	?	?	
Use - from fillings al-		43,188,000	number of		?	?	?	?	?	?	

ready in the mouth			inhabitants								
Disposal (lost and extracted teeth)		43,188,000	number of inhabitants		?	?	?	?	?	?	
Thermometers	***Y***	***61,197***		***61***	***6.1***	***18.4***	***0.0***	***0.0***	***36.7***	***0.0***	5.5.1
Medical Hg thermometers	Y	61,191	items sold/y	61							
Other glass Hg thermometers (air, laboratory, dairy, etc.)	?	6	items sold/y	?							
Engine control Hg thermometers and other large industrial/speciality Hg thermometers	?		items sold/y	?							5.5.1
Electrical switches and relays with mercury	?	43,188,000	number of inhabitants	?	?	?	?	?	?	?	5.5.2
Light sources with mercury	***?***	*0*	items sold/y	***?***	***?***	***?***	***?***	***?***	***?***	***?***	5.5.3
Fluorescent tubes (double end)	?		items sold/y	?							
Compact fluorescent lamp (CFL single end)	?		items sold/y	?							
Other Hg containing light sources (see guideline)	?		items sold/y	?							

Batteries with mercury	***N***	***0***	***t batteries sold/y***	-	-	-	-	-	-	-	5.5.4
Mercury oxide (button cells and other sizes); also called mercury-zinc cells	N		t batteries sold/y	-							
Other button cells (zinc-air, alkaline button cells, silver-oxide)	N		t batteries sold/y	-							
Other batteries with mercury (plain cylindrical alkaline, permanganate, etc., see guideline)	N		t batteries sold/y	-							
Polyurethane (PU, PUR) produced with mercury catalyst	N	43,188,000	number of inhabitants	-	-	-	-	-	-	-	5.5.5.
Paints with mercury preservatives	N		t paint sold/y	-	-	-	-	-	-	-	5.5.7
Skin lightening creams and soaps with mercury chemicals	?		t cream or soap sold/y	?	?	?	?	?	?	?	5.5.8
Medical blood pressure gauges (mercury	?		items sold/y	?	?	?	?	?	?	?	5.6.2

sphygmomanometers)											
Other manometers and gauges with mercury	?	43,188,000	number of inhabitants	?	?	?	?	?	?	?	5.6.2
Laboratory chemicals	?	43,188,000	number of inhabitants	?	?	?	?	?	?	?	5.6.3
Other laboratory and medical equipment with mercury	?	43,188,000	number of inhabitants	?	?	?	?	?	?	?	5.6.3, 5.6.5

Data presented in the table above were collected from the following sources:-

i. Hospitals; and

ii. Medical Store Department (MSD)

8.2 Background calculations and approximations

Data from point sources were provided in accordance with units indicated in the data collection questionnaire.

8.3 Data gaps and priorities for potential follow up

i. Dental amalgam fillings ("silver" fillings)

ii. Other glass Hg thermometers (air, laboratory, dairy, etc.)

iii. Engine control Hg thermometers and other large industrial/speciality Hg thermometers

iv. Electrical switches and relays with mercury

v. Light sources with mercury

vi. Fluorescent tubes (double end)

vii. Compact fluorescent lamp (CFL single end)

viii. Other Hg containing light sources (see guideline)

ix. Skin lightening creams and soaps with mercury chemicals

x. Medical blood pressure gauges (mercury sphygmomanometers)

xi. Other manometers and gauges with mercury

xii. Laboratory chemicals

xiii. Other laboratory and medical equipment with mercury

9 Data and inventory on crematoria and cemeteries

9.1 Data description

Source category	Source present?	Activity rate		Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y						
Crematoria and cemeteries	**Y/N/?**	Annual numbers dead	Unit	Standard estimate	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal	Cat. no.
Crematoria	?		corpses cremated/y	?	?	?	?	?	?	?	5.10.1
Cemeteries	Y	3,282,288	corpses buried/y	8,206	0.0	0.0	8,205.7	-	0.0	0.0	5.10.2

Data presented in the table above were collected from the following sources:-

i. Local Government Authorities (LGAs); and

ii. Tanzania National Bureau of Statistics

9.2 Background calculations and approximations

Data on cemeteries were extrapolated based on the national mortality rate.

9.3 Data gaps and priorities for potential follow up

i. Crematoria data.

10 List of major data gaps

Types of data gaps across all source categories are as follows:-

i. Other coal uses
ii. Use of pipeline gas (consumer quality)
iii. Biomass fired power and heat production
iv. Pulp and paper production
v. Incineration *of Municipal/general waste Incineration* of hazardous waste
vi. *Incineration of medical waste*
vii. *Open* fire waste burning (on landfills and informally)
viii. Dental amalgam fillings ("silver" fillings)
ix. Other glass Hg thermometers (air, laboratory, dairy, etc.)
x. Engine control Hg thermometers and other large industrial/speciality Hg thermometers
xi. Electrical switches and relays with mercury
xii. Light sources with mercury
xiii. Fluorescent tubes (double end)
xiv. Compact fluorescent lamp (CFL single end)
xv. Other Hg containing light sources (see guideline)
xvi. Skin lightening creams and soaps with mercury chemicals
xvii. Medical blood pressure gauges (mercury sphygmomanometers)
xviii. Other manometers and gauges with mercury
xix. Laboratory chemicals
xx. Other laboratory and medical equipment with mercury
xxi. Crematoria data.

References

i. Energy and Water Utility Regulatory Authority (EWURA)
ii. Tanzania Electric Supply Company (TANESCO)
iii. Ministry of Energy and Minerals (MEM)
iv. Medical Store Department (MSD)
v. Local Government Authorities (LGAs)
vi. Tanzania National Bureau of Statistics
vii. Hospitals
viii. Kiwira coal mine
ix. Independent Power Tanzania Limited (IPTL)
x. Songosongo Gas Mining Company (SONGAS)
xi. Large and small scale mining companies in the country;
xii. Tanzania Cement factories
xiii. Ministry of Water and Irrigation
xiv. Mnazi Bay Gas Mining Company (ARTUMAS)

Appendix 1 - Inventory Level 1 calculation spreadsheets