Environmental Pollution Prevention Office,
Ministry of Environment of the Republic of Moldova

NATIONAL INVENTORY OF MERCURY RELEASES IN THE REPUBLIC OF MOLDOVA

2019

LEVEL 2

INVENTORY OF MERCURY RELEASES IN THE REPUBLIC OF MOLDOVA

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Table of Contents

1 Executive summary 4

2 Mercury release source types present 10

3 Summary of mercury inputs to society 13

4 Summary of mercury releases 16

5Identified hot-spots of mercury contamination (contaminated sites) 21

6Data and inventory on extraction and use of fuels/energy sources 22

6.1 Coal combustion in large power plants 22

6.2 Other coal uses 23

6.3 Mineral oils – extraction, refining and use 25

6.4 Natural gas – extraction, refining and use 28

6.5 Biomass fired power and heat production 29

7. Data and inventory on primary (virgin) metal production 31

8. Production of other minerals and materials with mercury impurities 32

8.1 Cement production 32

8.2 Lime production 34

9. Data and inventory on intentional use of mercury in industrial processes 36

10. Data and inventory on consumer products with intentional use of mercury 37
10.1 Thermometers 38
10.2 Electrical switches and relays with mercury 44
10.3 Light sources with mercury 45
10.4 Batteries with mercury 48
10.5 Polyurethane (PU, PUR) produced with mercury catalyst 52
10.6 Biocides and pesticides with mercury 54
10.7 Paints with mercury preservatives 55
10.8 Cosmetics and related products 57

11. Data and inventory on other intentional product/process uses 58
11. 1 Dental mercury amalgam fillings 58
11.2 Manometers and gauges with mercury 59
11.3 Laboratory chemicals and equipment with mercury 64
11.4 Mercury metal use in religious rituals and folklore medicine 66
11.5 Miscellaneous product uses, mercury metal uses, and other sources 66

12. Data and inventory on production of recycled metals 67
12.1 Production of recycled mercury ("secondary production") 67
12.2 Production of recycled ferrous metals (iron and steel) 67

13. Data and inventory on waste incineration and burning 68
13.1 Incineration of municipal/general waste 68
13.2 Incineration of hazardous waste 68
13.3 Incineration of medical waste 68
13.4 Incineration of sewage sludge 71
13.5 Open fire waste burning (on landfills and informally) 71

14. Data and inventory on waste disposal, deposition/landfilling 76
14.1 Controlled landfills/deposits 76
14.2 Informal dumping of general waste 78
14.3 Waste water system/treatment 81

15. Data and inventory on crematoria and cemeteries 86
15.1 Crematoria 86
15.2 Cemeteries 86

References **90**

Appendix 1 – 2014 Inventory Level 2 calculation spreadsheet for the Republic of Moldova **93**

1 Executive summary

The **national inventory on mercury releases in the Republic of Moldova** has been developed for the reference year 2018 based on UNEP Toolkit Level 2 (version 2019).

The inventory of sources of mercury releases in the Republic of Moldova revealed that the **main source categories present in country** are:

i) Extraction and use of fuels/energy sources
ii) Production of other minerals and materials with mercury impurities
iii) Consumer products with intentional use of mercury
iv) Other intentional products/process uses,
vi) Waste incineration and waste burning
vi) Waste deposition/landfilling and waste water treatment,
vii) Cremation and cemeteries.
In addition potential hotspots were identified.

The following **source categories** of mercury releases were identified that are **absent in the country***: i) Primary (virgin) metal production ii) Intentional use of mercury as an auxiliary material in industrial processes.*

Series of the **subcategories were excluded** as well from the above mentioned main categories that are present, for instance: *Extraction and use of other fossil fuels, Geothermal power production, Pulp and paper production, Waste and sewage sludge incineration, crematoria.*

Main hotspots were identified as the former storage of pesticides present in the country (under the category of *Other sites of former chemical production where mercury compounds are/were produced (pesticides, biocides, pigments etc.), or mercury or compounds were used as catalysts (VCM/PVC etc.).*), however an additional in-depth review is needed in order to confirm / invalidate this category with reference to mercury contents.

The results of the inventory of sources of mercury releases in the Republic of Moldova (based on Level 2 methodology) **for the reference year 2018** show that **640** Kilogram of mercury per year (Kg Hg/y) are released, in which:

- 40% are from the consumer products with intentional use of mercury (whole life cycle),
- 31% are from the waste deposition/ landfilling and waste treatment,
- 1 % from waste incineration and burning,
- 15% are from the extraction and use of fuels/energy sources,
- 10% are from production of other minerals and materials with mercury impurities;
- 3 % are from crematoria and cemeteries.

Reference data that has been collected using the official data of the Republic of Moldova for all the sectors / categories concerned, that comprises of the Statistical Yearbooks, Energy Balances, import-export data provided by the customs office and other sectoral publications and official requests submitted to various national institutions.

In addition the official data available for Administrative Territorial Units on the Left Bank of Nistru River (ATULBD) for various categories was incorporated within the report and the spreadsheets.

The present mercury release inventory was made with the use of the **"Toolkit for identification**

Results and discussion

An aggregated presentation of the results for main groups of mercury release sources is presented in Figures 1.1- 1.6- Table 1.1 below.

Figure 1.1: Mercury releases to air (Kg of Mercury per year)

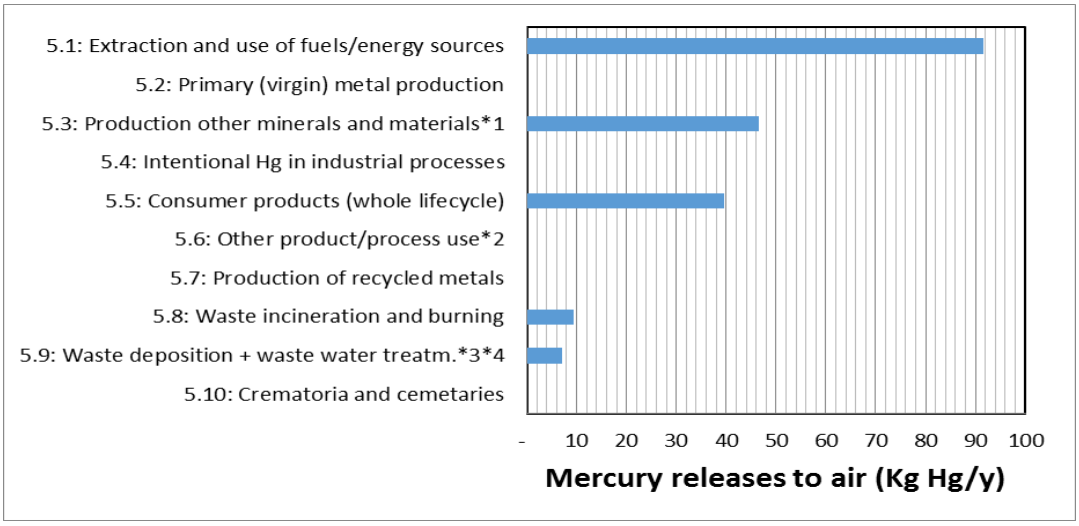


Figure 1.2: Mercury releases to water (Kg of Mercury per year)

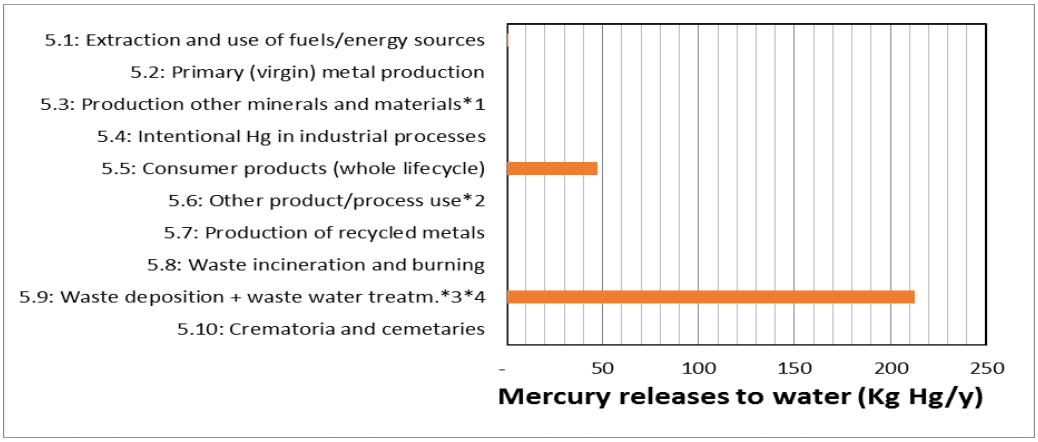


Figure 1.3: Mercury releases to land (Kg of Mercury per year)

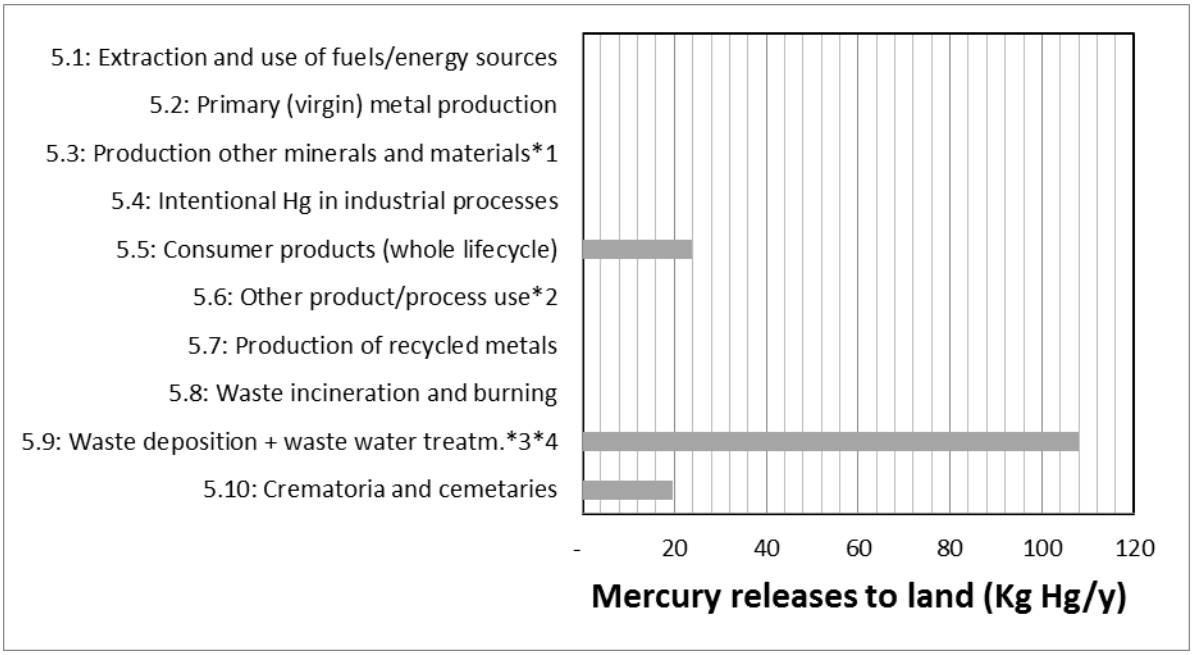


Figure 1.4: Mercury outputs to by-products and impurities (Kg of Mercury per year)

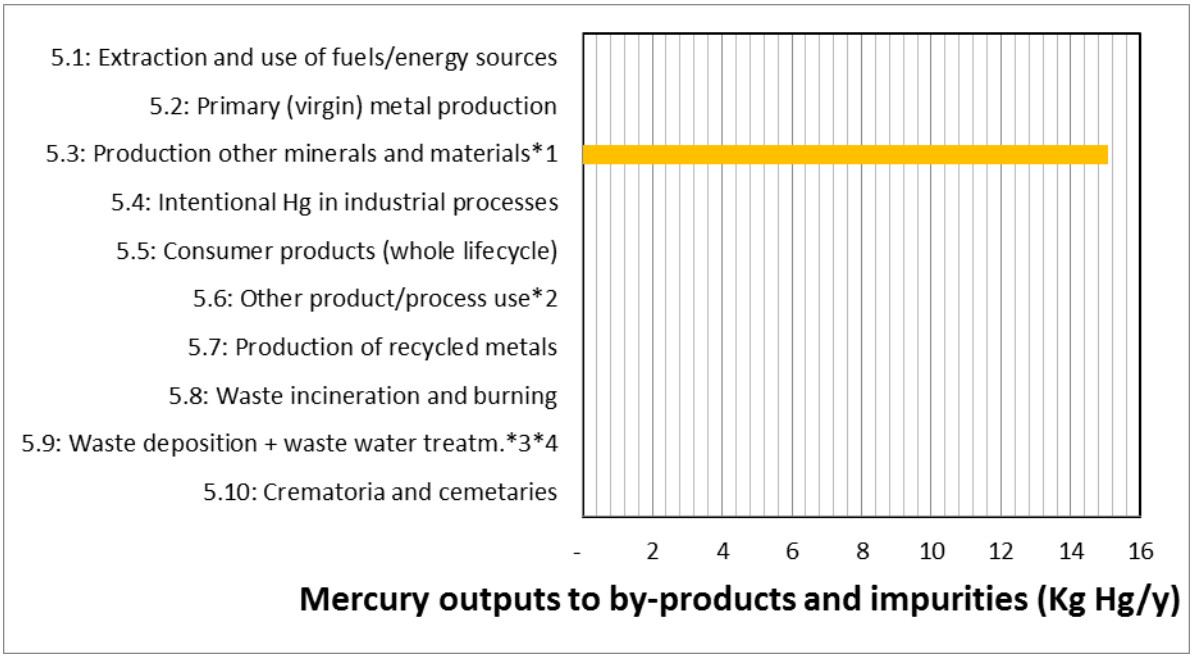


Figure 1.5: Mercury releases to general waste (Kg of Mercury per year)

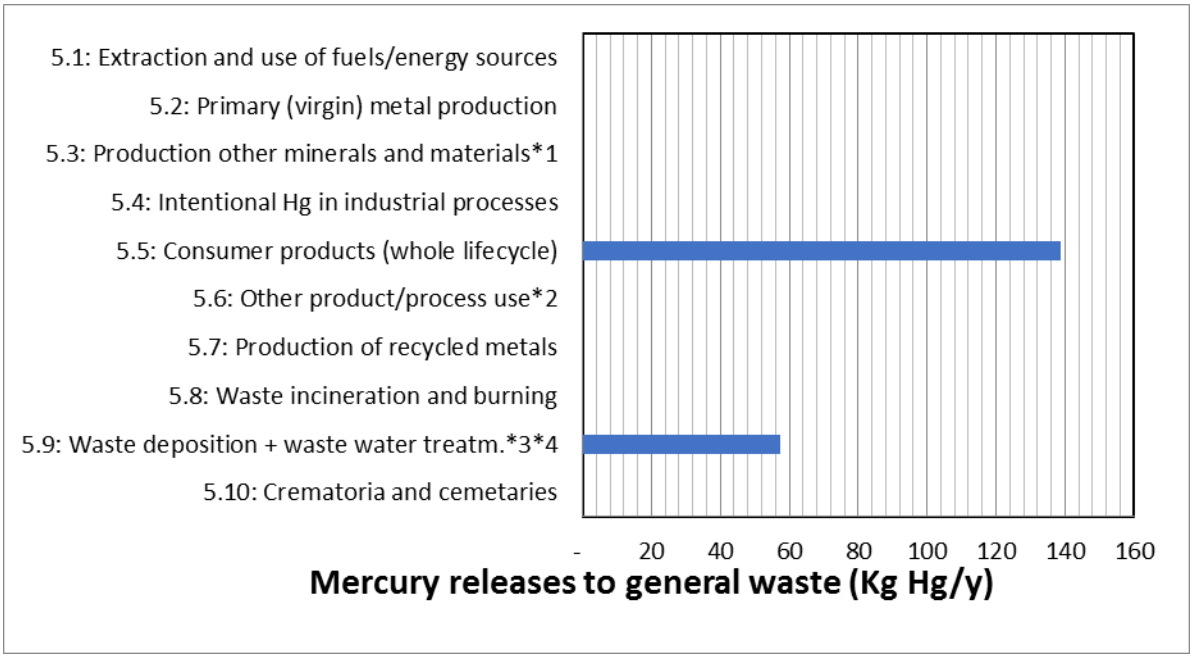


Figure 1.6: Mercury releases to sector specific waste treatment / disposal (Kg of Mercury per year)

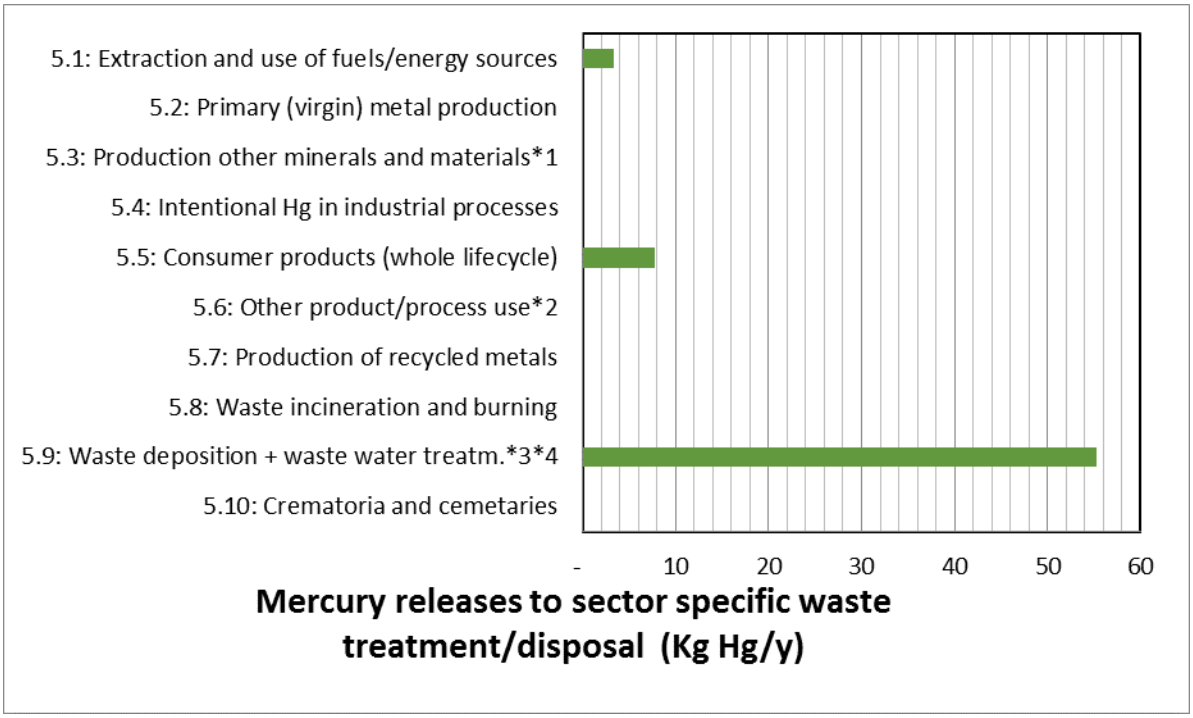


Table 1-1 Summary of mercury inventory results

Source category	Calculated Hg output, Kg/y							
	Air	Water	Land	By-products and impurities	General waste	Sector specific treatment /disposal	Total releases by source category	Percent of total releases*3*4
5.1: Extraction and use of fuels/energy sources	91.7	0.0	-	-	-	3.4	95	15%
5.2: Primary (virgin) metal production	-	-	-	-	-	-	-	0%
5.3: Production of other minerals and materials with mercury impurities*1	46.5	-	-	15.1	-	-	62	10%
5.4: Intentional use of mercury in industrial processes	-	-	-	-	-	-	-	0%
5.5: Consumer products with intentional use of mercury (whole life cycle)	39.6	47.1	23.7	-	138.6	7.8	257	40%
5.6: Other intentional product/process use*2	-	-	-	-	-	-	-	0%
5.7: Production of recycled metals	-	-	-	-	-	-	-	0%
5.8: Waste incineration and burning	9.5	-	-	-	-	-	9	1%
5.9: Waste deposition/landfilling and waste water treatment*3*4	7.2	212.9	108.0	-	57.3	55.2	441	31%
5.10: Crematoria and cemeteries	-	-	19.7	-	-	-	20	3%
SUM OF QUANTIFIED RELEASES*3*4	194	51	117	15	196	66	640	100%

Notes: *1 Includes production of cement, pulp and paper, lime and light weight aggregates. *2 Includes dental amalgam fillings, manometers and gauges, lab chemicals and equipment, Hg use in religious rituals and folklore medicine, and miscellaneous product uses. *3: 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. *4: The estimated input and release to water include mercury amounts which have also been accounted for under each source category. To avoid double counting, releases to water from waste water system/treatment have been subtracted automatically in the TOTALS.

The origin of mercury in waste and waste water produced in the country is mercury in products and in materials. Waste fractions and waste water do therefore not represent original mercury inputs to society. Based on legal provision the import of hazardous waste into Moldova is prohibited, thus there no imported waste data has been taken into account. Waste and waste water may however represent substantial flows of mercury through society. The following were found to be the major flows of mercury with waste and waste water: waste water treatment, informal dumping of general waste, informal waste burning and controlled landfills.

In this inventory, default input factors were used for the estimation of mercury releases from general waste treatment (using low end) and national input factor for wastewater treatment. The default factors were based on literature data of mercury contents in waste and wastewater, and these data were only available from developed countries. The calculations made indicate that the default input factors for general waste are with an assumed level of uncertainty and may over-

estimate the mercury releases from these sources (see the section on waste data in this report). This may be of priority in follow-up work, as feasible.

Detailed presentation of mercury inputs and releases for all mercury release source types present in the country are shown in the following report sections.

The Toolkit spreadsheets used in the development of this inventory are posted along with this report. Additional annexes contributing to the report contents are as well added to the report.

Major points sources of mercury releases identified are listed in each of the relevant source-sub category sections below.

2 Mercury release source types present

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

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

Cat. no.	Source category	Source presence (y/n/?)
5.1	**Main category - Extraction and use of fuels/energy sources**	**Y**
5.1.1	Coal combustion in large power plants	Y
5.1.2	Other coal combustion	Y
5.1.3	Extraction, refining and use of mineral oil	Y
5.1.4	Extraction, refining and use of natural gas	Y
5.1.5	Extraction and use of other fossil fuels	N
5.1.6	Biomass fired power and heat production	Y
5.1.7	Geothermal power production	N
5.2	**Main category - Primary (virgin) metal production**	N
5.2.1	Primary extraction and processing of mercury	N
5.2.2	Gold and silver extraction with the mercury-amalgamation process	N
5.2.3	Zinc extraction and initial processing	N
5.2.4	Copper extraction and initial processing	N
5.2.5	Lead extraction and initial processing	N
5.2.6	Gold extraction and initial processing by other processes than mercury amalgamation	N
5.2.7	Aluminium extraction and initial processing	N
5.2.8	Extraction and processing of other non-ferrous metals	N
5.2.9	Primary ferrous metal production	N
5.3	**Main category - Production of other minerals and materials with mercury impurities**	**Y**
5.3.1	Cement production	Y
5.3.2	Pulp and paper production	N
5.3.3	Lime production and light weight aggregate kilns	Y
5.3.4	Others minerals and materials	N
5.4	**Main category – Intentional use of mercury as an auxiliary material in industrial processes**	**N**
5.4.1	Chlor-alkali production with mercury-technology	N
5.4.2	VCM (vinyl-chloride-monomer) production with mercury-dichloride ($HgCl_2$) as catalyst	N
5.4.3	Acetaldehyde production with mercury-sulphate ($HgSO_4$) as catalyst	N
5.4.4	Other production of chemicals and polymers with mercury compounds as catalysts	N
5.5	**Main category - Consumer products with intentional use of mercury**	**Y**
5.5.1	Thermometers with mercury	Y
5.5.2	Electrical and electronic switches, contacts and relays with mercury	Y
5.5.3	Light sources with mercury	Y

Cat. no.	Source category	Source presence (y/n/?)
5.5.4	Batteries containing mercury	Y
5.5.5	Polyurethane with mercury catalysts	Y
5.5.6	Biocides and pesticides	N
5.5.7	Paints	Y
5.5.8	Cosmetics and related products	N
5.6	**Main category - Other intentional products/process uses**	**Y**
5.6.1	Dental mercury-amalgam fillings	N
5.6.2	Manometers and gauges	N
5.6.3	Laboratory chemicals and equipment	Y
5.6.4	Mercury metal use in religious rituals and folklore medicine	N
5.6.5	Miscellaneous product uses, mercury metal uses and other sources	N
5.7	**Main category - Production of recycled metals**	**Y**
5.7.1	Production of recycled mercury ("secondary production)	Y
5.7.2	Production of recycled ferrous metals (iron and steel)	Y
5.7.3	Production of other recycled metals	N
5.8	**Main category – Waste incineration**	**N**
5.8.1	Incineration of municipal/ general waste	N
5.8.2	Incineration of hazardous waste	Y
5.8.3	Incineration of medical waste	Y
5.8.4	Sewage sludge incineration	N
5.8.5	Informal waste burning	Y
5.9	**Main category - Waste deposition/landfilling and waste water treatment**	**Y**
5.9.1	Controlled landfills/deposits	Y
5.9.2	Diffuse deposition under some control	N
5.9.3	Informal local deposition of industrial production waste	N
5.9.4	Informal dumping of general waste	Y
5.9.5	Waste water system/treatment	Y
5.10	**Main category - Cremation and cemeteries**	**Y**
5.10.1	Crematoria	N
5.10.2	Cemeteries	Y
	Main category - Potential hot spots	**N**
	Closed/abandoned chlor-alkali production sites	N
	Other sites of former chemical production where mercury compounds are/were produced (pesticides, biocides, pigments etc.), or mercury or compounds were used as catalysts (VCM/PVC etc.)	N
	Closed production sites for manufacturing of thermometers, switches, batteries and other products	N
	Closed pulp and paper manufacturing sites (with internal chlor-alkali production or former use of mercury-based slimicides)	N

Cat. no.	Source category	Source presence (y/n/?)
	Tailings/residue deposits from mercury mining	N
	Tailings/residue deposits from artisanal and large scale gold mining	N
	Tailings/residue deposits from other non-ferrous metal extraction	N
	Sites of relevant accidents	Y
	Dredging of sediments	N
	Sites of discarded district heating controls (and other fluid controls) using mercury pressure valves	N
	Sites of previous recycling of mercury ("secondary" mercury production)	Y

*

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.

For waste categories, the "inputs" are calculated to show the distribution of mercury in waste through the different waste treatment activities and calculate releases from these activities, though waste is not an original source of input mercury into society .

Table 3-1 Summary of mercury inputs to society.

Category no.	**Source category**	**Estimated Hg input, Kg Hg/y, by life cycle phase (as relevant)**		
		Production phase*1	**Use phase**	**Disposal phase**
5.1	**Main category - Extraction and use of fuels/energy sources**			
5.1.1	Coal combustion in large power plants	0	12	0
5.1.2	Other coal combustion	0	22	0
5.1.3	Extraction, refining and use of mineral oil	0	2	0
5.1.4	Extraction, refining and use of natural gas	0	1	0
5.1.5	Extraction and use of other fossil fuels	0	0	0
5.1.6	Biomass fired power and heat production	0	23	0
5.1.7	Geothermal power production	0	0	0
5.3	**Main category - Production of other minerals and materials with mercury impurities**			
5.3.1	Cement production	44	0	0
5.3.2	Pulp and paper production	0	0	0
5.3.3	Lime production and light weight aggregate kilns	0	0	0
5.3.4	Others minerals and materials	0	0	0
5.5	**Main category - Consumer products with intentional use of mercury**			
5.5.1	Thermometers with mercury	0	0	195
5.5.2	Electrical and electronic switches, contacts and relays with mercury	0	0	81
5.5.3	Light sources with mercury	0	0	33
5.5.4	Batteries containing mercury	0	0	21
5.5.4	Polyurethane with mercury catalysts	0	0	66
5.5.6	Biocides and pesticides	0	0	0
5.5.7	Paints	0	21	0
5.5.8	Cosmetics and related products	0	0	0
5.6	**Main category - Other intentional products/process uses**			
5.6.1	Dental mercury-amalgam fillings	0	0	0
5.6.2	Manometers and gauges	0	0	5
5.6.3	Laboratory chemicals and equipment	0	34	0
5.6.4	Mercury metal use in religious rituals and folklore medicine	0	0	0
5.6.5	Miscellaneous product uses, mercury metal uses and other sources	0	0	0

Category no.	Source category	Estimated Hg input, Kg Hg/y, by life cycle phase (as relevant)		
5.7	**Main category - Production of recycled metals**			
5.7.1	Production of recycled mercury ("secondary production)	0	0	0
5.7.2	Production of recycled ferrous metals (iron and steel)	0	0	0
5.7.3	Production of other recycled metals	0	0	0
5.8	**Main category – Waste incineration**			
5.8.1	Incineration of municipal/ general waste	0	0	0
5.8.2	Incineration of hazardous waste	0	0	0
5.8.3	Incineration of medical waste	0	0	6
5.8.4	Sewage sludge incineration	0	0	0
5.8.5	Informal waste burning	0	0	96
5.9	**Main category - Waste deposition/landfilling and waste water treatment**			
5.9.1	Controlled landfills/deposits	0	0	13
5.9.2	Diffuse deposition under some control	0	0	0
5.9.3	Informal local deposition of industrial production waste	0	0	0
5.9.4	Informal dumping of general waste	0	0	223
5.9.5	Waste water system/treatment	0	0	448
5.10	**Main category - Cremation and cemeteries**			
5.10.1	Crematoria	0	0	0
5.10.2	Cemeteries	0	44	0

Notes: *1: Production phase includes raw material production.

Note that the following source sub-categories made the largest contributions to mercury inputs to society: thermometers with mercury (195 Kg Hg/y), electrical switches and relays (81 Kg Hg/y), polyurethane with mercury catalysis (66 KgHg/y), light sources with mercury (33 Kg Hg/y); paints with mercury (21 Kg Hg/y) Batteries containing mercury (21 Kg Hg/y); from the source category; laboratory chemicals and equipment with mercury (34 KgHg/y), the bio-mass fired power and heat production (23Kg Hg/y) and other coal use (22 Kg Hg/y) and coal combustion in power plants (12 Kg Hg/y).

The origin of mercury in waste and waste water produced in the country is mercury in products and materials. Waste fractions and waste water do therefore not represent original mercury inputs to society. Waste and waste water may however represent substantial flows of mercury through society. The following were found to be the major flows of mercury with waste and waste water: waste water system/treatment 448 Kg/Hg/y, informal dumping of general waste 223 Kg/Hg/y, informal waste burning 96 Kg/Hg/y and incineration of medical waste 6 Kg/Hg/y

4 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. See Table 4-2 below for a more detailed description and definition of the output pathways.

According to the table 4-1 below, 294 Kg of Hg /y were released to air. Note that the following source sub-categories made the largest contributions to mercury releases to the atmosphere: the informal waste burning (96 Kg Hg/y) thermometers with mercury (27 Kg Hg/y), paints with mercury (20 Kg Hg/y), electrical switches and relays (10 Kg Hg/y) the biomass fired power and heat production (23Kg Hg/y) and other coal use (19 Kg Hg/y) , the cement production (33Kg Hg/y).

In addition, 99 Kg Hg/y were released to water. The main sub categories of sources of this mercury releases to water were thermometers with mercury (59 Kg Hg/y) and informal dumping of general waste (22 Kg Hg/y).

The mercury releases to land per year were 164 Kg Hg/y.

Major outputs to by-products and impurities was reported for the cement production subcategory (11 Kg Hg/y).

Then, the mercury releases to general waste were 317 Kg/Hg/y. The main sub categories of source of mercury releases to general waste were products within the 5.5 category and laboratory chemicals. Finally, the output pathway the sector specific waste is amounting 92 Kg/Hg/y.

Table 4-1 Summary of mercury releases (overleaf)

C	Sub-C	Source category	Exists? (y/n/?)	Calculat. Hg input to society	Calculated Hg output, Kg/y					
					Air	Water	Land	By-pro-ducts and impurities	General waste	Sector specific treatment/disposal
5.1		**Source category: Extraction and use of fuels/energy sources**								
	5.1.1	Coal combustion in power plants	0	12	9	0	0	0	0.0	3
	5.1.2.1	Coal combustion in coal fired industrial boilers	0	8	8	0	0	0	0	0
	5.1.2.2	Other coal use	0	7	7	0	0	0	0	0
	5.1.3	Mineral oils - extraction, refining and use	0	2	2	0	0	0	0	0
	5.1.4	Natural gas - extraction, refining and use	0	1	1	0	0	0	0	0
	5.1.5	Other fossil fuels - extraction and use	0	0	0	0	0	0	0	0
	5.1.6	Biomass fired power and heat production	0	65	65	0	0	0	0	0
	5.1.7	Geothermal power production	0	0	0	0	0	0	0	0
5.2		**Source category: Primary (virgin) metal production**								
	5.2.1	Mercury (primary) extraction and initial processing (a	0	0	0	0	0	0	0	0
	5.2.2	Gold (and silver) extraction with mercury amalgamation processes	0	0	0	0	0	0	0	0
	5.2.3	Zinc extraction and initial processing	0	0	0	0	0	0	0	0
	5.2.4	Copper extraction and initial processing	0	0	0	0	0	0	0	0
	5.2.5	Lead extraction and initial processing	0	0	0	0	0	0	0	0
	5.2.6	Gold extraction and initial processing by methods other than mercury amalgamation	0	0	0	0	0	0	0	0
	5.2.7	Aluminium extraction and initial processing	0	0	0	0	0	0	0	0

	5.2.8	Other non-ferrous metals - extraction and processing	0	0	0	0	0	0	0	0
	5.2.9	Primary ferrous metal production	0	0	0	0	0	0	0	0
5.3		**Source category: Production of other minerals and materials with mercury impurities**								
	5.3.1	Cement clinker production	0	61	46	0	0	15	0	0
	5.3.2	Pulp and paper production	0	0	0	0	0	0	0	0
	5.3.3	Production of lime and light weight aggregates	0	0	0	0	0	0	0	0
5.4		**Source category: Intentional use of mercury in industrial processes**								
	5.4.1	Chlor-alkali production with mercury-technology	0	0	0	0	0	0	0	0
	5.4.2	VCM production with mercury catalyst	0	0	0	0	0	0	0	0
	5.4.3	Acetaldehyde production with mercury catalyst	0	0	0	0	0	0	0	0
	5.4.4	Other production of chemicals and polymers with mercury	0	0	0	0	0	0	0	0
5.5		**Source category: Consumer products with intentional use of mercury**								
	5.5.1	Thermometers with mercury	0	156	22	47	12	-	70	5
	5.5.2	Electrical switches and relays with mercury	0	67	8	0	9	-	47	3
	5.5.3	Light sources with mercury	0	9	1	0	1	-	7	0
	5.5.4	Batteries with mercury	0	17	2	0	2	-	13	0
	5.5.5	Polyurethane with mercury catalysts	0	1	0	0	0	-	1	0
	5.5.6	Biocides and pesticides with mercury	0	0	0	0	0	-	0	0
	5.5.7	Paints with mercury	0	7	7	0	0	-	0	0
	5.5.6	Pharmaceuticals for human and veterinary uses	0	0	0	0	0	-	0	0
	5.5.9	Cosmetics and related products with mercury	0	0	0	0	0	-	0	0
5.6		**Source category: Other intentional product/process use**								
	5.6.1	Dental mercury-amalgam fillings (b	0	0	0	0	0	0	0	0
	5.6.2	Manometers and gauges with mercury	0	0	0	0	0	0	0	0
	5.6.3	Laboratory chemicals and equipment with mercury	0	0	0	0	0	0	0	0
	5.6.4	Mercury metal use in religious rituals and folklore	0	0	0	0	0	0	0	0

		medicine								
	5.6.5	Miscellaneous product uses, mercury metal uses, and other sources	0	0	0	0	0	0	0	0
5.7		**Source category: Production of recycled metals ("secondary" metal production)**								
	5.7.1	Production of recycled mercury ("secondary production")	0	0	0	0	0	0	0	0
	5.7.2	Production of recycled ferrous metals (iron and steel)	0	0	0	0	0	0	0	0
	5.7.3	Production of other recycled metals	0	0	0	0	0	0	0	0
5.8		**Source category: Waste incineration*3**								
	5.8.1	Incineration of municipal/general waste	0	0	0	0	0	0	0	0
	5.8.2	Incineration of hazardous waste	0	0	0	0	0	0	0	0
	5.8.3	Incineration of medical waste	0	0	0	0	0	0	0	0
	5.8.4	Sewage sludge incineration	0	0	0	0	0	0	0	0
	5.8.5	Informal waste burning	0	9	9	0	0	0	0	0
5.9		**Source category: Waste deposition/landfilling and waste water treatment**								
	5.9.1	Controlled landfills/deposits*3	0	3	3	0	0	0	0	0
	5.9.2	Diffuse disposal under some control	-	0	-	-	-	-	-	-
	5.9.3	Informal local disposal of industrial production waste	0	0	0	0	0	-	-	-
	5.9.4	Informal dumping of general waste*1*3	0	43	4	4	34	-	-	-
	5.9.5	Waste water system/treatment*2	0	395	0	209	74	0	57	55
5.10		**Source category: Crematoria and cemetaries**								
	5.10.1	Crematoria/cremation	0	0	0	0	0	-	0	0
	5.10.2	Cemeteries	0	20	0	0	19.66818	-	0	0
SUM OF QUANTIFIED INPUTS AND RELEASES *1*2*3*4				**834**	**194**	**51**	**117**	**15.0647199**	**196**	**66**

Notes: *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 release to water includes mercury amounts which have also been accounted for under each source category. To avoid double counting, release to water from waste water system/treatment have been subtracted automatically in the TOTALS.

5 Identified hot-spots of mercury contamination (contaminated sites)

The inventory didn't reveal major contaminated sites that could be identified as mercury hot-spots in the country:

At the same time, still uncertain remains the situation with on site, that is pending obsolete pesticide burial in Cismichioi village for which the Ministry of Environment shall initiate the detailed investigations in 2017 with the support of the Czech Republic.

Site name	Location	Original source of mercury contamination	Summary description	References to detailed descriptions
Cismichioi landfill /burial of the obsolete pesticides	Village Cismichioi	Hg containing obsolete pesticides	Cismichioi landfill /burial of the obsolete pesticide – amounting 4000 tons of OPs . The composition of the OPs in some cells is classified as unknown, thus there is an uncertainty at which extend the mercury containing pesticides can be placed there.	n/a

6 Data and inventory on extraction and use of fuels/energy sources

6.1 Coal combustion in large power plants

Within the Source Category 5.1: Extraction and use of fuels/energy sources sub-category 5.1.1 "Coal combustion in large power plants" covers large combustion plants, typically with thermal boiler effect above 300 MW. Most of such plants are large-scale electricity production plants, some of which also supply heat. In most of cases, such plants represent large parts of the national consumption, and they are often equipped with extensive, individually configured emission reduction systems. Such equipment captures parts of the mercury output, which reduces direct release to the atmosphere.

Within the energy system of the Republic of Moldova exists only one facility that falls under this sub-category – and namely large plant, situated in Dnestrovsk, on the left bank of the Dniester River.

The information on the amount of bituminous coal used at MTTP in Dnestrovsk for power and heat generation is available in the sectoral statistical publications of the Administrative-Territorial Units on the Left Bank of Dniester (Table 6-1), which are available online on the website of the Ministry of Economy of the Transnistrian Moldavian Republic (ATULBD)[1]. Bituminous coal at MTTP in Dnestrovsk is imported mostly (>90%) from Ukraine, and according to the Toolkit for identification and quantification of mercury releases, the mean Hg concentration in Ukrainian bituminous coal is 0.07 g Hg/t.

Table 6-1 Coal consumption for power and heat generation at MTTP in Dnestrovsk, 2014-2018

	2014	2015	2016	2017	2018
Bituminous coal used at MTTP, thousand tons	178,3	176,0	169,1	169,1	168,6

Source: State Statistical Service of the Transnistrian Moldovan Republic, Socio-economic development of the TMR, 2015, 2016, 2017, 2018, 2019 Chapter 4 "Material and Energy Resources", http://mer.gospmr.org/gosudarstvennaya-sluzhba-statistiki/informacziya/o-soczialno-ekonomicheskom-polozhenii-pmr.html

According to energy sectors specialists from the Institute of Power Engineering of the Academy of Sciences of Moldova, at the MTTP in Dnestrovsk are available the following post-combustion emission control device configuration -Level 1: Particulate matter simple air polluting control: ESP – Electrostatic precipitator / PS – Particle Scrubber / CYC – Cyclones.
In such a case, the distribution factor or share of Hg input would be as following: 75% of Hg release from combustion of bituminous coal goes in air, while 25%, respectively in sector specific treatment/disposal (Table 6-2).

Summary of inputs and results

Table 6-2 Summary of inputs and results from sub-category 5.1.1 "Coal combustion in large power plants" in the Republic of Moldova in 2018

[1]<http://www.mepmr.org/gosudarstvennaya-statistika/informacziya/62-o-soczialno-ekonomicheskom-polozhenii-pmr>.

Sub-category 5.1.1 "Coal combustion in large power plants"	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	metric tons		168621.7		-
Input factor for phase	g Hg/ t coal		0.07		-
Calculated Hg inputs	kg Hg		11,803		-

6.2 Other coal uses

Within the Source Category 5.1: Extraction and use of fuels/energy sources sub-category 5.1.2.1 "Coal combustion in coal fired industrial boilers" covers coal combustion in smaller combustion plants (below 300 MW thermal boiler capacity), including industrial combustion/boilers in various sectors (cement production plants, metallurgical plants, food processing industry, etc.) and the sub-category 5.1.2.2 " Other coal use" covers district heating plants and household use of coal.

The information on the amount of other coal consumption, by economic sectors (Table 6-3), is available in the Energy Balances of the Republic of Moldova[2], as well as in the sectoral statistical publications of the ATULBD[3].

Table 6-3 Other hard coal consumption, by economic sector, in the Republic of Moldova, 2014-2018

	2014	2015	2016	2017	2018
Small combustion, including industrial plants, thousand tons	80.1	66.76	41.91	49.77	39.58
Use of coal for heating plants within institutional and commercial sectors, thousand tons	32.0	29.83	28.63	31.10	29.85
Subtotal	**112,1**	**96.59**	**70.54**	**80.87**	**69.43**
Household use of coal for heating and cooking, thousand tons	68.4	67.80	49.72	84.75	59.89

Source: Energy Balances of the Republic of Moldova for 2010-2014 years; State Statistical Service of the Transnistrian Moldovan Republic (2015), Socio-economic development of the TMR, 2014, Chapter 4 "Material and Energy Resources", page 22; Tiraspol, 2015, 88p;State Statistical Service of the Transnistrian Moldovan Republic (2014), Socio-economic development of the TMR, 2013 (final data), Chapter 4 "Material and Energy Resources", page 22. Tiraspol, 2014, 88p; State Statistical Service of the Transnistrian Moldovan Republic (2013), Socio-economic development of the TMR, 2012, Chapter 4 "Material and Energy Resources", page 23, Tiraspol, 2013, 85 p; State Statistical Service of the Transnistrian Moldovan Republic (2012), Socio-economic development of the TMR, 2011, Chapter 4 "Energy Resources", page 23,Tiraspol, 2012, 85 p.; State Statistical Service of the Transnistrian Moldovan Republic (2011), Socio-economic development of the TMR, 2010, Chapter 4 "Material Resources", page 21,Tiraspol, 2011, 79 p.

The coal (mainly hard coal: anthracite, cocking coal and bituminous coal) is imported in the Republic of Moldova mostly (>90%) from Ukraine.

In case of household use of coal for heating and cooking it was assumed Level 0 of post-combustion emission control system (no emission control); while in case of district heating plants and small combustion plants (including industrial combustion in various sectors) it was assumed Level 1 of post-combustion emission control (Particulate matter simple air polluting control: ESP/PS/CYC).

The input factor for mercury in other coal used in the Republic of Moldova represents a weighted value between the default input factor[4] (used for calculating the mercury releases from combustion of anthracite and cocking coal) and the regional input factor[5] (used for calculating the mercury releases from combustion of Ukrainian bituminous coal), considered as being most appropriately for the national conditions of the Republic of Moldova, calculated by considering also the share of var-

[2]< http://statistica.gov.md/pageview.php?l=ro&idc=263&id=2197>.
[3]<http://www.mepmr.org/gosudarstvennaya-statistika/informacziya/62-o-soczialno-ekonomicheskom-polozhenii-pmr>.
[4]According to the Toolkit for identification and quantification of mercury releases – Version 1.3, January 2015 (Table 5-12 on page 78), the default input factor for mercury in coal for energy production in industrial and other facilities is **0.15 g Hg/t**.
[5]According to the Toolkit for identification and quantification of mercury releases – Version 1.3, January 2015 (page 61), the mean Hg concentration in **Ukrainian** bituminous coal is **0.07 g Hg/t**.

ious type of coal used annually in different sectors of the national economy (see for reference Table 6-3 above).

Summary of inputs and results

Table 6-4. Summary of inputs and results from sub-category 5.1.2.1 and 5.1.2.2 in the Republic of Moldova in 2018

Sub-category 5.1.2.1 "Other coal use"	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	metric tons		69430		-
Input factor for phase	g Hg/ t coal		0.1219		-
Calculated Hg inputs	kg Hg		8,33		-
Sub-category 5.1.2.2	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	metric tons		59890		-
Input factor for phase	g Hg/ t coal		0.1219		-
Calculated Hg inputs	kg Hg		7,19		-

Data gaps and priorities for potential follow up

No major data gaps have been registered so far for this sub-category. As a priority for potential follow up is clarifying which are the post-combustion emission control device configurations used in the largest industrial coal combustion/boilers in various sectors (cement production plants, metallurgical plants, food processing industry, etc.), as well as in the largest district heating plants on coal combustion.

6.3 Mineral oils – extraction, refining and use

Within the Source Category 5.1: Extraction and use of fuels/energy sources sub-category 5.1.3 "Mineral oils – extraction, refining and use" includes extraction, refining and use of mineral oil. The sub-category includes also the combustion of oil to provide power, heat, and transportation, and other uses such as for example road asphalt (bitumen), synthesis of chemicals, polymer production, lubricants and carbon black production. Like other natural materials, mineral oil contains small amounts of natural mercury impurities, which are mobilised to the biosphere by extraction and use.

Oil extraction and refining

Oil is extracted in the Southern part of the Republic of Moldova, nearby Valeni village and Beleu Lake. Natural gas and oil resources were initially extracted (between 1995 and 2007) by an American company Redeco LTD, and starting with 2007, by Valiexchimp LTD Company. In 2016, the right to extract the resources in Valeni was granted to the American company "Fontera Resources Corporation".

The oil exploration in Valeni village, Cahul district is refined at Comrat refinery (set into exploitation on July 15, 2005) which has a capacity of 30 thousand tons per year. This refinery can produce diesel oil, gasoline, residual fuel oil, lubricants, as well as bitumen and bitumen for road construction, but is focused mainly on producing residual fuel oils, diesel oil and lubricants.

According to the information provided by the Institute of Ecology and Geography of the ASM, the specific density of the oil extracted in Valeni is 941 kg/m^3, while its retail price is approximately equal to residual fuel oil price on the regional markets.

Table 6-5 presents the annual oil production values in 2014-2018.

Table 6-5 Oil extraction and refining in the Republic of Moldova, 2014-2018.

	2014	2015	2016	2017	2018
Oil extraction in the Republic of Moldova thousand tons	8	7	7	5	5

Source: Energy Balances of the Republic of Moldova for 2014-2018 years.

As stated above, at Comrat Oil Refinery, the "Arnaut Petrol" Company produced various oil products (Table 6-6), not only from oil extracted in the Republic of Moldova, but also from imported oil.

Table 6-6 Oil refining products produced in the Republic of Moldova, 2014-2018

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total oil products, thousand tons	21.0	19.0	18.0	19.0	18.0	11	15	14	8

Source: Energy Balances of the Republic of Moldova for 2010-2014 years.

According to the Toolkit for identification and quantification of mercury releases, UNEP/AMAP (2012) has calculated a production weighted global average of mercury concentration in crude oil at 3.4 mg/metric ton of oil, respective value was used by the Republic of Moldova as well in this inventory cycle.

Summary of inputs and results

Table 6-7 Summary of inputs and results from Sub-category 5.1.3 "Mineral Oils – Extraction, Refining and Use", Source "Oil Extraction and Refinery" in the Republic of Moldova in 2018

5.1.3 "Mineral Oils – Extraction, Refining and Use", Source "Oil Extraction and Refinery"	**Unit**	**Production**	**Refining**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	metric tons	5000	8,000		-
Input factor for phase	mg Hg/ t oil	3.4	3.4		-
Calculated Hg input to phase	kg Hg	0.017	0.0272		-

Data gaps and priorities for potential follow up

No data gaps have been registered so far for this source.

Oil combustion

The most important factors determining releases from oil combustion sources are the mercury levels in the oil and amount of fuel burned.

The primary pathway of releases for these sources is to air. Since the entire fuel supply is exposed to high flame temperatures, essentially all of the mercury contained in the fuel oil will evaporate and exit the combustion chamber with the combustion gases.

Unless these combustion gases are exposed to low-temperature air pollution control systems and high efficiency PM control systems, the mercury will be released in vapour phase through the combustion stack.

The information on the amount of heavy oil consumption, by economic sectors (Table 6-8), is available in the Energy Balances of the Republic of Moldova, as well as in the sectoral statistical publications of the ATULBD.

Table 6-8 Heavy oil consumption, by economic sector, in the Republic of Moldova, 2014-2018

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Small combustion, including industrial plants, thousand tons	43.9	34.5	27.1	27.6	27.4	27.4	27.4	27.4	27.4
Use of heavy oil for heating plants within institutional and commercial sectors as well as in agriculture sector, thousand tons	1.0	1.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Total, thousand tons	**44.9**	**35.5**	**27.1**	**27.6**	**27.5**	**27.5**	**27.5**	**27.5**	**27.5**

Source: Energy Balances of the Republic of Moldova, Statistical Service of the Transnistrian Moldovan Republic (2014), Socio-economic development of the TMR, 2013 (final data), Chapter 4 "Material and Energy Resources", page 22. Tiraspol, 2014, 88p; State Statistical Service of the Transnistrian Moldovan Republic (2013), Socio-economic development of the TMR, 2012, Chapter 4 "Material and Energy Resources", page 23, Tiraspol, 2013, 85 p; State Statistical Service of the Transnistrian Moldovan Republic (2012), Socio-economic development of the TMR, 2011, Chapter 4 "Energy Resources", page 23,Tiraspol, 2012, 85 p.; State Statistical Service of the Transnistrian Moldovan Republic (2011), Socio-economic development of the TMR, 2010, Chapter 4 "Material Resources", page 21,Tiraspol, 2011, 79 p.

According to the UNEP Toolkit for identification and quantification of mercury releases, the default input factor for heavy oil combustion is 20 mg Hg/metric ton of oil; this value was used by the Republic of Moldova in respective inventory cycle (Table 6-9).

It was assumed considering the opinion of specialists from the Institute of Power Engineering of the Academy of Sciences of Moldova, that most of the oil combustion facilities in the Republic of Moldova have particulate matter (PM filter) control using an electrostatic precipitator (ESP) or scrubber.

Summary of inputs and results

Table 6-9 Summary of inputs and results from sub-category 5.1.3 "Mineral Oils – Extraction, Refining and Use", Source "Oil Combustion" in the Republic of Moldova in 2014

5.1.3 "Mineral Oils – Extraction, Refining and Use", source "Oil Combustion"	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	metric tons	27493			-
Input factor for phase	mg Hg/ t oil	20 mg Hg/t			-
Calculated Hg input to phase	kg Hg	0.54986			-

Data gaps and priorities for potential follow up

No data gaps have been registered so far for this source.

Petrol/gasoline, diesel, distilled fuel oil, kerosene and other light distillates

The information on the amount of light fuel oils consumption/use, by fuel type (Table 6-10), is available in the Energy Balances of the Republic of Moldova, as well as in the sectoral statistical publications of the ATULBD.

Table 6-10 Light fuel oils consumption, by fuel type, in the Republic of Moldova in 2017 and 2018

	2017	2018
Gasoline	164	169
Jet Kerosene	47	54
Diesel Oil	594	610
LPG	72	72
Total, thousand tons	877	905

Source: Energy Balances of the Republic of Moldova, State Statistical Service of the Transnistrian Moldovan Republic, Socio-economic development of the TMR

Data on mercury concentrations in a variety of refined oil products are presented in the Toolkit for identification and quantification of mercury releases. Concomitantly, the toolkit is offering a so-called "unabated emission factor" (equivalent to input factors) for use of light fuel oils (2 mg Hg/metric ton). According to the toolkit, in case of all uses without emission control (e.g., transportation and other uses of light fuel oils other than combustion) the distribution factor or share of Hg input assume that 100% of Hg release goes in air (Table 6-11).

Summary of inputs and results

Table 6-11 Summary of inputs and results from sub-category 5.1.3 "Mineral Oils – Extraction, Refining and Use", Source "Use of gasoline, diesel, light fuel oil, kerosene, LPG and other light to medium distillates" in the Republic of Moldova in 2018

5.1.3 "Mineral Oils – Extraction, Refining and Use", Source "Use of gasoline, diesel, light fuel oil, kerosene, LPG and other light to medium distillates"	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	metric tons		905000		-
Input factor for phase	mg Hg/ t light oil		2		-

5.1.3 "Mineral Oils – Extraction, Refining and Use", Source "Use of gasoline, diesel, light fuel oil, kerosene, LPG and other light to medium distillates"	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Calculated Hg input to phase	kg Hg		1,810		-

Data gaps and priorities for potential follow up

No data gaps have been registered so far for this source.

6.4 Natural gas – extraction, refining and use

Natural gas is a fossil fuel used for various purposes, especially combustion to produce electricity and heat. Like many other natural materials, natural gas contains small amounts of natural mercury impurities, which are mobilized to the biosphere during extraction, refining and combustion.

Under sub-category 5.1.4 "Natural gas – extraction, refining and use" of the Source Category 5.1: "Extraction and use of fuels/energy sources" are considered mercury releases from extraction, refining and combustion of natural gas.

Natural gas extraction and refining

In the Republic of Moldova, natural gas reserves have been identified nearby Victorovca village, Cantemir rayon.

After the natural gas is extracted, only moisture and some other impurities are removed. The extracted gas is cumulated in relative small gasholders which are connected through pipelines to the Moldovagaz" J.S.C. distribution network.

Table 6-12 reveals that between 2010 and 2014, the annual natural gas production in the RM has not exceeded 118 thousand m^3 per year.

Table 6-12 Natural gas extraction in the Republic of Moldova, 2010-2018

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Natural gas extraction in the Republic of Moldova, thousand m^3	88,60	59,06	118,13	118,1334908	88,60	88,60	118,13	118,13	118,13

Source: Energy Balances of the Republic of Moldova.

Natural gas use

Currently, the most used type of fuel in the Republic of Moldova is natural gas. This type of fuel has been used in the Republic of Moldova since 1966, being fully imported from Russian Federation through the gas pipeline system. The main operator on the natural gas market in the country is the Moldovan-Russian joint venture "MOLDOVAGAZ".

Table 6-13 Natural gas transited through, imported and consumed in the Republic of Moldova, 2014-2018

Natural Gas sold in the RM, million m3	2014	2015	2016	2017	2018
on the Right Bank of the Dniester, million m^3	1053,1	1008,45	1038,36	1033,85	1129,65
on the Left Bank of Dniester, million m^3	1770,4	1770,4	1770,4	1770,4	1770,4

Source: Energy Balance, 2014-2018

Data on mercury concentrations in various natural gas qualities are presented in the UNEP Toolkit for identification and quantification of mercury releases; the preliminary default input factor for mercury in raw or pre-cleaned gas is 100 µg Hg per Nm^3 gas, while for pipeline gas (consumer quality) the value of default input factor is 0.22 µg Hg per Nm^3 gas).

The toolkit is offering also default mercury output distribution factors (in case of natural gas combustion, it assumed that 100% of mercury release goes to air, while in case of extraction and processing without mercury removal, it is assumed that 20% goes to air, 20% to water, 50% to products and 10% to general waste).

Summary of inputs and results

Table 6-14 Summary of inputs and results from sub-category 5.1.4 "Natural Gas – Extraction, Refining and Use" in the Republic of Moldova in 2018

5.1.4 "Natural gas – extraction, refining and use"	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	Nm^3natural gas	118640	2,823,500,000		-
Input factor for phase	µg Hg per Nm^3 gas	100	0.22		-
Calculated Hg input	kg Hg	0,0118	0.6212		-

Data gaps and priorities for potential follow up

No major data gaps have been registered so far for this sub-category.

6.5 Biomass fired power and heat production

Under the sub-category 5.1.6 "Biomass fired power and heat production" of the source category 5.1: "Extraction and use of fuels/energy sources" are monitored the mercury releases from combustion of various biomass sources (wood, including twigs, bark, sawdust and wood savings; and/or agricultural residues, such as straw, pellets, shells, animal excretes and litter) for power and heat production.

Biomass is burned in a wide array of devices for power generation ranging from small stoker fired furnaces to large elaborate highly sophisticated boiler/burner systems with extensive air pollution control (APC) devices. The combustion of biomass for power generation takes place predominantly in two general types of boilers (stokers and fluidized bed boilers), which are distinguished by the way the fuel is fed to the system.

The information on the amount of biomass consumption by fuel type is available in the Energy Balances of the Republic of Moldova, which are available online on the website of the National Bureau of Statistics of the Republic of Moldova[6].

Table 6-15 Biomass consumption (TJ), by fuel type, in the Republic of Moldova, 2014-2018

	2014	2015	2016	2017	2018

[6]<http://www.statistica.md/pageview.php?l=en&id=2197&idc=263>.

Total biomass, TJ	11991	12452	29149	31885	32934
Of which charcoal, TJ	21	-	-	0	30

Source: Energy Balances of the Republic of Moldova.

As the information on biomass consumption in the Republic of Moldova is available in the last versions of the Energy Balances of the Republic of Moldova only in TJ, while in Level 2 calculation spreadsheets data should be entered in tons, there were used conversion factors available in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.2 'Default net calorific values (NCVs) and lower and upper limits of the 95% confidence intervals' (29.5 TJ/Gg in case of charcoal) to generate the data needed (tons of biomass consumed).

Table 6-16 Biomass consumption (metric ton of dry weight biomass), by fuel type, in the Republic of Moldova, 2014-2018

	2014	2015	2016	2017	2018
Total biomass, tons	782020	821832	1923834	2104410	2172744
Charcoal	712	-	-	-	900

Source: Energy Balances of the Republic of Moldova.

The most important factors determining releases are the mercury levels in the fuel and amount of fuel burned. Mercury in biofuels originates from both naturally present mercury and mercury deposited from anthropogenic emissions. For example, trees (especially needles and leaves) absorb mercury from the atmosphere overtime. This mercury is readily released mostly to air when the wood and other biomass are burned. A smaller amount of mercury may be released to the ashes or residues, the extent of which depends on the specific material burned; type of combustion device; and any emission controls present.

Data on mercury concentrations in various biomass sources are presented in the Toolkit for identification and quantification of mercury releases – (the preliminary default input factor for mercury in biomass used in combustion is 0.03 g Hg per ton of dry weight, while for charcoal the value of default input factor is 0.12 g Hg per ton of dry weight). The toolkit is offering also default mercury output distribution factors (it assumed that 100% of mercury released goes to air).

Summary of inputs and results

Table 6-17 Summary of inputs and results from sub-category 5.1.6 "Biomass fired power and heat production" in the Republic of Moldova in 2018

5.1.6 "Biomass fired power and heat production"	Unit	Production	Biomass Use	Charcoal Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	t (dry weight)		2173644	885		-
Input factor for phase	g Hg/t(dry weight)		0.03	0.12		-
Calculated Hg input	kg Hg		65,18	0.108		-

Data gaps and priorities for potential follow up

No major data gaps have been registered so far for this sub-category.

7. Data and inventory on primary (virgin) metal production

Proven by official data, the Republic of Moldova lacks this type of economic activity, thus no estimations have been done under this category.

8. Production of other minerals and materials with mercury impurities

6.5 Cement production

Within the source category 5.3 "Production of other minerals and materials with mercury impurities", the sub-category 5.3.1 "Cement production" is a potential mercury release source of the type involving materials with low mercury concentrations, but in very large amounts.

In the case of the Republic of Moldova, activity data on cement production for the territory on the left bank of Dniester River at Cement and Slate Combined Works in Ribnita are available in the Statistical Yearbooks of the ATULBD[7].

Information on cement production on the right bank of Dniester River is received on request from Lafarge Cement (Moldova) SA in Rezina town.

Information used to calculate Hg releases from the sub-category 5.3.1 "Cement production" is presented only aggregated at the national level (Table 8-1).

Table 8-1 Cement and clinker production in the Republic of Moldova, 2014-2018

		2014	2015	2016	2017	2018
Total	Cement production, tons	1.086.152	964581	900270	1045525	1175141

Source: Lafarge Cement (Moldova)SA in Rezina, Official Letter; Statistical Yearbooks of the ATULBD.

According to the information provided in the Toolkit for identification and quantification of mercury releases, the default mercury input factor recommended to be used in the calculations is **0.11 g Hg / ton** of cement produced (without co-incineration of waste) (the range is 0.004 - 0.5 g Hg / ton of cement produced), respectively **0.15 g Hg / ton of cement** produced (with co-incineration of waste) (the range is 0.06 - 1 g Hg / ton of cement produced).

Concomitantly, there are provided also other range of mercury input factors ("unabated emission factors") used for cement production by UNEP/AMAP (2012), including: **0.087 g Hg / ton of cement** produced (limestone only) (the range is 0.003 - 0.4g Hg / ton of cement produced); **0.118 g Hg / ton of cement** produced (limestone + waste incineration) (the range is 0.05–0.8g Hg / ton of cement produced); **0.091 g Hg / ton of cement** produced (limestone + pet coke + no waste incineration) (the range is 0.005–0.6g Hg / ton of cement produced); respectively **0.105 g Hg / ton of cement** produced (limestone + pet coke + waste incineration) (the range is 0.01–1.5g Hg / ton of cement produced).

It is to be noted also that the Toolkit for identification and quantification of mercury releases a range of country specific mercury input factors, such as: **0.045 g Hg / metric ton of cement** produced in the Russian Federation; **0.03 g Hg / metric ton of cement** produced in Austria and Germany; **0.01 g Hg / metric ton of cement** produced in United Kingdom and Spain. Under these circumstances, Cembureau (2010) suggested an average atmospheric emission factor for cement production of around **0.035 g Hg / ton of cement** produced.

[7]<http://www.mepmr.org/gosudarstvennaya-statistika/informacziya/122-ezhegodnik-gosudarstvennoj-sluzhby-statistiki>.

All those noted above are of extremely importance, specifically for being compared with the plant specific / country specific value of the atmospheric emission factor for cement production, which has been provided by the Lafarge Cement (Moldova) SA in Rezina, of **0.0337 g Hg / ton of clinker** produced, this value being equivalent to **0.0255 g Hg / ton of cement** produced. The respective values were calculated based on actual measurements of Hg emissions on stack, undertaken in August 2012. During the period of measurements, there was produced 85,749 tons of clinker, while the total Hg emissions constituted 2.8862 kg of Hg.

Concomitantly, considering that the mercury retention efficiency for filter configurations on Lafarge Cement (Moldova) SA in Rezina is Level 1: particulate matter simple air pollution control (APC): ESP – Electrostatic precipitator / FF – Fabric filter (or "bag filter") (when the Hg-containing filter dust from air exhausts is fed back into the process, by reintroducing it into the raw material preparation system), in this case the distribution factors for mercury outputs corresponds to:70% of mercury releases go to air, while 30% to products.

Under these circumstances, while considering also the Hg content in manufactured product, the average plant specific / country specific mercury input factor used for estimating the Hg releases from cement production at Lafarge Cement (Moldova)SA in Rezina for the whole period under review (2010-2014) would be around **0.0481 g Hg / ton of clinker** produced, which is equivalent to **0.0364 g Hg / ton of cement** produced.

In the case of the Cement and Slate Combined Works in Ribnita it has been considered appropriate using the average atmospheric emission factor of **0.0450 g Hg / ton of cement** produced, derived from information on mercury in raw materials and an assumption that on average 80% of the mercury in the raw materials are emitted in the air, while the rest in the products; respective atmospheric emission factor is specific to the cement plants of the Russian Federation, and it was considered that the Cement and Slate Combined Works in Ribnita (ATULBD) is very similar to them by technology and abatement techniques used.

Table 8-2 Cement and clinker production by type of fossil fuel in the Republic of Moldova, tones, 2015-2018

	2015	2016	2017	2018
Natural gas	21645.43	20806.29	24256.76	30248.18
Coal	914744.04	792170.46	868316.08	869960.64
Pet coke	3287.21	69089.37	152952.16	274932.18
Used tyres	19779.27	18203.87	0.00	0.00

Source: Lafarge Cement (Moldova)SA in Rezina, Official Letter, Statistical Yearbooks of the ATULBD.

The cement from Ribnita is considered to be produced with coal as fuel.

Summary of inputs and results

Table 8-3 Summary of inputs and results from sub-category 5.3.1 "Cement production" in the Republic of Moldova in 2018

5.3.1 "Cement production"	Unit	Production		Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
		Rezina	Ribnita			
Activity rate	metric tons cement	619141	556000			-
Input factor for phase	g Hg/ t cement produced	0.0364	0.0450			-
Calculated input to phase	kg Hg	27	34			-
Output distribution factors for phase: - Air	fraction	0.7	0.8			-

5.3.1 "Cement production"	Unit	Production		Use	Dispos-al	Sum of releas-es to pathway from assessed part of life-cycle
		Rezina	Ribnita			
- Water	fraction					-
- Land	fraction					-
- Products	fraction	0.3	0.2			-
- General waste treatment	fraction					-
- Sector specific waste treat-ment	fraction					-
Calculated outputs/releases to:		27	34			61
- Air	kg Hg	19,24	27,13			46,37
- Water	kg Hg					
- Land	kg Hg					
- Products	kg Hg	8,24	6,78			15,03
- General waste treatment	kg Hg					
- Sector specific waste treat-ment	kg Hg					

Data gaps and priorities for potential follow up

No major data gaps have been registered so far for this sub-category.

6.6 Lime production

Within the source category 5.3 "Production of other minerals and materials with mercury impurities", the sub-category 5.3.3 "Production of lime and light weight aggregates" includes the production of lime in lime kilns (other than the lime produced at cement plants) and light weight aggregate kilns.

Activity data on lime production for the territory on the left bank of Dniester River are available in the Statistical Yearbooks of the ATULBD[8].

Information on lime production on the right bank of Dniester River is available in the Statistical Reports PRODMOLD-A "Total production, as a natural expression, in the Republic, by product type" published yearly by the National Bureau of Statistics. Information used to calculate Hg releases from lime production is presented below aggregated at the national level in Table 8-4.

Table 8-4 Lime production in the Republic of Moldova, 2010-2014

	2014	2015	2016	2017	2018
Lime production, tons	8378	8180,6	4074,8	22381	24814

Source: National Bureau of Statistics of the Republic of Statistical Reports PRODMOLD-A „Total production, as a natural expression, in the Republic, by product type, for 2010-2014 periods"; Statistical Yearbooks of the ATULBD.

According to the information provided in the Toolkit for identification and quantification of mercury releases – Version 1.3, January 2015, the average atmospheric mercury emission factors for the coal-fired rotary kilns from the one Canadian facility and the two USA facilities were combined and showed an overall average atmospheric mercury emission factor of 7.4 mg Hg/metric tons of lime produced (Table 8-4). As no any attempts were made to establish a default factor for this sub-category it was taken the decision to use for this inventory cycle the above mentioned emission factor for estimating Hg emissions from lime production in the Republic of Moldova.

[8]<http://www.mepmr.org/gosudarstvennaya-statistika/informacziya/122-ezhegodnik-gosudarstvennoj-sluzhby-statistiki>.

According to the source based information, in the Republic of Moldova the mercury retention efficiency for filter configurations on lime production facilities is Level 0: with no pollution control. For this case the default distribution factors for mercury outputs from lime production is as following: 80% of mercury releases go to air and 20% to products.

Summary of inputs and results

Table 8-5 Summary of inputs and results from sub-category 5.3.3 "Production of lime and light weight aggregates" in the Republic of Moldova in 2018

5.3.3 "Production of lime and light weight aggregates"	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	metric tons of lime	24814			-
Input factor for phase	mg Hg/ t lime produced	7.4			-
Calculated input to phase	kg Hg	0,18			-

Data gaps and priorities for potential follow up

No major data gaps have been registered so far for this sub-category.

9. Data and inventory on intentional use of mercury in industrial processes

Proven by official data, at the moment of inventory elaboration, the Republic of Moldova lacks this type of economic activity, thus no estimations have been done under this category.

10. Data and inventory on consumer products with intentional use of mercury

Waste collection system in the Republic of Moldova

The special waste collection and disposal services are rendered in municipalities, in all the district centres, therefore the municipal waste management is relatively well organized. The separate waste collection system is at initial phase of implementation in urban area, with a few exceptions for some waste flows. However, this system covers only the 60 – 90% of the generators of municipal waste from the urban areas.

Almost no organized services of waste management exist in the vast majorities of rural settlements, therefore the transportation of waste to the waste deposits is done individually by the generators, except for waste collection services established in some of the rural areas. The number of persons from the rural areas who use these services is relatively low because of the lack of financial sources. Only a small part of the rural settlements, and namely those situated in the neighbourhood of district centers, benefit of waste collection services.

The methodology for calculation of mercury emissions and distribution recommends three ”scenarios” of waste collection systems:
(1) No separate collection. Waste handling controlled,
(2) No separate collection. Informal waste handling widespread, and
(3) Separate collection. Waste handling controlled.
For each category of products, the ”scenarios” of waste collection systems will differ and will be described separately.

ATULBD

The population of ATULBD represents 15 % of population of the Republic of Moldova. The telephone conversation with the Customs Service revealed that a big part of the goods imported through the Moldovan border are used in ATULBD. Considering this it can be assumed that, out of 15 % mentioned above, 10 % represent the goods imported in Moldova which are already included in the official import statistics provided by the Customs Service. Therefore, only the remained 5 % are imported directly to ATULBD. Hence, in order to avoid double counting of the imports already provided by the Customs Service, the coefficient to be used in calculations for ATULBD will constitute 5 % of officially recorded for Moldova imported quantities.

Table 10-1. Data on population

Population	**2014**	**2015**	**2016**	**2017**	**2018**
Total	3413200	3384100	3369100	3356800	3330000
Urban	1383300	1379600	1379500	1379600	1376600
Rural	2029900	2004500	1989600	1977200	1953400

Source: www.statistica.md

10.1 Thermometers

Production

There is no production of thermometers containing mercury in the Republic of Moldova.

Use and disposal

The mercury containing thermometers are not produced in the Republic of Moldova. However, they are widely used in homes and in medical institutions, even though mercury free alternatives exist. The main reason for using the mercury thermometers is their price (5-10 times less comparing to electronic one) and perception that provides better accuracy of the measurement.

As regards the regulatory issues related to mercury thermometers, according to the recently approved Chemicals Law no 277/2018 (will enter into force early 2020) it is prohibited the manufacture, place on market and use mercury and its compounds in:

1) medical thermometers;
2) other measuring devices intended for sale to the general public, such as:
   a) manometers,
   b) barometers,
   c) sphygmomanometers,
   d) thermometers, other than medical thermometers
3) measuring devices intended for professional and industrial use, such as:
   a) barometers;
   b) hygrometers;
   c) manometers;
   d) sphygmomanometers;
   e) deformation measuring devices used in plethysmographs, tensiometers, thermometers and other non-electrical thermometric applications.

   The restriction shall also apply to devices which are placed on the market empty if intended to be filled with mercury.

   The restriction does not apply sphygmomanometers used as reference standards in clinical validation studies of mercury-free sphygmomanometers and mercury triple point cells which are used for the calibration of platinum resistance thermometers.
4) measuring devices intended for industrial and professional uses, such as pycnometers on mercury and mercury containing measuring devices for the determination of softening point;
5) pesticides used as plant protection products;
6) biocidal products;
7) local antiseptics, anti-microbial agents which are used for the destruction, the inhibition or reduction in the number of microorganisms on the skin;
8) cosmetics (containing mercury above 1 ppm), including soaps and creams to whiten skin, except for the eye area, where mercury is used as a preservative and there is an effective preservative to replace preservative;
9) dental amalgams.

The mercury input factor for the clinical thermometer, i.e. the mercury content in a thermometer, was consulted with "*Romed"* (Netherlands) in 2015. The data on Hg content in produced thermometers officially confirmed by and Romed is 0,8 g of Hg/item. Considering that most of thermometers are imported from Netherlands comparing to China, this emission factor was applied.

For other types thermometers, the default input factors will be used.

The "output scenario" provides 3 options. For distribution of the emissions, the following scenarios will be used:
(1) No separate collection. Waste handling controlled – 50 % of emissions,
(2) No separate collection. Informal waste handling widespread – 40 %, and
(3) Separate collection. Waste handling controlled – 10 %.

The 3 scenario is assigned 10 % of releases, because the laboratory, ambient air, special use and small share of clinical thermometers are disposed off in safe conditions, most of them being kept in special dedicated rooms or handed over to authorized companies.

The basic information on the mercury containing measuring devices registered in the Republic of Moldova was received from the National Metrology Institute, which keeps and manages the State Register of Approved Measuring Instruments. All the measuring instruments imported in the country pass the metrological control, receive a conformity certificate and are recorded in this Register, which is available online and contains records for the period 1993-2019. The records of mercury containing thermometers were selected from the Register and are included in the table below:

Table 10-2. Mercury containing thermometers recorded in the State Registry of measuring instruments

	Measuring device	Type	Producer, country	Validity of all certificates
1.	Clinical glass thermometer	-	Wuxi Hongguang Medical Equipment Co., Ltd", China	2013-2023
2.	Clinical glass thermometer filled with liquid	EXATHERM	"Exatherm" s.r.o., Republica Cehă	expired
3.	Clinical glass thermometer	GT004-100	"Wuxi Hongguang Medical Equipment Co., Ltd.", China	expired
4.	Clinical glass thermometer	CR-W23	Jiangsu Yuyue Medical Instruments Co., Ltd., China	2014-2019
5.	Clinical glass thermometer		OAO Termopribor, Russian Federation	Last registration - 2015
6.	Technical liquid filled thermometer	TTJ-M	OAO Steclomopribor, Russian Federation	Last registration - 2014

Source: Letter of the Metrology, completed with information from the official website http://www.metrologie.md/state-register-measuring-instruments-ro/



Clinical thermometers, mercury

GB - Romed mercury thermometers, clinical type, in plastic case, per 12 pcs in a box, 10 x 12 pcs = 120 pcs in an inner box, 12 x 120 pcs = 1.440 pcs in a carton.
Only for export outside EU.

NL - Romed kwik thermometers in plastic huls, kwik, per 12 stuks in een doosje, 10 x 12 stuks = 120 stuks in een binnendoosje, 12 x 120 stuks = 1.440 stuks in een karton.
Alleen voor export buiten de EU.

DE - Romed Quecksilber Fieberthermometer, in Kunststoffhülle, pro Stück verpackt, pro 12 Stück in einer Schachtel, 24 x 12 = 1.440 Stück im Karton.
Nur für Export außerhalb der EU.

Carton: 0.091 cbm, 33 kgs
1 pallet: 23.040 pcs (16 cartons)
REF: THERM-1440

Figure 10-1. Clinical mercury thermometer imported from Netherlands
Source: https://romed.nl/downloads/catalogue.pdf

The description of picture taken from official web page of the Romed company shows that mercury thermometer imported from the Netherlands and that it is produced only for export outside the EU countries. In this case the assumption is made that Moldova as well is within the list of these countries. In the official information received from Customs Service, these types of thermometers still appear as imported in 2014-2018 from Netherlands.

The import statistics provide data on all liquid filled thermometers – customs codes – 902511200 and 902511800. The HS codes make no distinction between thermometers that might contain mercury and those that don't. Basing on the State Register of Approved Measuring Instruments and import statistics an attempt was made to select the mercury thermometers from the total imports. Therefore, from the total quantity of supplied thermometers those imported from China and Netherlands, in the period 2008-2018 was selected:

Table 10-3. Imports of liquid filled thermometers, 2005-2018

Thermometers	2005	2006	2007	2008	2009	2010	2011	2012
902511200 Total per category	82040.0	201303.0	246641.0	217320.0	130576.0	202760.0	153400.0	181,360.0
	2013	2014	2015	2016	2017	2018	Average	Incl ATULBD
	145,440.0	134,160.0	181.360,0	145.440,0	134.160,0	127.872,0	165715,6	165715,6

Source: Customs Service of the RM

Overview of the main users of clinical mercury thermometers

The main users of mercury containing thermometers are medical institutions (clinics, hospitals), educational institutions and other organizations (that must be provided with a medical room). However, the largest user so far is the population.

The information on the use/disposal rate of mercury containing clinical thermometers (as well as other mercury containing devices and mercury compounds) in the medical institutions for the period 2010-2014 was provided by the Ministry of Health and is presented in the table below.

Table 10-4. Estimation of the quantity of clinical mercury thermometers purchased and disposed of by medical institutions in the country, 2014-2018

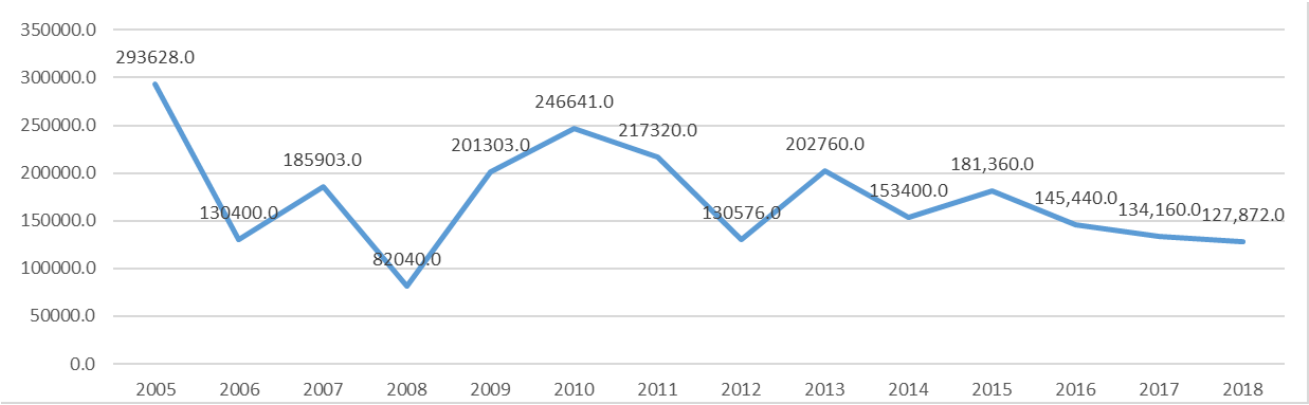
Years	2014	2015	2016	2017	2018	Average
Purchased	13349.18	15782.31	12931.00	10019.00	10682.04	
Disposed	7750.88	7573.87	4903.00	4483.00	4652.07	
Disposal rate (%) (EPPO estimations) (disposed/purchased*100)	58.06	47.99	37.92	44.74	43.55	46,45
Share of purchased from the total no. of imports (%) (EPPO estimations) (purchased/imported*100)	5.05	4.18	3.37	3.34	3.64	3,63

Source: Letter of the MoHealth

Activity rate

Considering that is very difficult to determine the breakage rate in each year of the reference period and for each type of thermometer, for calculation of mercury emissions 2018, the average quantity of thermometers imported during 2008-2018 period will be used as activity rate – 165715,6 items imported/year.

However, overall it should be noted that the import of Hg thermometers in the period 2005-2018 has decreased almost twice, which is a good signal that the existing restrictions are being already put in place by the importing companies and regulatory agencies.



Ambient air thermometers

The State Hydrometeorological Service (SHS) within the Ministry of Environment of the Republic of Moldova is the main user of ambient air mercury thermometers at its observation stations and posts (90 stations and posts). In their official reply SHS noted that in the following 5 years it does not foresee any possibility to replace the Hg thermometers in use with Hg free alternatives.

In their reply, it was not reported any thermometers or other measuring devices which were disposed off in the inventory period (2015-2018). However, in the period 2004-2019, it acquired about 2083 mercury containing thermometers.

Other glass thermometers

According to the data from the previous inventory, there were imported about 2784 of thermometers in the period 2000-2014 (of which - TTM - 1153 pieces before 2008 year, ТЛС - 689 in the period 2012-2013 and СП - 253 in the period 2012-2013).
According to the data on imports, there were imported about 63 mercury containing thermometer's – laboratory and meteorological.

Nevertheless, the number of laboratory thermometers in use can be linked with the number of all laboratories existing in the country. On the basis of the statistical data, in the country there are in average 2293 laboratories located in the educational institutions and in other relevant companies[9]. Due to difficulties in identification of the number of enterprises in ATULBD, the mentioned above coefficient of 15 % will be used. Therefore, the estimated number of laboratories is 2636.

The breakage rate of the laboratory thermometers was is used from the previous inventory – 1,5 thermometer/year.
The activity rate used for calculation of releases from laboratory thermometers will be 790 (2636*1.5/5). The default input factor is used.

Industrial and special use thermometers

The letter from Metrology Institute reveals the following Hg special thermometers, other than clinical one, imported since 2008:

- СП-83М type - designed for special uses (measuring the temperature in disinfection chambers, deep exploratory oil and gas wells);

[9] http://statbank.statistica.md

- ТПК type – maintaining a constant (predetermined) temperature in industrial, laboratory, energy and other installations (imported since 2008)

In addition, other potential major users of special thermometers such as: Termoelectrica – heat supply company, Moldelectrica – power supply company and Moldovagaz – gas supply company were also approached.

The table below includes the list of major user of special use thermometers in the Republic of Moldova.

Table 10-5 Use/disposal of special use thermometers in the Republic of Moldova, units, 2014-2018

	2014-2018		Disposal method
	Purchased	Disposed	
I. S. Moldoelectrica[10]	5	30	Elminated along with general waste
S.A. Termoelectrica[11]	2	-	-
S.A. Moldovagaz[12]	-	-	-
Total , units	7	30	

By adding ATULBD coefficient of 15%, the activity rate was estimated at 35 thermometers.

Summary of inputs and results

Table 10-6 Summary of inputs and results from sub-category 5.5.1 "Thermometers with mercury" in the Republic of Moldova in 2018

Thermometers	Unit	Production	Use/Disposal	Sum of releases to pathway from assessed part of life-cycle
Clinical thermometers				
Activity rate	Items used/y	-		-
- Medical thermometers			165715,6	156
- Ambient air thermom.			-	139
- Industrial and special th.			35	0
- Other glass Hg thermometers			791	0
Input factor for phase	g Hg/item	-		16
- Medical thermometers			0,8	
- Ambient air thermom.			3,5	
- Industrial and special th.			8	
- Other glass Hg thermometers			20,5	
Calculated input to phase	Kg Hg/y	-	156	-

Data gaps and priorities for potential follow up

[10] Letter to I.S. Moldoelectrica as official reponse to MADRM.
[11] Fax from 28.01.2016 as official reponse to Ministry of Environment letter nr. 05-07/2295 din 11.12.15.
[12] Letter SA Moldovagaz nr. 02/2-5161 from 29.12.2015 as official reponse to Ministry of Environment letter nr. 05-07/2295 din 11.12.15.

The data obtained from the Customs Service provided the total amount of liquid filled thermometers and the identification of the mercury one was based only on the country of origin. The activity rate for ATULBD deduced basing on the number of population may cause some uncertainties, due to the fact that particularly for the special use thermometers the primary data from the enterprises is important. As a priority for potential follow up would be collection of a more precise data on quantities of laboratory thermometers, as well as of the industrial and special use thermometers present at the country.

10.2 Electrical switches and relays with mercury

This sub-category is a very diverse product group both in terms of differences in applications, mercury content and life spans for the electrical components and estimation of mercury releases from these sub-category is very difficult.

Production

There is no recorded production of electrical switches and relays with mercury in the Republic of Moldova.

Use and disposal

In the Republic of Moldova, the industrial use of this type of equipment is mostly power supply and distribution. The representative of Î.C.S. „RED UNION FENOSA" S.A. (power supply company) noted during project event[13] that the mercury containing switches and relays were produced in the Soviet Union until `70 years. Since that time, the newly produced and replaced equipment is mercury free. However, their life span is high (at least 50 years) and they are not replaced so often.
In addition, Moldelectrica JSC - state power supply company – noted that it is currently using about 200 mercury relays and only two of them were replaced with mercury free relays[14]. The disposed relays are kept in the storage facilities of the company.

As, it is very difficult to estimate the exactly number of disposed switches and relays, the UNEP methodology suggests to use as activity rate the number of population.

The UNEP Toolkit recommends the default input factor of 0,02-0,25 g Hg per inhabitant per year, average 0,14 g Hg. To adjust the prevalence of "technical installations" in the country, the calculated mercury input is further reduced with the fraction of the population with access to electricity. In the Republic of Moldova the electrification rate is 100 %.

Considering the decrease of energy consumption three times comparing to level of 1990s, the low end input factor (0,02 g Hg per inhabitant per year) was used.
The "output scenario" provides 3 options:
(1) No separate collection. Waste handling controlled – 80 % of emissions,
(2) No separate collection. Informal waste handling widespread – 10 %,
(3) Separate collection. Waste handling controlled – 10 %.

[13]Workshop Assessment of the institutional and legal framework for mercury management in Moldova, held on 4.12.2015

[14]Letter no 46-74/3 of 05.01.2015 as reply to the letter 05-07/2295 of 11.12.2015 of the MoE

Summary of inputs and results

Table 10-7 Summary of inputs and results from sub-category 5.5.2 "Electrical switches and relays with mercury" in the Republic of Moldova in 2018

Electrical switches and relays with mercury	Unit	Production	Use/Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	inhabitants	-	3330000	-
Input factor for phase	g Hg/inhabitant/year	-	0.02	-
Calculated input to phase	kg/y	-	**67**	-

Data gaps and priorities for potential follow up

Identification of use of mercury switches and relays is very time and resource demanding.

10.3 Light sources with mercury

Mercury is used in small amounts per lamp in a number of different types of discharge lamps, with fluorescent tubes and compact fluorescent lamps (CFLs) as the most common examples.

Production

The Republic of Moldova does not produce light sources with mercury.

Use and disposal

Mercury containing light sources are largely used by population and in public institutions, street lighting, etc as they are energy saving and with longer life-spin.

Activity rate

The statistical data for the reference period 2005-2018 on imports and exports presented by Customs Service of the Republic of Moldova were used for this sub-category analysis..
The data on the supply of lamps received from the Customs Service provides distinguished data for the quantity on imported/exported lamps per categories identified in the Toolkit:

853931	**Fluorescent, hot cathode**
85393110	Double ended
853931900	Others
853932	**Mercury or sodium vapours, metal halide**

85393290	Metal Halide
85393232	Mercury and sodium vapors
853939	**Others**
853949	**Ultra-violet/infra-red lamps**

The activity rate recommended by the UNEP Toolkit is the number of sold items per year as it is assumed that when its lifetime ends, the lamp is disposed of. However, the actual lifetime of the lamp is very difficult to estimate due to very diverse use.
In should be noted that since the last inventory (2014) and due to new legal provisions prohibiting place on market mercury containing lamps, the imports of mercury containing lamps decreased significantly. Therefore, for calculations, the average imports for 5 years will be used, as their use decreased significantly and users have tendency to replace them with other.

The data on import of mercury lams is presented in the table below. The import of mercury and sodium vapours lamp is reported together in one commodity code, and therefore will be used together as activity rate, by applying a medium emission factor. As regards the ultraviolet and infrared lamps, the same situation occurs – they are imported under the same commodity code. Therefore, based on the data on imports for the previous years, it was assumed that a half represents ultraviolet lamps.

Table 10-8. Import of light sources with mercury for 2005-2018 and the estimated activity rate, items

Types of lamps/year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Discharge lamps, fluorescent, hot cathode, with double ended cap	786625	688730	1248720	1037708	568813	570921	783473	656246
Discharge lamps, fluorescent, hot cathode (excl. with double ended cap)	242260	85017	196466	753712	644711	1727156	1630089	1258373
Mercury vapor lamps and Sodium lamps	45527	67218	70639	93986	26308	44644	40056	23016
Ultraviolet lamps	69793	22343	5686	12005	5147	6076	7466	6087
Metal halide lamps	33305	15857	17221	8679	3576	23118	10770	7520
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**Average RM (excluding ATULBD)**	**Average RM (including ATULBD**
Discharge lamps, fluorescent, hot cathode, with double ended cap	629516	920158	522006	506587	506669	362700	574606	603336
Discharge lamps, fluorescent, hot cathode (excl. with double ended cap)	1274818	1807019	617694	448993	172226	110214	738494	775419
Mercury vapor lamps and Sodium lamps	37048	60259	10662	27244	26407	25749	31228	32790
Ultraviolet lamps	10116	8637	12568,5	39085,5	175375	216423	77034	80886
Metal halide lamps	15453	22479	5200	2489	16030	3418	10845	11387

Source: Customs Service of the RM and https://comtrade.un.org/db/default.aspx

UNEP Guide recommends default input factors for each type of lamp. Since mercury in lamps varies by country of origin and decreased with time, it is difficult to set input factors the national side, so that has been used the average value of stakeholders recommended by the guide, presented in the table below :

Table 10-9 Default mercury input factors, by type of light source

Type of light source	Mercury content in light source, mg
Fluorescent tubes (double end)	8
Compact fluorescent lamp (CFL single end)	2,7
High pressure mercury vapour	40
High-pressure sodium lamps*	20
UV light for tanning	15
Metal halide lamps	25

*for mercury vapor and sodium lamps, an average of 30 mg per was used.

Summary of inputs and results

The evolution of the mercury content in the lamps is difficult to identify, therefore the default input factor will be used.

The "output scenario" provides 3 options.
(1) No separate collection. Waste handling controlled – 40 % of emissions,
(2) No separate collection. Informal waste handling widespread – 30 %, and
(3) Separate collection. Waste handling controlled – 30 %.

The 3 scenario is assigned a biggest share, because the spent double ended fluorescent tubes used in public institutions and organizations are stored in special dedicated rooms and, therefore, are considered to be separately collected.

Table 10-10 Summary of inputs and results from sub-category 5.5.3 "Light sources with mercury" in the Republic of Moldova in 2018

Light sources with mercury	**Unit**	**Production**	**Use/Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	items sold/year	-		kg of Hg/year
- Fluorescent tubes (double end)		-	603336	5
- Compact fluorescent lamp (CFL single end)		-	775419	2
- High pressure mercury vapour and High-pressure sodium lamps		-	32790	1
- UV light for tanning		-	80886	0
- Metal halide lamps		-	11387	1
Input factor for phase	mg Hg/lamp	-		-
- Fluorescent tubes (double end)		-	8	
- Compact fluorescent lamp (CFL single end)		-	2,7	

Light sources with mercury	Unit	Production	Use/Disposal	Sum of releases to pathway from assessed part of life-cycle
- High pressure mercury vapour and High-pressure sodium lamps		-	30	
- UV light for tanning		-	15	
- Metal halide lamps			25	
Calculated input to phase		-	**9**	-

Data gaps and priorities for potential follow up

It is difficult to estimate the exactly quantity of the sold items per years, as well as the life span of the lamp. As it is difficult to identify the consumption and breakage rate, the average imports for 5 years were used, considering that the use of mercury lamps decreased and there is a tendency to replace them. Commodity codes din not offer distinguished import data on mercury and sodium lamps, as well as ultraviolet and infrared lamps. The estimations of the lamps used in ATULBD may cause some uncertainties.

10.4 Batteries with mercury

Subcategory description

The use of mercury in various types of batteries has been extensive and it has been among the largest product uses of mercury. Mercury has mainly - or perhaps solely - been used in primary (that is non-rechargeable) batteries.

As regards the mercury content regulation, currently it is missing in the country. However, the Article 49 of the draft Waste Law (which transposes the Directive 2008/98/EC of the European Parliament and of the Council of November 19, 2008 on waste) includes a detailed provision on batteries and batteries waste. So, according to the Article, all batteries and accumulators with more than 0.0005% mercury by weight, whether they are incorporated or not into appliances shall not be placed on market. The prohibition shall not apply to button cells with a mercury content of no more than 2 % by weight before January 1, 2018.

Production

The Republic of Moldova does not produce batteries with mercury.

Use and disposal

The activity rate is the number of sold items per year. However, the actual lifetime of the battery is very difficult to estimate. In addition, it is very difficult to identify in the import statistics the quantity of mercury containing batteries, especially considering that most of the brands do not use mercury any more. Hence, the average quantity sold in the period 2010-2018 will be used as annual activity rate.

Activity rate

No statistical data on the total use/disposal of mercury containing batteries are available in the Republic of Moldova. In such conditions, the consumption of batteries was estimated considering statistical data on import and export. Customs Service of the Republic of Moldova is a primary source of information on import-export operations and it provided the information on import-export activities for 2010-2018 time series.
Therefore, in the period 2010-2018 the Republic of Moldova imported the following categories of mercury batteries identified in the UNEP Toolkit:

Tabelul 10-11 Types of batteries imported under the categories identified in UNEP Toolkit

Code	Item	Category based on UNEP toolkit
8506 30 000	Mercuric oxide cells and batteries (excl. spent, and in the form of cylindrical or button cells)	**Mercury oxide**
8506 10	– Manganese dioxide:	**Manganese dioxide**
	– – Alcaline:	
8506 10 110	– – – Cylindrical	
8506 10 180	– – – Others	
	– – Others:	
8506 10 910	– – – Cylindrical	
8506 10 980	– – – Others	
8506 40 000	**Silver oxide cells**	
8506 60 000	**Zinc-air button cells**	
8506 80 800	**Others**	
8506 80 050	**Parts**	

All lithium batteries and secondary (rechargeable) batteries have always been mercury-free[15].

Conversion of units

The data on imports received from the Customs Service provided data in number of items, as well as in kg.

The quantity of imported batteries per category are presented in the table below.

Table 10-12. Import and export of batteries for the period 2010-2014, in the Republic of Moldova, tonnes

	NC	2010	2011	2012	2013	2014
Mercury oxide cells and batteries	850630	0,000	0,000	0,000	0,000	0,000
Zinc-air button cells	850660	0,06368	0,08064	0,17616	0,1607	0,123334
Silver oxide button cells	850640	0,060618	0,07902	0,060242	0,076952	0,17056
Manganese dioxide cells and bat.*	850610	95,151	104,03	54,98	51,06	53,552
	2015	**2016**	**2017**	**2018**	**Average RM (excluding ATULBD)**	**Average RM (including ATULBD)**
Mercury oxide cells and batteries	0,000	0,000	0,001	0,000	**0,00011**	**0,00012**
Zinc-air button cells	2,26	0,30	0,25	0,32	**0,781**	**0,820**
Silver oxide button cells	0,04	0,05	0,15	0,05	**0,071**	**0,075**
Manganese dioxide cells and bat.	45,62	78,85	68,23	116.00	**76.74**	**80,58**

*the alkaline button cells were deduced

Source: Customs Service of the RM, https://comtrade.un.org/db

[15] Floyd, P., P Zarogiannis, M Crane, S Tarkowski, V Bencko. Risks to Health and the Environment Related to the Use of Mercury Products. Prepared for the Eropean Commission, DG Enterprise by Risk & Policy Analysts Limited. 9. August, 2002., pg. 23

Mercury oxide batteries

Mercuric oxide batteries are known to be used in many types of finished products, including hearing

The extent to which such batteries can be conceived of as being imported in finished goods is very difficult to determine. Some efforts were made to assess the imports of hearing aids and the emissions that may be generated by the button cells contained in them.

Table 10-13. Imports of hearing aids in the period 2000-2014 and calculation of weight in tones of the incorporated button cells

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average RM (excluding ATULBD)	Average RM (including ATULBD
Number of hearing aids	1295	2613	2747	2314	2906	2701	1496	1971	2456		
Weigth of batteries, tones	0.003	0.005	0.005	0.005	0.006	0.005	0.003	0.004	0.005	**0.0046**	**0,0048**

Source: http://comtrade.un.org/db/

The table 10-12 provides data on traded amounts of hearing aids in accordance with the UNComtrade database (for the missing data the average quantity calculated from the available data were used). Each hearing aid has incorporated one button cell. The weight of cells was calculated by using the formula mentioned in the Conversion of units.

It is assumed that all of them contain mercury oxide button cell. However, it could also be other button cell types with much lower mercury concentration. There is no data about the country of origin that could provide additional information on the potential concentration of the mercury in the button cell or on the type of cells incorporated in the hearing aids.

Manganese dioxide cells and batteries

The Toolkit mentions that global brands generally do not anymore contain mercury, but some regional or national brands may contain mercury adding up to potentially large amounts due to the high numbers sold.

In the last inventory, the activity data used for calculation represented 20% of the average imported quantity in the period 2010-2018. For the present inventory, it assumed that 15 % of average import might contain mercury, as there are already in force legal provisions regulating the content of the batteries that are allowed to be placed on market.

It should be also noted that a brand of batteries produced in China mentions its mercury content of <0.015 % (on all sizes: D, AA, AAA). Hence, it is assumed that this content can be used as high end mercury input factor.

Other button cells

The Toolkit mentions that button cells generally contain mercury to reduce risk of breakage. Due to this reason, it is assumed that all of the supplied button cells contain mercury.

The Toolkit mentions three categories of button batteries: zinc-air, alkaline button cells and silver-oxide.

Additionally, there are significant imports of batteries in inexpensive electronic articles watches, pocket calculators, greeting cards (which play melodies), toys and such like, bicycle lamps and bicycle computers). The extent to which such batteries can be conceived of as being imported in finished goods is very difficult to determine. However, it can be assumed that additional 30 % from the imports constitute batteries incorporated in goods. Customs service did not provide data on alkaline button cells.

Table 10-14 Mercury input factor and activity rate by button battery type

Types of batteries	Activity rate	Mercury content in battery (kg Hg/metric ton batteries)
Mercury oxide cells and batteries	0,0049	320
Zinc-air button cells	0,097	12
Silver oxide button cells	1,066	4
Manganese dioxide cells and bat.*	12,09	0,15

Summary of inputs and results

The "output scenario" provides 3 options. For distribution of the emissions the first 2 scenarios will be considered as follows:
(1) No separate collection. Waste handling controlled – 60 %, and
(2) No separate collection. Informal waste handling widespread – 40 %.

Table 10-15 Summary of inputs and results from sub-category 5.5.4 "Batteries with mercury" in the Republic of Moldova in 2018

Batteries with mercury	**Unit**	**Pro-duction**	**Use/Disposal**	**Sum of re-leases to pathway from as-sessed part of life-cycle**
Activity rate	tones	-		Kg Hg/y
- Mercury oxide (all sizes);		-	0,0054	1,728
- Zinc-air button cells		-	1,033	12,396
- Silver oxide button cells			0,094	4
- Manganese dioxide cells and bat.*			0,094	0,376
Input factor for phase	g Hg/batt ery	-		-
- Mercury oxide (all sizes);			320	-
- Zinc-air button cells			12	-
- Silver oxide button cells			4	-
- Alkaline, other than button cell shapes			0,015	-
Calculated input to phase	kg Hg /y	-	**16,486**	-

Data gaps and priorities for potential follow up

The data on the import-export of batteries received from the Customs Service is not enough to provide accurate mercury emission calculations, it does not provide the imported brands, only the country of origin. There is no data about the country of origin that could provide additional information on the potential concentration of the mercury in the button cell or on the type of cells incorporated in the hearing aids.

10.5 Polyurethane (PU, PUR) produced with mercury catalyst

General description

The use of mercury compounds as catalysts in polyurethane has been restricted in the EU hrough the September 2012 EU Commission Regulation No.848/2012amending the REACH regulation's Annex XVII by adding the following five phenylmercury compounds used as catalysts in polyurethane (PU) elastomer production to a list of restricted substances:

- Phenylmercury neodecanoate (CAS # 26545-49-3)
- Phenylmercury acetate (CAS # 62-38-2)
- Phenylmercury 2-ethylhexanoate (13302-00-6)

- Phenylmercuric octanoate (CAS # 13864-38-5)
- Phenylmercury propionate (CAS # 103-27-5)

After October 10, 2017, these five compounds can no longer be manufactured in the EU, placed on the market or used as a substance or in mixtures, in articles (= final products) or parts of articles in EU-based manufacturing, if the concentration of mercury is equal to or greater than 0.01% by weight.

Production

The Republic of Moldova does not produce polyurethane.

Use and disposal

The main importers of polyurethane in the Republic of Moldova are manufactures of shoes, wiring harness systems, exclusive interiors and central electrical and electronic components; companies dealing with construction materials and gas supply installations. The main countries of import are European one, were the restrictions are already applied.

Methodology applied

The calculation formula for this subcategory is:

Estimated mercury release to pathway Y = **activity rate x input factor x output distribution factor for pathway Y**

Activity rate

UNEP Guidelines recommended as the activity rate of the population reported at the rate of electrification, but in the present cycle inventory activity rate was calculated based on the average amount of polyurethanes import during 2010-2018.

At the same time for the inventory purpose, the activity rate is the average quantity of imported polyurethanes with mercury.

The Customs Service provided data on the imports of polyurethanes in the period 2010-2018 (Table 10-15).

Table 10-16. Import of polyurethanes in the period 2010-2018 in the Republic of Moldova, tones

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average RM (excluding ATULBD)	Average RM (including ATULBD
Polyurethane, tones	918,80	1134,10	717,88	426,43	431,09	180,71	187,25	248,91	339,80		
5 % of imports	18,38	22,68	14,36	8,53	8,62	3,61	3,74	4,98	6,80	10,19	10,70

Source: Customs Service of the RM

For estimation of mercury emissions generated by the use of polyurethanes, it will be assumed that 2 % of the imported polyurethanes contain mercury. Hence the activity rate is 10.7 tones of polyurethane/year. The mercury input factor used shall be the allowed concentration of mercury which is equal to 0.01% by weight, which corresponds to 100 g/ton.

The "output scenario" provides 3 options. For distribution of the emissions the will be considered as follows:
(1) No separate collection. Waste handling controlled – 80 %, and
(2) No separate collection. Informal waste handling widespread – 20 %.

Distribution factors of mercury emissions from the elimination of polyurethanes are default factors stipulated in UNEP Toolkit (Chapter 5.5.5.5)

Summary of inputs and results

Table 10-17 Summary of inputs and results from sub-category 5.5.5 "Polyurethane with mercury catalysts" in the Republic of Moldova in 2018

Polyurethanes	**Unit**	**Pro-duction**	**Use/Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	tones	-	10.7	
Input factor for phase	% of Hg by weight	-	0,01	-
Calculated input to phase	kg /year	-	**1.07**	-

Data gaps and priorities for potential follow up

The calculated mercury releases are generated by polyurethanes as raw materials. As a potential priority for follow up would be the estimation of the quantity of mercury containing polyurethanes in the final products (shoes, rollers and others).

10.6 Biocides and pesticides with mercury

Many mercury compounds are toxic to microorganisms, and mercury compounds have been used in biocides in paper industry (slimicides in the production - see section 5.3.2), in paints (dis-cussed separately in section 5.5.6), and on seed grain and other agricultural applications. These uses have been discontinued or banned in many countries.

The use of biocides in the Republic of Moldova is regulated by the Ministry of Health and of pesticides – by the Ministry of Agriculture and Food Industry.

The official reply of the Ministry of Health[16] revealed that the biocidal products placed on the national market are recorded in the National Register of Biocidal Products, which also includes the relevant active substances and their concentration. The National Register of Biocidal Products does not include records on biocidal product containing mercury.

The official reply of the Ministry of Agriculture and Food Industry[17] revealed that in the period 2010-2015 it has not approved, neither included in the State Register of Plant Protection Products and Fertilizers any products that might contain mercury. Additionally, the Ministry noted that the use of mercury containing fertilizers, such as granosan, mercuran, mercurhexane and mercurbenzol was prohibited at the end of 80s of the last century (at the time of Soviet Union).

Considering, the mentioned above, it can be assumed that the country is not using mercury containing biocides and pesticides and they do not represent a source of mercury emissions.

10.7 Paints with mercury preservatives

Production

Paint production is present at the Republic of Moldova and due to construction boom at the last decade, the volumes of the products within this category is increasing.
There are several producers of paints in the Republic of Moldova – Supraten S.A., ChetonGrup S.R.L, Akzo Nobel N.V, Midgard Terra, Cover-line.

The information received from the Customs Service on the import of chemicals revealed a very modest import of mercury and mercury compounds, mainly used by the laboratories (medical and research institutions).

Production and imports

Phenyl mercuric acetate (PMA) and similar mercury compounds were formerly widely added as biocide to water based paints and may still be used in some countries. These compounds were used to extend shelve-life by controlling bacterial fermentation in the can (in-can preservatives) and to retard fungus attacks upon painted surfaces under damp conditions (fungicides).
The European Union directive 76/769/EEU restricts the marketing and use of certain dangerous substances and preparations, and includes a prohibition of the use of mercury substances in marine anti-fouling paints, wood preservatives, among others.
In addition, the Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel establishes the voluntary ecolabel award scheme. According to the 2014/312/EU Commission Decision of 28 May 2014 establishing the ecological criteria for the award of the EU Ecolabel for indoor and outdoor paints and varnishes the mercury and its compounds shall not be present in the product or the ingredients used in the product above the specified cut-off limit (0,010 %).

[16]Letter no 01-1-9/147 of 02.02.16 of the MoHealth as reply to the letter 05-07/54 of 13.01.2016 of the MoEnv
[17]Letter no 20-29/5 of 04.02.2016 of the MoAgr as reply to the letter no 05-07/40 of 15.01.2016 of the MoEnv

Yet, other big share of the paints present the countries that enter into the Customs Union countries (Russia, Belarus, Kazakhstan, Kirgizstan and Armenia). In this case, for the purpose of the inventory the provisions of the draft Technical Requirements on "Uniform sanitary and epidemiological and hygienic requirements for goods subject to sanitary and epidemiological supervision."[18] were taken into account. In this regards, the Paragraph 4.3. "Requirements for chemical safety of coating materials" **prohibits the use** in the composition of paints such chemicals as mercury, arsenic and its compounds. Thus the assumption was made that all paints imported from these countries do not contain mercury and its compounds in their composition.

Methodology applied

The calculation formula for this subcategory is:

Estimated mercury release to pathway Y = **activity rate x input factor x output distribution factor for pathway Y**

Due to lack of data regarding the mercury content in imported paints and considering that the use of mercury in paints decreased in the last years the low end input factor shall be used for calculations.

Activity rate

The data on import of paints were provided by the Customs Service and is presented in the table below:

Table 10-18. Import of paints in the period 2010-2018 in the Republic of Moldova, tones

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average	Including ATULBD
Import of paints (HS code 3208 and 3209)	6511	6631	6998	6636	6905	6528	7481	7806	8631	7125,1	7481,4

Source: Customs Service

The Toolkit recommends that the latex paints and some special uses paint might contain mercury. However, the customs codes do not distinguish these types of paint. Due to lack of information about the quantity of mercury containing paints and considering the analyses of the imports provided above, it is assumed that from the total quantity of imported paints 1 % or 74.8 tones might contain mercury.
The EU Ecolabel for indoor and outdoor paints and varnishes mentions that the mercury and its compounds shall not be present in the product or the ingredients used in the product above the specified cut-off limit of 0,010 % and this shall be used as mercury input factor.

Summary of inputs and results

Table 10-19 Summary of inputs and results from sub-category 5.5.7 "Paints with mercury" in the Republic of Moldova in 2018

[18] http://www.eurasiancommission.org/ru/act/texnreg/deptexreg/tr/Pages/bezopLakokrasok.aspx

Paints	Unit	Pro-duction	Use/Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	tones	-	74.08	
Input factor for phase	% of Hg by weight	-	0,1	
Calculated input to phase	kg/year	-	7.48	

Data gaps and priorities for potential follow up

The import-export statistics does not provide distinguished data on the import of different types of paints. The main gap of information and concern is the current status quo of use of mercury in production of paints worldwide and particularly within the Eurasia region.

10.8 Cosmetics and related products

Production

The Republic of Moldova has one big manufacture of cosmetics and additionally is importing several types of cosmetic products.

The "Sanitary-epidemiological rules and norms for labeling of cosmetic products" of 22.12.2004 prohibits the manufacture and placing on market of cosmetic products that contain substances prohibited by the Ministry of Health, in accordance with the Council Directive of 27 July 1976. The EU Directive prohibits the use of mercury and mercury compounds in the cosmetics, excepting some specific cosmetic products such as eye products with a concentration of 0,007 % (of Hg) if mixed with other mercurial compounds.

Therefore, it can be concluded that this source category does not represent a source of mercury emissions in the country.

Data gaps and priorities for potential follow up

No data gaps

11. Data and inventory on other intentional product/process uses

11. 1 Dental mercury amalgam fillings

Even though for numerous countries within the region the issue on the dental filling with mercury amalgam presents a serious issue, however in case of the Republic of Moldova based on expert review and official confirmation from competent national authorities, such as Stomatological association[19] confirmed the lack of such source at national level.

The dental care system in the Republic of Moldova is well developed, primarily represented by private practices, that constantly modernize the equipment and materials that use. The materials used for teeth restorations are mostly polymers.

It should be also noted that in Moldova obligatory medical insurance doesn't cover the dental fillings contrary to the medical insurance in some region countries, that provides for dental cover and in most cases the restorative materials used are represented by amalgams, because they are generally less expensive than most alternatives. Another point is the general affordability of the dental service in Moldova for the population.

Another interesting finding of the study allowed us to track the dynamics of development of the dental tourism business in Moldova that provides dental services to patients from abroad (http://traveltodentist.com/). Some of such dental tourists are coming to Moldova and dental amalgams are being extracted in Moldova, however their number is small and official statistics on these figures is missing.

The Republican Dental Clinic was founded in 1967 and its medical documentation provides no statistical records on the dental filling materials. The letter also mentions that due to complicated technology and harmful action on workers' health care, amalgams wasn't used broadly in dentistry. Since 1982 to present, Moldova has not received mercury containing dental fillings.

Yet leading professionals have mentioned that that at present, the amalgam fillings continue to be the general practice in some countries (including some EU countries) whose medical insurance covers the dental services. Due to high migration rate among Moldovan population and their potential exposure, some records on Moldovan citizens working in these countries return home with amalgam fillings, however very few in number - 12-15 patients per year or about 0.001% / year.

Data gaps and priorities for potential follow up

No data gaps have been identified for this sub-category.

[19] Letter nr. 01-13/159 from 21.12.2015 from Republican Stomatological Policlinica official response to Ministry of Environment letter no 05-07/1906 as of 13.10.2015

11.2 Manometers and gauges with mercury

Sub-category description

Mercury is used in some blood pressure gauges, industrial and meteorological manometers, and pressure valves (UNEP, 2002 as cited in UNEP, 2015). Mercury may be supplemented during the use period for all types mentioned. The mercury may be disposed of with the apparatus or separately (UNEP, 2015).

Production

Manometers and gauges with mercury **are not produced** in the Republic of Moldova.

Use and disposal of medical blood pressure gauges

Use

According to the UNEP IL2 Toolkit, the activity rate data needed to estimate releases from the use of medical blood pressure gauges in the Republic of Moldova is the number of medical blood pressure gauges supplied annually.

Ministry of Health provided data on the purchased and disposed mercury manometers in 2016 and 2017, and are presented in the table below.

Table 11-1 Number of medical mercury manometers purchased/disposed by public health institutions in the Republic of Moldova in 2016 and 2017

	2016	2017	2016	2017
	Purchased		Disposed	
Number of medical mercury manometers	23	31	1	9
Sphygmomanometers	23	16	5	10

Table 11-2 Number of medical mercury manometers purchased/disposed by public health institutions in the Republic of Moldova in 2010-2018, including data on previous inventory

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Manometers purchased by MoH institutions	80	38	52	61	41	42	46	47	47

Additionally, medical blood pressure gauges may be purchased by doctors activating outside the public health sector, such as private medical clinics and hospitals, educational institutions, pharmacies, various enterprises and the general public. It should be noted, however, that blood pressure gauges sold in pharmacies throughout the country are mercury-free. Visits made in November 2015 by the project expert to several brands of pharmacies in Chisinau city revealed that medical blood pressure gauges sold in the pharmacies are mercury free and have not been sold for many years already (how many years ago pharmacists could not recall). Only one pharmacist estimated that manometers with mercury are not available in pharmacies for more than 20 years. Medical sphygmomanometers available for sale were electronic, automated or semi-automated, and mechanical with aneroid.

Therefore, it is estimated that the general public does not have access to such devices, nor pharmacies and most of enterprises purchasing blood pressure gauges for their own use. It is assumed that medical sphygmomanometers with mercury potentially could be purchased for professional use by doctors activating in private offices or private hospitals or other institutions

outside the health sector such as the Ministry of Internal Affairs, the Ministry of Defense, the Ministry of Labor, Clinic of the State Chancellery, the Department of Border Police, Centre of Civil Aviation, Moldova Railway company, universities and prisons from the country[20].

To estimate the number of medical mercury sphygmomanometers purchased by medical doctors activating outside the public health sector the following assumption has been made. It is assumed that the ratio of the number of medical blood pressure gauges with mercury purchased and used by medical doctors activating within the Ministry of Health to those activating outside the Ministry of Health is approx. 5 to 1.

This estimate is made based on the statistical data on medical doctors in the country presented in Table 10-5 below and extrapolation from the estimated number of medical manometers with mercury purchased by public health institutions in the Republic of Moldova (see Table 10-4 above).

According to the statistical data available from the National Bureau of Statistics of the Republic of Moldova, the total number of medical doctors in the country activating outside the Ministry of Health constitutes roughly 18% of the total medical doctors in the country (see Table 11-3 below).

Table 11-3 Number of medical doctors and percentage of medical doctors from other institutions, activating outside the Ministry of Health from the total number of doctors in the Republic of Moldova (except ATULBD territory), % (2010-2018)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total per country	12780	12914	12794	12934	12880	13012	13039	13021	12635
Ministry of Health - total	10619	10657	10570	10560	10424	10397	10388	10287	10044
other ministries	2161	2257	2224	2374	2456	2615	2651	2734	2591
Percentage of medical doctors from Other ministries from Total per country, %	16.91	17.48	17.38	18.35	19.07	20.10	20.33	21.00	20.51

Source: Ministry of Health, data available on the webpage of the National Bureau of Statistics, http://statbank.statistica.md/

Based on the results presented in Table 11-3, the assumption is made that medical doctors activating outside public health institutions under the Ministry of Health purchased on average 19 % of medical manometers with mercury content placed on the market in the Republic of Moldova. Thus, based on the data presented in tables above, the following calculations and extrapolations have been with regard to the total number of medical blood pressure gauges with mercury sold in the period 2014-2018 in the Republic of Moldova:

Table 11-4 Estimate of the number of medical mercury manometers purchased by medical doctors in the Republic of Moldova in the period 2010-2018

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Estimate of total number of medical manometers with Hg purchased by public health institutions in the Republic of Moldova	80	38	52	61	41	42	46	47	47
Share of medical doctors from *Other ministries* from *Total per country*, %	16.91	17.48	17.38	18.35	19.07	20.10	20.33	21.00	20.51

[20]List of institutions with medical doctors which are not subordinated to the Ministry of Health was communicated by phone by Mrs. Silvia Rusu from the Ministry of Health on 5 February 2016 (tel. +373 22 72 52 02).

Estimate of the number of medical mercury manometers purchased by medical doctors outside the MoH	13.53	6.64	9.04	11.20	7.82	8.44	9.35	9.87	9.64
Estimated total number of medical mercury manometers sold annually in the Republic of Moldova	**94**	**45**	**61**	**72**	**49**	**50**	**55**	**57**	**57**

Data and estimates presented above do not include information on the supply and use of mercury medical manometers in the ATULBD territory. Such information has not been identified or collected from this region. Due to the fact that situation with regard to the supply and use of medical devices with mercury in the ATULBD territory is not known, no estimates have been made for this region part of this inventory.

Emissions of mercury from the Use phase for this sub-category may occur by breakage or loss during use of medical blood pressure gauges with mercury by the medical personnel in public health centers. What may be the loss of mercury during use of these devices could not be estimated, especially since no data on liquid mercury that is needed to top up mercury had been reported by the medical institutions. Also, the information presented by NPCHs did not specify the cause for withdrawing from use the mercury sphygmomanometers, whether it was due to breakage or not.

Disposal

According to the UNEP IL2 Toolkit, the activity rate data needed to estimate releases from the disposal of medical blood pressure gauges in the Republic of Moldova is the number of medical blood pressure gauges disposed of annually.

According to the data presented by NPHCs from the country, medical mercury sphygmomanometers withdrawn from use are stored separately within the public health institutions. Taking into consideration this information and the legal provisions of the national waste law which provides that all hazardous waste should be disposed of by an authorized company, or the stakeholder should ensure safe storage of hazardous waste (items containing hazardous elements) on their own premises till hazardous waste facilities will be established, one may consider that disposal of such devices from medical institutions should not take place in the country. The same assumption is made with regard to the medical mercury manometers used by medical doctors in private sector and institutions outside the Ministry of Health listed earlier. Thus, it is assumed that waste medical manometers with mercury content are safely stored until future organized collection and recycling shall be established by authorized companies.

As discussed in the beginning of the section, mercury sphygmomanometers are not sold to the general public and have not been sold perhaps for more than 20 years. Additional discussion with representative of the Ministry of Health have revealed that such devices with mercury have been used in the past only by medical institutions and were not sold to the general public in the past. Therefore, calculation of potential mercury emissions from medical manometers used in households has not been carried out.

Possible mercury emissions have been calculated only from the use and disposal of medical manometers in the medical sector. Activity rate data used in calculations of emissions for the year 2018 is the average number of medical mercury manometers purchased throughout the period 2014-2018 (see Table 11-6).

Table 11-5 Estimated number of medical mercury manometers disposed in the medical sector in the period 2010-2018

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	Average	Estimated number of medical mercury manometers disposed annually (20%)
Estimated total number of medical mercury manometers sold annually in the Republic of Moldova	94	45	61	72	49	50	55	57	57	60	**12**

Mercury input factors

The default input factor provided by the UNEP Toolkit has been used for the calculation of mercury emissions from this sub-category.

Output distribution factors

The default output distribution factors provided by the UNEP Toolkit have been used for the calculation of mercury emissions from this sub-category.

Output Scenario

The third Output Scenario: *Separate collection. Waste handling controlled* has been used for the calculation of mercury emissions from this sub-category.

Use and disposal of other manometers

Data collected on other types of manometers and gauges with mercury that could be used in different sectors of the economy in the Republic of Moldova is estimated to be not representative since information on this type of devices was received from several enterprises only.

The approach offered by the UNEP Toolkit methodology was used to make an estimation of mercury emissions from this sub-category. Thus, the default input factor suggested by the Toolkit has been adapted to the national circumstance and used together with the data on the number of inhabitants in the Republic of Moldova, including ATULBD.

At the same time, the default input factor provided by the Toolkit is used additionally in the calculations to illustrate the likely mercury emissions when this approach is applied.

Mercury input factor

The default input factor has been adapted to the national circumstance by using the factor of difference between EU GDP (gross domestic product) per capita and RM GDP per capita and an assumed factor of difference in substitution rate of mercury devices and laboratory equipment in the Republic of Moldova compared to the European Union (the default factor was development

based on data on use of these devices in European countries). Data on GDP (gross domestic product) per capita in the Republic of Moldova and the European Union is used in order to set a default factor more suitable to the level of economic development in the Republic of Moldova. According to the statistical data, the GDP per capita in EU in 2014 was 38076 USD[21] and the GDP per capita in EU in RM in 2018 was 2684.10 USD[22]. Therefore, the calculated factor of difference between EU GDP per capita and RM GDP per capita would be on average the following: 38076 / 2684.10 = 14. In order to account for the level of difference in the substitution rate of laboratory equipment with mercury content in Moldova and EU, the assumption is made that up to 50% of such laboratory equipment has been substituted with mercury free alternatives. Thus, the factor of difference in substitution rate of mercury devices is assumed to be 0.5. The national default input factor is obtained by dividing the default input factor (0.005 g Hg/inhabitant) with 14 and with 0.5. Hence, the resulting default input factor would be: 0.005 / 14 / 0.5 =0.0007 g Hg/inhabitant.

Output distribution factors

The default output distribution factors provided by the UNEP Toolkit have been used for the calculation of mercury emissions from this sub-category.

Output Scenario

The first Output Scenario: *No separate collection. Waste handling controlled* has been used for the calculation of mercury emissions from this sub-category.

Summary of inputs and results

Table 11--6 Summary of inputs and results from sub-category 5.6.2 "Manometers and gauges with mercury" in the Republic of Moldova in 2018

Sub-category 5.6.2 Manometers and gauges with mercury	**Unit**	**Production**	**Use and disposal of medical blood pressure gauges**	**Use and disposal of other manometers**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate		-	12 items/y	3330000 inhabitants	-
Input factor for phase	g Hg	-	80 per item	0.0007 per inhab.	-
Calculated input to phase	kg Hg/y	-	1	2	-

[21] www.tradingeconomics.com/european-union/indicators
[22] www.tradingeconomics.com/moldova/gdp-per-capita

Data gaps and priorities for potential follow up

There is uncertainty with regard to the extrapolation made to the procurements of medical blood pressure gauges with mercury made by medical doctors activating outside the Ministry of Health since no information has been identified whether medical blood pressure gauges with mercury have been purchased for professional use only by public health institutions under the Ministry of Health or by other institutions as well.

11.3 Laboratory chemicals and equipment with mercury

Production

Production of laboratory chemicals and equipment with mercury is not present in the Republic of Moldova.

Use and disposal of laboratory chemicals

The alternative approach offered by the UNEP Toolkit methodology was used to make an estimation of mercury emissions from this sub-category. The default input factor (0.01 g Hg/inhabitant) suggested by the Toolkit was adjusted to the national context by using the similar approach as above with regards to GDP, and deduced at 0.01/14= 0.0007 g/capita. It has been used additionally with the data on the number of inhabitants in the Republic of Moldova, including ATULBD to illustrate the likely mercury emissions when this approach is applied.

Output distribution factors

The default output distribution factors provided by the UNEP Toolkit have been used for the calculation of mercury emissions from this sub-category.

Use and disposal of other laboratory equipment

Data on imports of laboratory equipment in the Republic of Moldova has been obtained from the Customs Service of the Republic of Moldova; however the provided data does not distinguish between equipment with mercury and without mercury. Also, taking into consideration the fact that mercury in some of the laboratory equipment may have been substituted (UNEP, 2015) it is estimated that new equipment such as spectrophotometers and other equipment of physical and chemical analysis which are imported annually in the country **do not contain** mercury.

Barometers with mercury have been reported as being used in a few laboratories in the country such as the one at the State Meteorological Service and the State Enterprise “Glass factory from Chisinau”. At the same time National Institute of Metrology confirmed that **few or almost none of new barometers** per year come for verification. This is also the case for other mercury containing equipment, such as **blood gas and lead analyzers centrifuges, thermostats and electron microscopes**.

For the barometers still in use the assumption is made that emissions of mercury from this devices is presently not occurring. The same applies to other type of laboratory equipment with mercury that maybe still in use within various institutions and laboratories of enterprises in the country. Potential emissions from such equipment might occur only upon their disposal, however it is assumed that in case this equipment is withdrawn from use it would not be disposed as general waste on landfills but stored as waste separately within the institution or enterprise.

Information on **possible use of mercury barometers** in the present or in the past **by the general population has not been identified**. For this reason assumptions with regard to this practice have not been made part of this report.

As in the case of **other manometers**, the alternative approach offered by the UNEP Toolkit methodology was used to make an estimation of mercury emissions from this product category. Thus, the default input factor suggested by the Toolkit has been adapted to the national circumstance and used together with the data on the number of inhabitants in the Republic of Moldova, including ATULBD.

The default input factor of 0.04 g Hg/inhabitant suggested by the Toolkit has been adapted to the national circumstance by using the factor of difference between EU GDP per capita and RM GDP per capita and an assumed factor of difference in substitution rate of mercury devices and laboratory equipment in the Republic of Moldova compared to the European Union for which the default factor had been initially produced. According to the statistical data, the GDP per capita in EU in 2014 was 38076 USD and the GDP per capita in EU in RM in 2018 was 2684.10 USD . Therefore, the calculated factor of difference between EU GDP per capita and RM GDP per capita would be on average the following: 38076 / 2684.10 = 14. In order to account for the level of difference in the substitution rate of laboratory equipment with mercury content in Moldova and EU, the assumption is made that up to 50% of such laboratory equipment has been substituted with mercury free alternatives. Thus, the factor of difference in substitution rate of mercury devices is assumed to be 0.5. The national default input factor is obtained by dividing the default input factor (0.04 g Hg/inhabitant) with 14 and with 0.5. Hence, the resulting default input factor would be: 0.04 / 25 / 0.2 **= 0.006 g Hg/inhabitant**.

Summary of inputs and results

Table 11-7 Summary of inputs and results from sub-category 5.6.3 "Laboratory chemicals and equipment with mercury" in the Republic of Moldova in 2014

Sub-category 5.6.3 Laboratory chemicals and equipment with mercury	**Unit**	**Production**	**Use and disposal of laboratory chemicals**	**Use and disposal of laboratory equipment**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	inhabitants	-	3330000	3330000	-
Input factor for phase	g Hg/y* inhabitant	-	0,0007	0.006	-
Calculated mercury releases	kg Hg/y	-	2,33	19.98	-

Data gaps and priorities for potential follow up

Specific data on the types of laboratory chemicals with mercury imported and used in the laboratories of the country is missing. Imports data provided by the Customs Service is presented in aggregated form as organic and inorganic mercury compounds.

The same applies to the laboratory equipment imported annually in the country. From the imports data cannot be distinguished whether any laboratory equipment with mercury is being presently imported in the country.

11.4 Mercury metal use in religious rituals and folklore medicine

Evidence of mercury metal use in religious rituals and folklore medicine in the Republic of Moldova has not been identified.

11.5 Miscellaneous product uses, mercury metal uses, and other sources

Several additional possible sources of mercury uses and releases are identified and included in this sub-category by the UNEP Toolkit. These are the following:

- Infra red detection semiconductors;
- Bougie tubes and Cantor tubes;
- Educational uses;
- Gyroscopes with mercury;
- Vacuum pumps with mercury;
- Use of mercury as refrigerant in certain cooling systems;
- Light houses;
- Mercury in large bearings of rotating mechanic parts as in older waste water treatment plants;
- Tanning;
- Pigments;
- Browning and etching steel;
- Certain colour photograph paper types;
- Explosives (mercury-fulminate);
- Fireworks;
- Executive toys.

Production

Production of enumerated above products involving the use of liquid mercury or mercury compounds has not been identified in the Republic of Moldova.

Use and disposal

Use of Cantor and Bougie tubes has not been reported in the information provided by the NPHCs in each rayon of the Republic of Moldova.

In addition it has been confirmed by the National Institute of Metrology that mercury is not used as refrigerant in cooling systems in the Republic of Moldova. No information could be provided with regard to the use of vacuum pumps with mercury and mercury gyroscopes.

During the meetings with “Apa-Canal Chisinau” company (municipal water supply and treatment) it was identified that mercury might have been present in large bearings of rotating mechanic parts in the old waste water treatment plant built in Chisinau before the 1960’s, however that plant has been later redeveloped and it is not known what might have happened to the disassembled parts. Presently, such items with mercury are not present in any waste water treatment facilities in the country.

The presence of other sources mentioned above **has not been** identified in the Republic of Moldova.

Data gaps and priorities for potential follow up

Additional research can be done for some of the products, however it is time consuming and the potential quantities are not expected to be significant for the country’s context.

12. Data and inventory on production of recycled metals

12.1 Production of recycled mercury ("secondary production")

In the Republic of Moldova there are no facilities that collects and recovers mercury from mercury containing waste. Therefore, this category was not assessed.

12.2 Production of recycled ferrous metals (iron and steel)

This category was not estimated during this cycle of inventory, as its contribution to the total releases was not significant.

13. Data and inventory on waste incineration and burning

13.1 Incineration of municipal/general waste

In the Republic of Moldova, there are no authorized facilities for incineration of municipal/general waste. For this reason, emissions of mercury from this sub-category were not estimated for the inventory development.

13.2 Incineration of hazardous waste

At country level there is no authorized hazardous waste treatment / incinerator facility.

13.3 Incineration of medical waste

Subcategory description

Medical waste includes infectious and non-infectious wastes generated by a variety of facilities engaged in medical care, veterinary care, or research activities such as hospitals, clinics, doctors' and dentists' offices, nursing homes, veterinary clinics and hospitals, medical laboratories, and medical and veterinary schools and research units. The mercury content in the medical waste stream originates primarily from intentionally used mercury in discarded products and process waste. The mercury concentrations are directly dependent on the inputs of mercury to the waste (UNEP, 2015).

Medical waste is considered to be every waste generated from medical activities regardless if these activities take place in a hospital or are performed by a medical doctor, dentist or any other physician. The waste generated during these activities includes secretes, blood, pharmaceuticals and packaging materials and/or tools used for the medical treatment of people or animals. To reliably destroy viruses, bacteria, and pathogens this waste is often thermally treated by incineration (UNEP, 2003).

Activity rate data

The activity rate data needed to estimate releases from incineration of medical waste in the Republic of Moldova is the amount of medical waste incinerated/ burnt annually.

In the Republic of Moldova, there are no authorized medical waste incinerators.

However, it is common practice that medical waste is burnt at the medical institutions and hospitals in order to destroy infectious waste. The practice of medical waste burning is carried out mainly through three methods: 1) open burning, 2) closed burning in boilers for heating or metal barrels and 3) transportation for treatment through pyrolysis by a specialized authorized company[23].

The total amount of medical waste burnt in the public health institutions in the country *(except for missing data for Anenii Noi, Cahul and Causeni, there the amount of medical waste burnt has been*

[23] Trisumg Ltd treats certain plastic medical waste through pyrolysis

estimated based on extrapolation of the information available from neighboring rayons) h as been summed up from the data presented by the National Public Health Centre and is presented in the Table 13-1 below.

Table 13-1 Estimated amounts of medical waste treated by thermal methods from public medical institutions in Republic of Moldova for the period 2010-2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Number of beds	22021	22031	22162	20760	20131	18803	18805	18398	18138	18042
Generation rate per capita/day	0.13	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Total generation per country	1044.9	1125.8	1213.4	1136.6	1102.2	1029.5	1029.6	1007.3	993.1	987.8
Share of waste open burnt	72.5	74.6	72.6	71.4	66.2	55.9	45.6	35.3	25	10.3
Amount of medical waste open burnt	757.50	840.26	880.87	811.83	729.29	575.23	469.32	355.49	248.26	101.67

Mercury input factor

Available information indicates that medical waste incineration systems can be significant sources of mercury emissions. Mercury emissions result from mercury-bearing materials contained in the waste. Known mercury sources include thermometers, blood pressure gauges, dental material with mercury amalgam, batteries, laboratory chemicals (in tissue samples etc.), fluorescent lamps, high-intensity discharge lamps (mercury vapour, metal halide, and high-pressure sodium); special paper and film coatings, and pigments; most of which should preferably be sorted out the waste stream before incineration, if possible (UNEP, 2015).

The type of medical waste burnt within medical institutions in the country constitutes largely infectious (pathological) waste, such as syringes and post-operational waste. Mercury-bearing materials mentioned above such as mercury thermometers, fluorescent lamps and high-intensity discharge lamps are usually collected and stored separately within the institutions. As discussed earlier, dental material with mercury amalgam is not used in the country, therefore it is estimated as not being present in the produced medical waste.

The mercury content in the medical waste determines the mercury inputs to incineration of medical waste. However, as presented above, the medical waste burned by medical institutions in the Republic of Moldova is composed of infectious waste, which is free of mercury containing products. Information received from medical institutions in the country confirmed that the type of medical waste burned includes infectious waste.

Analysis of mercury in infectious waste burned in the country has not been carried out up to date, therefore in order to determine potential concentration of mercury in medical waste burned, results of studies of mercury emissions from incineration of medical waste carried out in other countries could be used. Results of an USA study that looked at mercury emissions from incineration of pathological waste and general medical waste can be considered relevant for establishing possible mercury concentration in medical waste burned in the Republic of Moldova. According to the data obtained in this study, an average atmospheric emission of 8.9 g Hg per metric ton of incinerated pathological and general medical waste was produced in the USA in 1996 (US EPA, 1997b cited in UNEP, 2015). Also, it was established that pathological waste contain significantly less than mercury than general medical waste, which on average contain about 8.2 g mercury per metric ton (US EPA, 2004 cited in UNEP, 2015).

Based on above data, it can be deduced that infectious medical waste could contain up to 8 g of mercury per metric ton. Additionally, the UNEP Toolkit methodology indicates that the low end input factor (8 g Hg/metric ton waste) is expected to be relevant for a situation where substantial parts of the waste products with high mercury concentration (thermometers, batteries, dental amalgam wastes, fluorescent lamps etc.) have been sorted out of the waste for separate treatment, and will therefore be present in lower amounts in the waste (UNEP, 2015). Taking into consideration this information, in the case of the Republic of Moldova it was deemed appropriate to choose the low end default input factor of 8 g Hg/t of incinerated waste, which was used for the quantification of mercury releases from this sub-category.

The incineration technology and particularly the flue gas cleaning systems applied, determine the distribution of the output of mercury between air emissions and releases to water (UNEP, 2013). According to the data presented by the National Public Health Centres across the country, in the Republic of Moldova, medical waste is burnt either openly or in furnaces of the local medical institutions. Therefore, no emission reduction devices are applied; hence for the quantification of releases from this sub-category *Output Scenario 1) No emission reduction devices* has been chosen.

Output distribution factors

For the calculation of mercury emissions, the default output distribution factors already provided in the IL2 Excel calculation spreadsheet have been used.

inputs and results

Table 13-2 Summary of inputs and results from sub-category 5.8.3 Incineration of medical waste in the Republic of Moldova in 2018

Sub-category 5.8.3 Incineration of medical waste	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	t waste/y	248.26	-	-	-
Input factor for phase	g Hg/t waste	8	-	-	-
Calculated input to phase	kg Hg/y	1,98	-	-	-
Output distribution factors for phase:		***Output scenario:*** No emission reduction devices			
- Air	-	1	-	-	-
- Water	-	0	-	-	-
- Land	-	0	-	-	-
- Products	-	0	-	-	-
- General waste treatment	-	0	-	-	-
- Sector specific waste treatment	-	0	-	-	-
Calculated outputs/releases to:					
- Air	kg Hg/y	1,98	-	-	1,98

Sub-category 5.8.3 Incineration of medical waste	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
- Water	kg Hg/y	0.0	-	-	0.0
- Land	kg Hg/y	0.0	-	-	0.0
- Products	kg Hg/y	0.0	-	-	0.0
- General waste treatment	kg Hg/y	0.0	-	-	0.0
- Sector specific waste treatment	kg Hg/y	0.0	-	-	0.0

Data gaps and priorities for potential follow up

Information on the quantity of medical waste produced in medical institutions from ATULBD has not been identified among the statistical data published in this region. The type of treatment applied to this type of waste has not been established as well. Additionally, the full data on amounts of waste formed in private hospitals, clinics, doctors' and dentists' offices that activate in the country is missing. Additionally, an in-depth assessment of mercury contents in medical waste is needed.

13.4 Incineration of sewage sludge

In Republic of Moldova, the practice of sewage sludge incineration is not present. For this reason, emissions of mercury from this sub-category are not estimated and presented.

13.5 Open fire waste burning (on landfills and informally)

Subcategory description

Informal waste incineration is defined as waste incineration undertaken at informal conditions, in barrels, containers, or on bare land, with no flue gas controls and diffuse spreading of incineration residues on land. Open burning of waste at landfills – often applied to reduce waste amounts - also belong to this sub-category. The mercury present in the waste, part of it will be released to air, and part of it will remain in incineration residues (including unburned and semi-degraded waste) with a potential for additional subsequent mercury releases to air, ground water and surface waters. Given the volatility of mercury, it is expected that most of the mercury is released into the air as a result of informal waste incineration. This waste disposal method may pose an immediate risk for the local community in which it takes place, because air emissions (of several potent pollutants) are not controlled and residues may cause contamination of the local ground water (UNEP, 2015).

Methodology applied to estimate releases from open fire waste burning

If open fire waste burning is a widespread waste disposal method in the country examined, the potential mercury releases can be indicated through 1) quantification of mercury inputs with individual products and, or 2) by applying the mercury input default factors (mercury concentrations in municipal waste), in combination with rough estimates of amounts of waste incinerated informally per year. The resulting estimates are of course very uncertain, but may give a rough indication of the order of magnitude of mercury releases from informal waste incineration.

The approach chosen to estimate potential mercury releases from open-burning of general waste is to apply the mercury input default factors for IL2, in combination with rough estimates of amounts of waste incinerated informally per year.

Activity rate data

The activity rate data needed to estimate releases from open fire waste burning in the Republic of Moldova is the amount of waste burned informally per year

The amount of waste burned informally per year has been estimated by using the equation suggested for calculation of the amount of municipal solid waste open-burned in the IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 5section 5.3.2 (2006).

The equation used is the following:

$$\mathbf{MSW_B = P*P_{frac}*MSW_P*B_{frac}*365*10^{-3}}$$

Where:
MSW_B = Total amount of municipal solid waste open-burned, t/yr
P = population (capita)
P_{frac} = fraction of population burning waste, (fraction)
MSW_P = per capita waste generation, kg waste/capita/day
B_{frac} = fraction of the waste amount that is burned relative to the total amount of waste treated, (fraction)
365 = number of days by year
10^{-3} = conversion factor from kilogram to ton.

Data on population used

National statistics on population are available from the National Bureau of Statistics of the Republic of Moldova.

The population data used are presented below in Table 13-9 for the Republic of Moldova and in Table 13-3 for the ATULBD territory.

Table 13-3 Number of population present at the beginning of the year in the Republic of Moldova in the period 2014-2018

	2014	2015	2016	2017	2018
Total population, pers., Moldova	3413200	3384100	3369100	3356800	3330000
Urban population, pers., Moldova	1383300	1379600	1379500	1379600	1376600
Rural population, pers., Moldova	2029900	2004500	1989600	1977200	1953400
Total population, pers, ATULBD	500700	474500	470600	469000	465100
Urban ATULBD	346500	331900	329700	328900	326500
Rural, ATULBD	154200	142600	140900	140100	138600

Source: National Bureau of Statistics of the Republic of Moldova, http://statbank.statistica.md/
State Statistical Service of the Pridenstrovian Moldavian Republic

Estimate of P_{frac} = fraction of population burning waste

According to IPCC Guidelines for National Greenhouse Gas Inventories (2006), for estimating fraction of population burning waste in a developing country, mainly in urban areas, P_{frac} can be

roughly estimated as being the sum of population whose waste is not collected by collection and population whose waste is collected and disposed in open dumps that are burned. At the same time for a developed country, P_{frac} can be assumed to be the rural population for a rough estimate. In a region where urban population exceeds 80 percent of total population, one can assume no open burning of waste occurs (IPCC 2006).

Fraction of rural population burning waste ($P_{frac\ rural}$) is assumed to be around 40% of the total population and fraction of urban population burning waste is considered 15 %.

Data used for per capita waste generation, kg waste/capita/day

Estimates of per capita waste generation have been produced using national context[24], average estimates are 0 0.5 kg/capita/day for rural areas, 0.9 kg/capita/day for urban areas of the Republic of Moldova, including ATULBD.

Estimates of the fraction of the waste amount that is burned relative to the total amount of waste treated (B_{frac})

An assessment of morphological composition of municipal waste was carried out in 2012 in Chisinau and Balti municipality and smaller towns like Leova and Causeni. The table below present the results the following average ratios of combustible waste from total municipal waste.

Table 13-4. Average annual country morphological composition of municipal waste in 2012

Waste type		Morphological composition of municipal waste, %
Recyclable waste	Paper and cardboard	5.28
	Glass	6,121
	Plastics	4.66
	Metals and non-metals	1.67
Organic waste	Food scraps	46.06
	Phyto-technical waste	10.77
	Textile	2.59
	Footwear	0,35
Bulky waste	Furniture	1,95
	EEE	1.21
Construction and demolition waste	Wood	1,76
	Other construction waste	17.58

Source: National waste inventory report 1990-2013.

Based on these results, the several assumptions were made with regard to the waste fractions burned from the total amount of waste generated in rural and urban areas. It is assumed that around 10-20% of general waste generated in urban areas is burned by urban population not covered by waste collection system. $B_{frac\ urban}$ used for calculation of the amount of waste burned in urban areas is 0.15. In rural areas, it is assumed that 20-30% of waste generated might be burned openly or for heating of individual houses by rural population. $B_{frac\ rural}$ used for calculation of the amount of waste burned in rural areas is 0.2.

Calculation of the total amount of municipal solid waste open-burned, t/yr (MSW_B)

[24]National Waste Management Strategy approved by the Governmental Decision nr. 248 dated 10.04.2013, published in Official monitor nr 82 from 12.04.2013

Total amount of municipal waste open-burned constitutes the sum of amount estimated waste burned by rural population and amount of estimated waste burned by urban population: $MSW_B = MSW_{B\ rural} + MSW_{B\ urban}$

$MSW_{B\ rural} = P_{rural} * 0.5$ kg/capita/day $*0.2*0,4*365*10^{-3}$

$MSW_{B\ urban} = P_{urban} *09$ kg/capita/day $*0.15*0,2*365*10^{-3}$

Table 13-5 Total amount of municipal solid waste estimated open-burned in the Republic of Moldova, including ATULBD territory, in the period 2014-2018

	2014	2015	2016	2017	2018
Amount of waste estimated open burned in urban areas in the Rep. of Moldova, t	13632,4215	13595,958	13594,9725	13595,958	13566,393
Amount of waste estimated open burned in rural areas in the Rep. of Moldova, t	29636,54	29265,7	29048,16	28867,12	28519,64
Amount of waste estimated open burned in urban areas in ATULBD, t	3414757,5	3270874,5	3249193,5	3241309,5	3217657,5
Amount of waste estimated open burned in rural areas in ATULBD, t	2251320	2081960	2057140	2045460	2023560
Total amount of municipal solid waste estimated open-burned ($MSW_B = MSW_{B\ rural} + MSW_{B\ urban}$), t	48935,039	48214,4925	47949,466	47749,8475	47327,2505

Mercury input factor

In previous versions of the Toolkit, default input factors of 1-10 (intermediate 5) g/Hg/t MSW were suggested, focusing on developing countries. This was done as a conservative estimate as no measured data were available from developing countries, as substitution with mercury-free products was expected to be less prevalent in these regions, and because separate collection of mercury-added products is generally absent in developing countries. However, for the 2019 update of the Toolkit, limited data from developing countries have become available as described above. At the same time, mercury-free products such as for example digital thermometers have been observed frequently in developing countries over the last years. Based on the data collected for the 2019 Toolkit update, revised default input factors of 0.2 – 4 (intermediate 1) gHg/t MSW are suggested as shown below.

Possible mercury concentration in municipal solid waste disposed of in the Republic of Moldova can be inferred on the basis of available statistical data on imports of mercury containing products , such as fluorescent lamps, thermometers and batteries with mercury and appropriate input factors for each product category (see section on consumer products with intentional use of mercury). Estimated amount of mercury to be released in Moldova with mercury-added products in 2018 is shown in the Table 13-6 below. Using statistics on the total amount of waste transported to controlled landfills and the assumption that most mercury containing products are shipped along general waste to these landfills, the calculation is done based on the average concentration of mercury possible per tonne of waste from controlled landfills.

Table 13-6. Estimated amount of mercury to be released in Moldova with mercury-added products in 2018 and estimation of the concentration of mercury in a tonne of municipal waste, considering that all imported products are removed annually

Consumer products with intentional use of mercury	Estimated quantity of mercury at disposal stage in 2014, kg/year
Thermometers with mercury	155.70
Electrical switches and relays with mercury	66.60
Light sources with mercury	9.40

Batteries containing mercury	16.56
Polyurethane with mercury catalysts	1.07
Total	**249.33 kg/year**
The total amount of municipal solid waste transported to landfills controlled in Moldova, including AUTLBD, 2014	1436480 tonnes
The average concentration of mercury calculated per ton of waste	249330 g Hg/ 1436480 tonnes waste = 0.17 g Hg/tonne of waste

As the result given calculations are based on estimates, the default factor concentration used for calculations in this report is the low end factor 0,2 g Hg / tonne waste, as reccomended by UNEP Toolkit.

Output distribution factors

For the calculation of mercury emissions the default output distribution factors that are provided in the IL2 Excel calculation spreadsheet have been used.

Summary of inputs and results

Table 13-7 Summary of inputs and results from sub-category 5.8.5 Informal burning of waste in the Republic of Moldova in 2018

Sub-category 5.8.5 Informal burning of waste	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Waste burned, t/y	-	-	47327,2505	-
Input factor for phase	g Hg/t waste burned	-	-	0,2	-

Data gaps and priorities for potential follow up

No major data gaps were revealed within this category. The assumptions made with regard to the practice of informal waste burning for the population living on the left side of Dniestr River have been made based solely on the data available for the population from the right bank of Dniestr River.

14. Data and inventory on waste disposal, deposition/landfilling

14.1 Controlled landfills/deposits

Subcategory description

The mercury content in the general waste stream originates from three main groups of inputs: 1) intentionally used mercury in discarded products and process waste; 2) natural mercury impurities in high volume materials (plastics, paper, etc.) and minerals; and 3) mercury as a human-generated trace pollutant in high volume materials. The mercury concentrations are directly dependent on the inputs of mercury to the waste, and will therefore likely vary much between different countries and circumstances (UNEP, 2015).

Throughout the history of any deposit/landfill, relatively small amounts of mercury are released annually from the deposit with outputs of water (leaching water and surface run-off), and with air to the atmosphere, because part of the mercury is slowly evaporating from the waste. The fate of the mercury released with water depends greatly on the presence and efficacy of protective lining under the deposit and associated waste water management. If the water is not collected and sent to waste water cleaning, the mercury (and other substances) may contaminate soil and groundwater under and around the deposit. (COWI, 2002 as cited in UNEP, 2015).

The largest "release" of mercury, in terms of mercury quantities associated with deposition of waste, is of course the actual accumulation of waste - and thereby mercury - on the site, possibly giving rise to long term environmental impacts through excavation, urbanization and other impacts (UNEP, 2015).

Activity rate data

The activity rate data needed to estimate releases from controlled landfills/deposits in the Republic of Moldova, using the IL2 approach, is the amount of waste land-filled annually on controlled deposits.

In order to estimate releases from controlled landfills/deposits in the Republic of Moldova the following assumptions have been made:
1) The amount of waste land-filled annually on controlled landfills/deposits is assumed to be the same with the amount of municipal solid waste transported to landfills by authorized waste transportation companies.
2) For the purposes of IL2, it is assumed that all landfills, where general/ municipal solid waste is deposited by waste transportation companies, are controlled landfills.

The amount of waste transported to such landfills/deposits for the period 2014-2018, is presented below in the Table 14-1. Because the methodology for calculation of mercury emissions from this sub-category requires the use of tonnes as unit of measure and not cubic meters, the data provided in cubic meters in the tables above has been converted to tons of transported waste using conversion factors. Based on the approach applied in the National Inventory Report of GHG in the Republic of Moldova for the period 1990-2013, the conversion factor of 0.4 t per 1 m^3 of solid general waste was used for the data on transported waste in the Republic of Moldova, and for the data on transported waste in ATULBD the conversion factor of 0.25 t per 1 m^3 was used due to the fact that waste is transported in smaller trucks of Soviet production. The obtained results are presented in the

Table 14-1 Statistical data on municipal solid waste transported in the period 2014-2018 in the Republic of Moldova, including ATULBD,

	2014	2015	2016	2017	2018
Solid general waste transported in the Republic of Moldova, thousand cubic meters	2823,4	2834,1	2915,5	3084,4	2966,6
Solid general waste transported in ATULBD, thousand cubic meters	643,2	642,4	620,8	608,9	624,6
Solid general waste transported in the Republic of Moldova, t	705850	1133640	1166200	1233760	1186640
Solid general waste transported in ATULBD, t	257280	256960	248320	243560	249840
TOTAL AMOUNT of solid general waste transported to landfills, t	963130	1390600	1414520	1477320	1436480

Source: Statistical data bank StatBank of the National Bureau of Statistics, Table: Municipal solid waste in urban areas, 2001-2014, www.statistica.mds **Source:** The State Statistical Service of the Pridnestrovian Moldavian Republic, Press releases on the State of the locative - communal household for the years 2011-2014. Data for the year 2010 have been taken from the National Inventory Report: 1990-2013.Greenhouse Gas Sources and Sinks in the Republic of Moldova

Mercury Input factor

For the calculation of mercury emissions from the sub-category Waste land-filling/deposits it is necessary to have data on the concentration of mercury in the waste. Part of this inventory, analysis of mercury content in the waste land-filled in the Republic of Moldova was not carried out and no published studies with data on mercury content in waste in Moldova have been identified.

As the result calculations made in Table 13-12, the default factor concentration used for calculations in this report is the low end factor 0,2 g Hg / tonne waste, as reccomended by UNEP Toolkit.

Output distribution factors

For the calculation of mercury emissions the default output distribution factors that are provided in the IL2 Excel calculation spreadsheet have been used.

Summary of inputs and results

Table 14-2 Summary of inputs and results from sub-category 5.9.1 Controlled landfills/ deposits in the Republic of Moldova in 2018

Sub-category 5.9.1 Controlled landfills/ deposits	Unit	Pro-duc-tion	Use	Disposal	Sum of releases to pathway from as-sessed part of life-cycle
Activity rate	t/y	-	-	1436480	-
Low-end input factor for phase	g Hg/t waste	-	-	0,2	-
Calculated Hg input	kg Hg/y	-	-	287	-

Data gaps and priorities for potential follow up

The data available from the National Bureau of Statistics on the amount of waste transported to controlled landfills is generally regarded as reliable. However a certain degree of uncertainty of

this data comes from the fact that different types of waste transportation vehicles are used by waste transportation companies. In rural areas, trucks may even be used. For this reason, certain waste transportation services may not accurately report the actual amounts of solid waste transported in cubic meters.

Also, the level of compaction can be different among waste transportation vehicles used in the Republic of Moldova. The average level of 0.4 t per m^3 has been used for conversion of cubic meters in tons; however it should be taken in consideration that certain vehicles have also higher compaction level such as 0.6 and other lower or no compaction at all.

14.2 Informal dumping of general waste

Subcategory description

Informal dumping of waste is defined as waste dumping undertaken under informal conditions with no public control and no safeguards to minimise releases of pollutants to the surroundings. If mercury is present in the waste, it represents a potential for mercury releases to soil, air, ground water and surface waters. This waste disposal method may pose an immediate risk for the local community in which it takes place, because mercury (and other contaminants) may cause contamination of the local ground water (UNEP, 2015).

If informal dumping of waste is a widespread waste disposal method, the potential mercury releases can be indicated through 1) quantification of mercury inputs with individual products and materials, or 2) by applying the mercury input default factors (mercury concentrations in municipal waste), in combination with rough estimates of amounts of waste dumped informally per year. The resulting estimates are of course very uncertain, but may give a rough indication of the order of magnitude of mercury releases from informal waste dumping (UNEP, 2015).

Activity rate data

The activity rate data needed to estimate releases from informal dumping of general waste in the Republic of Moldova is the amount of waste informally dumped annually.

The amount of waste dumped informally per year has been estimated by using the same approach used in the estimation of the amount of waste burned informally per year. The equation used for calculation of the amount of municipal solid waste dumped informally has been adapted accordingly from the IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 5 section 5.3.2 (2006).

The adapted equation is the following:

$$\mathbf{MSW_D = P * P_{frac} * MSW_P * D_{frac} * 365 * 10^{-3}}$$

Where:
MSW_D = Total amount of municipal solid waste dumped informally, t/yr
P = population (capita)
P_{frac} = fraction of population dumping waste informally, (fraction)
MSW_P = per capita waste generation, kg waste/capita/day

D_{frac} = fraction of the waste amount that is informally dumped relative to the total amount of waste generated, (fraction)
365 = number of days by year
10^{-3} = conversion factor from kilogram to ton.

Data on population used

The population data used in the calculations of mercury emissions from this sub-category is presented in Table 14-4 below.

Estimate of P_{frac} = fraction of population dumping waste informally

In the Republic of Moldova, informal dumping of waste occurs both in rural and urban areas, however it is more prevalent in rural areas, especially in villages where waste collection systems do not exist.

Fraction of population (P_{frac}) dumping waste informally is be assumed to be the rural population, and the urban population whose waste is not collected by waste collection services (P_{frac}= $P_{frac\ rural}$ + $P_{frac\ urban}$).

Fraction of rural population dumping waste informally ($P_{frac\ rural}$) is estimated to be the rural population not covered by waste collection services. The fraction of population from rural areas not covered by waste collection services has been estimated to be approx. 90% (or 0.9).
Hence, the fraction of rural population dumping waste informally used in the calculations is the following:
$P_{frac\ rural}$ = 0.9*0.6 (fraction of rural population from total population) **= 0.54.**

For ATULBD, it is assumed that the fraction of population from rural areas not covered by waste collection services is 100% (or 1). Hence, the fraction of rural population dumping waste informally used in the calculations is the following: $P_{frac\ rural}$ = 1*0.3 (fraction of rural population from total population in ATULBD) **= 0.3**.

The share of urban population whose waste is not collected by waste collection services is estimated to be between 10-30%. The assumption is made that the fraction of population dumping waste informally in urban areas is the same with the fraction of population burning waste in urban areas ($P_{frac\ urban}$= 8% or 0.08)). Also, it is assumed that same rate of informal waste dumping occurs both in the Republic of Moldova and ATULBD.

Data used for per capita waste generation, kg waste/capita/day

Per capita waste generation data used is the same with the data used for sub-category 5.8.5 Open fire waste burning: **0.5 kg/capita/day for rural population and 0,9 kg/capita/day for urban population** in the Republic of Moldova, including ATULBD.

Estimate of the fraction of the waste amount that is dumped informally relative to the total amount of waste generate (D_{frac})

The assumptions made with regard to the fraction of waste informally dumped in the rural and urban areas are the following:
1) It is assumed that around 30-50% of general waste generated in urban areas is informally dumped by urban population not covered by waste collection system. $D_{frac\ urban}$ used for calculation

of the amount of waste dumped informally in urban areas is 0.4 (both in the Republic of Moldova and ATULBD).

2) In rural areas, it is assumed that 30-70% of waste generated by rural population is informally dumped. $D_{frac\ rural}$ used for calculation of the amount of waste dumped informally in rural areas is 0.5 (both in the Republic of Moldova and ATULBD).

Calculation of the total amount of municipal waste dumped informally, t/yr (MSW_D)

Total amount of municipal waste dumped informally in the country is calculated by the summing up the amount of estimated waste dumped informally by rural population and the amount of estimated waste dumped informally by urban population:

$MSW_D = MSW_{D\ rural} + MSW_{D\ urban}$

$MSW_{D\ rural} = P*P_{frac\ rural}*MSW_{P\ rural}*D_{frac\ rural}*365*10^{-3}$

$MSW_{D\ rural\ RM} = P*0.54*0.5\ kg/capita/day\ *0.5*365*10^{-3}$

$MSW_{D\ rural\ ATULBD} = P*0.3*0.5\ kg/capita/day\ *0.5*365*10^{-3}$

$MSW_{D\ urban} = P*P_{frac\ urban}*MSW_{P\ urban}*D_{frac\ urban}*365*10^{-3}$

$MSW_{D\ urban\ RM} = P*0.08*0,9\ kg/capita/day\ *0.4*365*10^{-3}$

$MSW_{D\ urban\ ATULBD} = P*0.08*0.9\ kg/capita/day\ *0.4*365*10^{-3}$

Table 14-3. Total amount of municipal solid waste estimated dumped informally in the Republic of Moldova , including ATULBD in the period 2014-2018, t/y

	2014	2015	2016	2017	2018
Total population in the Republic of Moldova, persons	3413200	3384100	3369100	3356800	3330000
Total population in ATULBD , thousand persons	500700	474500	470600	469000	465100
Amount of waste estimated dumped informally in rural areas in the Republic of Moldova ($MSW_{D\ rural\ RM}$), t	36353.1	36255.9	36253.3	36255.9	36177.0
Amount of waste estimated dumped informally in rural areas in ATULBD ($MSW_{D\ rural\ ATULBD}$), t	166705.5	164619.6	163395.9	162377.6	160423.0
Amount of waste estimated dumped informally in urban areas in the Republic of Moldova($MSW_{D\ urban\ RM}$), t	9106.0	8722.3	8664.5	8643.5	8580.4
Amount of waste estimated dumped informally in urban areas in ATULBD ($MSW_{D\ urban\ RM}$), t	10130.9	9368.8	9257.1	9204.6	9106.0
Total, t	**222295.6**	**218966.6**	**217570.8**	**216481.5**	**214286.5**

Mercury input factor

As the result calculations made in Table 13-12, the default factor concentration used for calculations in this report is the low end factor 0,2 g Hg / tonne waste, as reccomended by UNEP Toolkit.

Output distribution factors

For the calculation of mercury emissions the default output distribution factors that are provided in the IL2 Excel calculation spreadsheet have been used.

Summary of inputs and results

Table 14-5 Summary of inputs and results from sub-category 5.9.4 Informal dumping of general waste in the Republic of Moldova in 2014

Sub-category 5.9.4 Informal dumping of general waste	**Unit**	**Pro-duc-tion**	**Use**	**Disposal**	**Sum of releases to pathway from as-sessed part of life-cycle**
Activity rate	Waste dumped t/y	-	-	214286.5	-
Input factor for phase	g Hg/t waste	-	-	0,2	-
Calculated input to phase	kg Hg/y	-	-	43	-

Data gaps and priorities for potential follow up

The assumptions made with regard to the practice of informal waste dumping for the population living ATULBD are based mainly on the data available for the population from Republic of Moldova. Also, it was assumed that the fraction of population from rural areas not covered by waste collection services in ATULBD is 100% since there are no data that would indicate the presence of waste collection in rural villages in this region. For this reason, there is high uncertainty associated with the use of estimated data for ATULBD in the calculation of total mercury emissions from the sub-category Informal dumping of general waste in the Republic of Moldova.

14.3 Waste water system/treatment

Subcategory description

The most important factors determining releases of mercury from waste water are the amount of mercury-containing wastes that are discharged to the system and the concentration of mercury in those wastes. Mercury content in waste water mainly originates from the two source groups: 1) intentionally used mercury in products and processes (such as from dental amalgams, spillage from thermometers and other devices, and industrial discharges); and 2) atmospheric mercury washed out by precipitation that goes to waste water systems (originating from both anthropogenic and natural sources) (UNEP, 2015).

The quantitative split between the parts of waste water that go to public waste water (treatment) systems and waste water discharged directly to aquatic environments varies between countries, and possibly also among local regions within a country. The same may be the case for the degree of mercury removal attained in treatment systems before the water is discharged to the environment (efficiency for mercury retention may vary considerably depending on individual plant configurations). This sub-category also includes waste water piping systems that lead the collected

waste water directly to the sea, ocean or water ways without any waste water cleaning activities involved (UNEP, 2015).

Activity rate data

The activity rate data needed to estimate releases from waste water treatment in the Republic of Moldova is the amount of waste water treated annually.

Data on the amount of conveyed and treated waste water in the country is available from the National Bureau of Statistics of the Republic of Moldova. This data does not cover, however, the territory of ATULBD. Data for this region has been collected from the State Statistical Service of the self-proclaimed Pridnestrovian Moldavian Republic.

Table 14-4 Volume of discharged residual water 2014-2018, m^3/y

	2014	2015	2016	2017	2018
Polluted water	10000000	8000000	28000000	8000000	9000000
..without treatment	1000000	1000000	2000000	1000000	2000000
..insufficient treated	9000000	7000000	26000000	7000000	7000000
Sufficiently treated	109000000	112000000	94000000	115000000	123000000
Total	119000000	120000000	122000000	123000000	132000000

Source: Statistical data bank StatBank of the National Bureau of Statistics, www.statistica.md

Table 14-5 Volume of wastewater discharged in surface water reservoirs in the region in ATULBD in the period 2014-2018, thousand m^3/y

	2014	2015	2016	2017	2018
Total volume of waste water discharged, thousand m^3	**20873.0**	21086,8	18816,3	18228,8	18305,7
Volume of treated waste water, thousand m3	20605.2	20961900	18750900	18141000	18201200
Volume of waste water going through full biological treatment, thousand m^3	20600.6	20961900	18750900	18141000	18201200
Volume of normative treated water, thousand m^3	19876.4	20071700	17868600	17212300	17261100
Volume of insufficiently treated water, thousand m^3	724.2	890200	882300	928700	940100

Source: State Statistical Service of the Pridnestrovian Moldavian Republic

Total amount of wastewater conveyed in the Republic of Moldova has been calculated by summing up the data on discharged residual water in the Republic of Moldova and ATULBD. The obtained results are used as the activity data for estimating releases from the sub-category Waste water system/treatment

Table 14-6 Activity rate data used to estimate releases from waste water system/ treatment in the Republic of Moldova (including ATULBD) for the period 2014-2018, m^3

	2014	2015	2016	2017	2018
Volume of conveyed waste water, m^3	**139873000**	**120021086,8**	**122018816,3**	**123018228,8**	**132018305,7**
treated	133525800	128876400	132071700	111868600	132212300
insufficiently treated	8734300	9724200	7890200	26882300	7928700
untreated	1306700	1267800	1124900	2065400	1087800

Mercury input factor

The mercury input factor necessary for a more accurate quantification of releases from sub-category Waste water treatment is the concentration of mercury in input waste water. Such data are not available from the entities running the waste water collection and treatment systems in cities/towns where such systems are in place. Analysis of mercury content in the sewage sludge at the "Apa-Canal" enterprise in Chisinau was performed by the Laboratory for testing "Geolab" of the Institute of Chemistry of the Academy of Sciences of Moldova. The results revealed a concentration of 0.521 and0.687 mg Hg per kg of sludge[25]. The results of this investigation have been used to make a rough estimate of the concentration of mercury in the waste water conveyed to the waste water treatment facility in Chisinau.

Additionally, relevant data has been gathered from online literature on production of waste water sludge. The data collected suggests that the activated sludge process produces about 110-170 kg of primary sludge in the primary sedimentation tanks per ML (mega liter) of waste water treated and 70-100 kg (typically 80 kg) of waste activated sludge per ML of waste water treated. This means that the total sludge production is in the range of 180–270 kg/ML, being the sum of primary sludge and waste activated sludge[26].

By using this data, it has been assumed that on average 220 kg of waste sludge is produced per 1 ML = 1000 m^3 of waste water treated. Hence it is estimated that 2.2 kg of sludge is produced per 1 m^3 of waste water treated. The highest identified concentration of mercury in the sludge at Chisinau "Apa-Canal" waste water treatment facility was 0.687mg/kg of sludge. Therefore, the concentration of mercury in 1 m^3 of waste water conveyed may be estimated through the following equation: 0.687 mg Hg / kg of sludge * 2.2 kg (=1m^3) of produced sludge = 1.5 mg Hg.

It should be noted that not all of the mercury is caught in the sludge but is released with the treated water. According to the Toolkit output distribution factors for waste water treatment, about 50% is released with treated water and the other 50% caught in the sludge. Taking into consideration this fact, it means that the concentration of mercury in 1 m^3 of waste water would be: 2 * 1.5 mg Hg = 3 mg Hg. Therefore, the input factor chosen for this sub-category is **3 mg Hg/m^3 waste water.**

This default input factor has been used for all wastewater treatment facilities in the country, including ATULBD. Since mercury releases to waste water can originate primarily from dental offices using mercury amalgam and considering the fact that such practice is not occurring in the Republic of Moldova (except for the few cases of amalgam extraction from patients that had treated their teeth with mercury amalgam in other countries[27]), expected releases of mercury to waste water are on the lower end. It is assumed that the same situation applies to the ATULBD.

Output scenario

In the Table 14-7 below are presented the ratios used in the calculation of the mercury input from each type of wastewater treatment present in the country. In the UNEP Toolkit methodology Level 2, four Output Scenarios are suggested for use in the quantification of mercury releases from this sub-category. These are:

[25] Test Report nr. 131 of 10 December 2015 performed by the Test Laboratory "Geolab" of the Institute of Chemistry of the Academy of Sciences of Moldova aimed at establishing the concentration of heavy metals in the sediment of the treatment station.
[26] Wastewater engineering: treatment and reuse (4th ed.). Metcalf and Eddy, Inc. McGraw Hill, USA. 2003. p. 1456.
[27] Letter response of the Republican Stomatological Clinic to the letter nr. 62 from 15 December 2015 of the Ministry of Environment.

1) No treatment; direct release from sewage pipe;

2) Mechanical treatment only;

3) Mechanical and biological (activated sludge) treatment; no land application of sludge; and

4) Mechanical and biological (activated sludge) treatment; 40% of sludge used for land application.

Based on the data presented in the tables above, the output scenarios were calculated.

Table 14-7 Output scenarios used in the IL2 Excel calculation spreadsheet for sub-category 5.9.5 Waste water system/treatment, %

		2014	2015	2016	2017	2018
treated	Output Scenario: No treatment; direct release from sewage pipe	92,1	93,6	79,4	93,6	93,3
insufficiently treated	Output Scenario: Mechanical treatment only	7,0	5,6	19,1	5,6	5,3
untreated	Output Scenario: Mechanical and biological (activated sludge) treatment;	0,9	0,8	1,5	0,8	1,4

Output distribution factors

For the calculation of mercury emissions the default output distribution factors that are provided for each of the Output Scenarios in the IL2 Excel calculation spreadsheet have been used.

Summary of inputs and results

Table 14-8 Summary of inputs and results from sub-category 5.9.5 Wastewater system/ treatment in the Republic of Moldova in 2018

Sub-category 5.9.5 Waste water system/ treatment	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Waste water, m^3/y	-	-	132018305,7	-
Input factor for phase	mg Hg/ m^3 waste	-	-	3	-
Calculated input to phase	kg Hg/y	-	-	368	-

Data gaps and priorities for potential follow up

Data gaps for this sub-category comprise of absence of information on the practice of sludge treatment and land application in the ATULBD. For this reason, the assumption was made that 40% of sludge is used for land application, similar to the situation in the Republic of Moldova.

Due to this, the uncertainty linked to the calculated mercury emissions from this sub-category is considered moderate to high.

15. Data and inventory on crematoria and cemeteries

15.1 Crematoria

In the Republic of Moldova the practice of cremation of human bodies is not present. Only burial of bodies in cemeteries is practiced.

15.2 Cemeteries

Sub-category description
Mercury in the human body, primarily from dental amalgam fillings, will be released to the soil at the cemetery. Smaller amounts of mercury present in body tissues, such as in blood and hair are also released. The amount of mercury in each corpse varies considerably and largely depends on the number of dental amalgam fillings, and to a lesser extent on the size of the fillings (UNEP, 2015).

Activity rate data

The activity rate data needed to estimate releases from cemeteries in the Republic of Moldova, using the IL2 approach, is the number of corpses buried annually (see Table 15-1).

Due to the fact that only burial of deceased persons is practiced in the Republic of Moldova, it is assumed that number of persons buried in cemeteries corresponds to the number of deceased persons registered in the country.

Statistical data the number of deceased persons in the Republic of Moldova is available from the National Bureau of Statistics and is presented in Table 15-2 below for the years 2014-2018.

Table 15-1 Total number of deceased persons in the Republic of Moldova, excluding ATULBD in the period of 2014-2018

	2014	2015	2016	2017	2018
Number of deceased persons in Republic of Moldova	39 555	39 848	38 454	36 820	37 285

Information on the number of deceased persons from ATULBD has been collected for the year 2012 and 2013 from the publications on population status published by the Statistical service of the ATULBD [28]. Data for other years has not been identified on the webpage of this Statistical service. Therefore, for the years 2010-2011 and 2014, estimates have been produced based on data of deceased persons for these years in ATULBD.

Table 15-2 Total number of deceased persons in the Republic of Moldova, including ATULBD in the period of 2014-2018

	2014	2015	2016	2017	2018

[28] The State Statistical Service of the Prednestrovian Moldavian Republic. Press-release Demographical situation in the Prednestrovian Moldavian Republic for the year 2012 and 2013. URL: http://mer.gospmr.org/gosudarstvennaya-sluzhba-statistiki/informacziya/o-demograficheskoj-situaczii-v-pmr.html

Number of deceased persons in Republic of Moldova	39 555	39 848	38 454	36 820	37 285
Number of deceased persons in ATULBD, based on 18% ratio	6867	6867	6758	6684	6727
Total estimated number of deceased persons in the Republic of Moldova including ATULBD, persons	46422	46715	45212	43504	44012

Source: Statistical data bank StatBank of the National Bureau of Statistics, http://www.statistica.md/ Государственная служба статистики ПМР http://mer.gospmr.org/gosudarstvennaya-sluzhba-statistiki/informacziya/o-demograficheskoj-situaczii-v-pmr.html

Because releases of mercury from the source sub-category Cemeteries come primarily from dental amalgam fillings of buried human bodies, it is considered appropriate to estimate the number of buried human bodies that potentially had dental amalgam fillings with mercury at the time of their death.

Such an estimate can be made based on the information received from the Republican Dental Clinic of the Ministry of Health which states that in the Republic of Moldova material for dental amalgam fillings have not been received in the country since 1982. Therefore, it can be assumed that for almost 30 years (after 1990) dental amalgam fillings have not been placed to the population over 18 years old from the Republic of Moldova (dental amalgam fillings were applied only to adults). Thus, it can be deduced that as of 2020, persons older than 43 years old constitute the only population group that may have dental amalgam fillings.

Based on these findings and assumptions, the activity rate data used to estimate releases of mercury from Cemeteries constitutes the number of deceased persons from the age group 50-54 and above. Data on number of deceased persons for these age groups are available from the National Bureau of Statistics presented in the Table 15-4 below, except for the population in ATULBD.

Table 15-3 Number of deceased persons over 40 years old registered in the period 2014-2018 in the Republic of Moldova (excluding ATULBD)

	2014	2015	2016	2017	2018
Age group					
50-54	2497	2377	2135	1763	1716
55-59	3560	3653	3564	3102	3029
60-64	4625	4600	4440	4051	4272
65-69	3381	4206	4690	4813	5324
70-74	4816	4240	3919	3244	3224
75-79	5674	5339	5206	5201	5139
80-84	5260	5334	4874	5049	5048
85-89	3486	3693	3610	3823	3643
90-94	1284	1454	1322	1470	1563
95-99	192	229	236	323	343
100+	25	76	54	25	23
Total	34800	35201	34050	32864	33324

Source: Statistical data bank StatBank of the National Bureau of Statistics. Table: Deceased persons per age groups and sex, in territory profile, 2014-2018, http://www.statistica.md/

Due to lack of data on current stomatological practice and usage of dental fillings in the ATULBD, it is assumed that on the left bank of river Dniestr the practice of using dental amalgam fillings has been the same as the practice on the right bank of river Dniestr (Republic of Moldova) over the period from 1982 to 2020. Therefore, the number of deceased persons from the age group 50-54 and above is also used to estimate releases of mercury from Cemeteries from ATULBD.

Statistical data on number of deceased persons based on age groups has not been identified for the population on left bank of river Dniestr, for this reason it is estimated based on the data available for population on right bank of river Dniestr from the Bureau of Statistics of the Republic of Moldova. It is assumed that the ratio of deceased persons above 50 years old to the total number of deceased persons in the Republic of Moldova is the same on both banks of river Dniestr.

Calculation of the ratio of deceased persons above 50 years old to the total number of deceased persons in the Republic of Moldova is presented below in Table 15-5.

Table 15-4 Ratio of deceased persons above 40 years old to the total number of deceased persons in the Republic of Moldova(excluding ATULBD)

	2014	2015	2016	2017	2018
Total deceased 50+	34800	35201	34050	32864	33324
Share from total deceased	88,0	88,3	88,5	89,3	89,4
Estimation for ATULBD	6041,5	6066,18	5984,0	5965,8	6012,3
Total deceased 50 +	40841,5	41267,18	40034,0	38829,8	39336,3

Also, it is assumed that a half of population has dental amalgam fillings. In Table 15-7 below is presented the total estimated number of number of deceased persons over 50 years old which are assumed to have dental amalgam fillings in their mouth when buried in cemeteries and which are used as activity rate data for estimation of mercury releases from this subcategory in IL2.

Table 15-5 Activity rate data used to estimate releases of mercury from Cemeteries in the Republic of Moldova in the period 2010 - 2014

	2014	2015	2016	2017	2018
Number of corpses buried	20420,8	20633,6	20017,0	19414,9	19668,2

Mercury input factor

Considering the information provided by the National Stomatological Clinic that dental mercury amalgam has not been available in the Republic of Moldova since the beginning of 1990's, it is reasonable to assume that the average number of dental amalgam fillings present in the bodies of the deceased persons over 40 years old is rather low. Therefore, it is deemed appropriate to use the low end default input factor of 1 g Hg/corpse for the quantification of mercury releases from this sub-category.

Output distribution factors

For the calculation of mercury emissions for the sub-category 5.10.2 Cemeteries, the default output distribution factors that have been already provided in the IL2 Excel calculation spreadsheet were used.

Summary of inputs and results

Table 15-6 Summary of inputs and results from sub-category 5.10.2 Cemeteries in the Republic of Moldova in 2018

Sub-category 5.10.2 Cemeteries	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	Corpses buried/ year	-	-	19668,2	-
Input factor for phase	g Hg/ corpse	-	-	1	-
Calculated input to phase	kg Hg/ year	-	-	19,67	-

Data gaps and priorities for potential follow up

The assumption was made that the persons over 50 years old in the Republic of Moldova may have dental amalgam fillings at the time of their death and hence have been buried with them in cemeteries. However, there is no data available on the number of dental amalgam fillings per person and percentage of population from this age group that may have had their teeth treated with mercury dental amalgam. Also, there is no information available with regard to potential use of mercury dental amalgam after 1990 in ATULBD.

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Appendix 1 – 2014 Inventory Level 2 calculation spreadsheet for the Republic of Moldova

Annex 1 List of vehicles that could possible contain mercury light switches

Mark	Model	Model Year	Switch Location
Audi	Audi	1977-1988	Hood
	Audi 100	1977-1988	Hood
	Audi 200	1980-1988	Hood
BMW	All	Until 1992	Hood/trunk
Buick (General Motors)	Celebrity Century Firenza LeSabre Park Avenue Regal SkyLark, Skyhawk	1977-1988	Hood/trunk
Cadillac	Cimmaron Deville	1979	Hood/trunk
Chrysler (DaimlerCrysler)	Aries Cordoba Laser LeBaron NewYorker Reliant Shadow Sundance	1975-1998	Hood trunk
DaimlerChrysler	Dodge Jeep Plymouth Eagle	Until 1998	Hood/trunk
Ford	Lincoln Black-wood	2001	Hood
	Bronco II Cougar	1974 - 1998	Hood/trunk
	Crown Victoria Mustang	1974-2000	Hood/trunk
	Escort	1974 - 1998	Hood/trunk
	Excursion	2000	Hood
	Expedition	2000-2001	Hood
	Explorer	2000	Hood/trunk
	F-Series Truck (F 150-550)	1974-2000	Hood/trunk
	F-150 Supercrew	2001	Hood
	F-250	1974-1994	Hood
	Fiesta	1983-1989	Trunk

	Granada	1982-1985	Trunk
	LTD	1974-1994	Hood
	Mercury Models	1970-2003	Hood/trunk
	Merkur Models	Until 1996	Hood/trunk
	Lincoln Models	1970-2003	Hood/trunk
	Ranger	1974-1998, 2000	Hood/trunk
	Sierra	1983-1985	Trunk
	Taurus	1974 - 1998	Hood/trunk
	Tempo	1974 - 1998	Hood/trunk
	Thunderbird	1974 - 1998	Hood/trunk
	Topaz	1974 - 1998	Hood/trunk
General Motors	Cadillac Escalade	2000-2001	Hood
	Chevrolet Beretta	1981-1990	Hood/trunk
	Chevrolet Blazer	2000-2002	Hood
	Chevrolet Caprice	1981-1990	Hood/trunk
	Chevrolet Cava-lier	2000 2001	Hood/trunk Trunk
	Chevrolet Cor-vette	2000	Hood
	Chevrolet Ex-press	2000-2002	Hood
	Chevrolet Lumina	1981-1990	Hood/trunk
	Chevrolet S-10	2002	Hood
	GMC Denali	2000	Hood
	GMC Envoy	2000-2001	Hood
	GMC Jimmy	2000-2001	Hood
	GMC Savanna	2000-2001	Hood
	GMC Sonoma	2002	Hood
	Luxury G-van	2001-2002	Hood
	Pontiac Sunfire	2000 2001	Hood Trunk
Mazda	Navajo	1993-1997	Hood
	B-Series Pickup	1995-1999	Hood
Oldsmobile	Bravada	2000-2001	Hood
	Calais Cutlass Ciera Cutlass Supreme Delta Regency Toronado	1970-1990	Hood/trunk
Pontiac	Bonneville Grand Am Sunbird	1984-1990	Hood/trunk
Peugeot	All	Until 1992	Hood
Porsche	924	1976-1985	Hood
	924 S	1986-1988	Hood

	944	1982-1988	Hood
	944 S	1987-1988	Hood
	944 S2	1989-1991	Hood
	944 Turbo	1986-1991	Hood
	928	1978-1983	Hood
	928 S	1980-1983	Hood
	928 S/S4	1984-1990	Hood
Rolls Royce	All	Until mid-1960s	Hood
Rover Group (MCs)	All	1988-1999	Hood
Saab	900/9000cc,cd	Until 1991	Hood/trunk
Saturn (General Motors)	All	Until 1999	Hood/trunk
Volvo	240/260	1975-1991	Hood/trunk
	740/760	1982-1990	Hood
	744/764	1982-1991	Trunk

*__Mitsubishi, Nissan, Subaru and Toyota__ vehicles DO NOT contain mercury switches
* Vehicles manufactured 2003 Model Year and beyond DO NOT contain Hg switches