Toolkit for Identification and Quantification of Mercury Releases

Guideline
for Inventory Level 1

Version 2.2
February 2023

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This Toolkit is a part of the seventh version of the Toolkit. The Toolkit will be further developed and updated as appropriate.

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The Toolkit can be found on UNEP Chemicals and Health Branch's web-site:

https://www.unep.org/explore-topics/chemicals-waste/what-we-do/mercury/mercury-inventory-toolkit

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Table of Contents

Introduction

Welcome to the Toolkit for identification and quantification of mercury releases - Inventory Level 1. The Toolkit consists of 6 separate documents:

- This Guideline for Inventory Level 1;
- An electronic spreadsheets for calculation of estimates of mercury inputs and releases on Inventory Level 1;
- Two templates for data collection letters;
- An Inventory Reporting Template; and
- A Toolkit Reference Report.

The Toolkit Reference Report gives additional guidance on inventory development and describes the background inventory principles and the mercury source categories in more detail. It also describes Inventory Level 2 which gives guidance to performing more detailed and potentially more technically accurate mercury inventories.

This guideline works closely together with the Toolkit electronic Inventory Level 1 spreadsheet for calculation of estimates of mercury inputs and releases[1]. The guideline and the calculation spreadsheet bring you step by step through the development of your mercury inventory on Inventory Level 1. The design of Inventory Level 1 makes it simple to organise and calculate your first national mercury inventory. We acknowledge however that mercury inventory development is generally challenging, especially getting hold of the needed data types for your country. We have made every effort to collect and organise the needed background information to pave the way for a resource-saving and efficient mercury inventory development for you.

The Inventory Level 1 guideline and calculation spreadsheet is organised with the following steps:

Step 1: Getting started;
Step 2: Energy consumption and fuel production;
Step 3: Domestic production of metals and raw materials;
Step 4: Domestic production and processing with intentional mercury use;
Step 5: Waste treatment and recycling;
Step 6: General consumption of mercury in products, as metal mercury and as mercury containing substances;
Step 7: Crematoria and cemeteries;
Step 8: Miscellaneous mercury sources not quantified on Inventory Level 1;
Step 9: Reporting your inventory and
Step 10: Refining your inventory (optional).

Steps 2 through 7 provides brief descriptions of the mercury source categories included, the data types needed and ideas for where to search for data, and the main factors informing your decisions of whether to refine your inventory further for this category or not. Step 8 lists source categories which are not quantified via Inventory

[1] All the UNEP Mercury Toolkit documents can be found on UNEP's website: https://www.unenvironment.org/sw/node/2988

Level 1. Steps 1, 9 and 10 give you general guidance on performing and reporting your inventory.

Background

The UN Environment Governing Council (GC) concluded in 2003 that there is sufficient evidence of significant global adverse impacts from mercury to warrant international action to protect human health and the environment from mercury and its compounds. The GC decided that national, regional and global actions should be initiated as soon as possible and urged all countries to adopt goals and take actions, as appropriate, to identify populations at risk and to reduce human-generated releases.

In response to the Governing Council's request, UN Environment established a Mercury Programme to encourage all countries to adopt goals and take actions, as appropriate, to identify exposed populations, minimize exposures through outreach efforts, and reduce anthropogenic mercury releases. An important part of the UN Environment Mercury Programme is to develop training materials, guidance documents and toolkits on a number of relevant topics that may be of use to Governments and others in their efforts to evaluate and address mercury pollution.

A certain level of knowledge is required to evaluate risks posed by mercury and to take appropriate action to reduce potential risks. This "Toolkit for identification and quantification of mercury releases" (Toolkit) assists countries to develop part of the required knowledge through the development of a mercury inventory that identifies sources of mercury releases in their country and quantify their releases.

A Pilot Draft version of the Toolkit was published by UN Environment in November 2005, providing the initial version of what is now referred to as Inventory Level 2 and the "Toolkit Reference Report" in the current guideline document. Pilot tests in a number of countries have identified a need for further simplification of the Toolkit, thus the development of Inventory Level 1.

More reading on the Toolkit and mercury as a pollutant

For more information on the background for this Toolkit, see Section 1 and 2 of the Toolkit Reference Report. For more information on mercury release fundamentals, see Section 3 of the Toolkit Reference Report. Two other reports published by UN Environment Chemicals, the Global Mercury Assessment[2], and the Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport[3] give a deeper understanding of mercury pollution, its adverse effects, global release estimates and its global significance. These are useful for seeing your national release estimates in a global perspective.

This revised Toolkit

The Toolkit suggests two levels of inventory development, a simplified and standardised methodology called Inventory Level 1, and a more detailed Inventory Level 2.

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[2] http://www.unep.org/hazardoussubstances/Mercury/Informationmaterials/ReportsandPublications/tabid/3593/Default.aspx

[3] http://www.unep.org/hazardoussubstances/Mercury/Informationmaterials/ReportsandPublications/tabid/3593/Default.aspx

This guideline describes a step by step procedure for Inventory Level 1. It also describes limitations of the Inventory Level 1 methodology and gives advice for situations where you may want to refine your inventory on Inventory Level 2. Finally this guideline provides advice for the reporting of your inventory. Besides providing background information, the Toolkit Reference Report describes Inventory Level 2.

Earlier users of the Toolkit will recognise Inventory Level 2 as the original methodology of the Pilot Draft version of the Toolkit published November 2005. As part of the current revision, the Toolkit has undergone certain revisions. Most importantly, default input and output distribution factors have been developed for more mercury release source categories than previously, making it simpler to use the Toolkit.

The MS Excel calculation spreadsheets were updated for Inventory Level 1 as part of the latest revision including updated default factors for some sources, improved estimation principles for selected consumer products, and improved design for more user friendliness.

The MS Excel calculation spreadsheets for Inventory Level 2 have also been revised with new default input factors for some source categories based on new knowledge of existing mercury release sources.

The mass balance principle, inputs and outputs

The mercury release calculations used in this Toolkit are based on the mass balance principle: All the mercury fed into the system (e.g. an industrial sector) with materials and fuels will come out again, either as releases to the environment or in some kind of product stream. In other words: "Sum of inputs = sum of outputs".

Inputs: Therefore we quantify the mercury inputs from the amount of mercury containing material fed into the system (called "**activity rate**"[4]) and general data on the mercury concentration in the feed material (called "**input factor**").

Outputs: The mercury releases from the system are calculated by distributing this mercury amount on the relevant release pathways based on available data on how the releases (or "outputs") are generally distributed in this sector. For calculating this distribution, we use general "**output distribution factors**".

On Inventory Level 1, these calculations are automatic, and are based on *default* input factors and *default* output distribution factors, which are already entered in the electronic calculation spreadsheet. So all you need to do is to enter the amount of material used or produced in each sector, as carefully described in the individual steps of this Guideline.

The generalised formula used in the calculations is:

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

[4] For some source categories, other types of activity rates are used; see specific advice in the Steps in this guideline.

It is not crucial at this step to understand the above mentioned principles fully. Should you however desire a deeper understanding of the principles for the inventory calculations, read sections 3.1 and 4.1.1 in the Toolkit Reference Report, where several calculation examples are also shown.

The background for all default input factors and output distribution factors is also described in detail in the Toolkit Reference Report, in section 5. Appendix 1 to this guideline provides background information on how the default factors were implemented in Inventory Level 1.

Simplifications and limitations in the design of Inventory Level 1

Mercury concentrations in raw materials, fuels or products used vary depending on their type and origin and this naturally affects the amount of mercury being released. Production set-ups and pollution reduction equipment configurations may also influence the distribution of mercury releases among the release output pathways (air, water, land, waste, etc.). These factors are incorporated in the Toolkit. Simplification and standardisation of the inventory development was a priority in the Toolkit Inventory Level 1. The Inventory Level 1 is aimed at assisting developing countries and countries with economies in transition so the default factors need to reflect the input and release scenarios predominant in these countries. In Inventory Level 1, the Toolkit spreadsheet uses medium input and release factors (here called output distribution factors) for the calculation of the mercury inputs and releases, and presents the results as "standard estimates" with no uncertainty interval[5].These calculated “standard estimates” are simplified results of inputs and releases and may as such be above or below the actual inputs and releases in your country. These simplified results aim at providing a useful first insight into your country’s situation on mercury inputs and releases. Generally, it may be useful to produce refined inventories at later stages, as the work with national management of mercury develops further.

Specifically, it is recommended to develop more detailed and refined inventories for targeted sectors or activities prior to launching any far reaching regulation or management procedures for these sectors or activities, preferably in cooperation with the relevant stakeholders.

For users who wish to reflect mercury management improvements in their inventory, which are not reflected on Inventory Level 1, the Toolkit Reference Report provides more detailed descriptions of the source categories, and release estimate calculations can be made in more detail in the Inventory Level 2 spreadsheet pages.

It should be noted that for some mercury source categories, the data available for developing the default factors have been very scarce, and some default factors are therefore associated with substantial uncertainty. In some cases where detailed mass balances have not been available, default output distribution factors were developed preliminarily based in expert assessment. In these cases the output distribution default factors are considered "signal values", which indicate a probable release distribution.

[5] The Toolkit Reference Report provides additional documentation for default factors used in the calculation of the mercury inputs and releases.

As mentioned, the available data background for the default factors can be seen in the Toolkit Reference Report.

Each source-category section ("Step") in this guideline describes the limitations of Inventory Level 1 and lists the main factors which may influence the actual inputs and releases, including cases of more technically advanced source configurations, and cases with particularly uncertain default factors, including "signal values".

Users are invited to estimate mercury inputs and releases in such cases by using Inventory Level 2 procedures, and source specific data. Guidance for including Inventory Level 2 estimations in your inventory is introduced in Section 10 "Refining your inventory".

1 Step 1: Getting started

This guideline works closely in parallel with the Toolkit spreadsheets. You simply read Section 1 (this section) and open spreadsheet page Step 1 and fill in the information requested, using the advice given in this guideline. On Inventory Level 1, only the white cells are open for entering data in the spreadsheet. The coloured cells contain complex formulas without which the calculations will not work, and they are therefore protected and no changes can be made in them on Inventory Level 1. When you have established an overview of your work in Step 1, simply proceed to Step 2 of the guideline and the spreadsheet to proceed with the inventory work.

1.1 Data collection

Data collection may take time, and once specific data are requested from data owners it may take time before responses are received. Therefore, it is recommended to start data collection early for all inventory steps, and not wait for data for one step before proceeding to the next inventory step. This also allows for coordination of data collection in cases where several data types are requested from the same sources of information (such as for example the national statistics bureau, or similar). The step by step procedure however makes it more simple to keep an overview of the data needed, and the data can be filled into the spreadsheet as they become available, which also provides an overview of current status of the inventory work at any time.

We recommend that while collecting data, you keep notes describing your contacts and the information they gave, for later reference in your work and for your reporting. Description of your data sources and the data they provided are a part of your reporting. See also reporting advice in Section 9.

As the inventory should aim at describing the mercury situation in (or around) a given year, try to get data for that same year from the different data sources. If some data types are not available for that year, data from other adjacent years can be used, or averages over several adjacent years, if this describes the situation better. Note the data year(s) for all data used, in your inventory report.

Data units are important

It is of paramount importance that you enter your activity rate data (production, consumption or use, as stated in spreadsheet) with the exact unit stated in the spreadsheet at the appropriate cell for each mercury source sub-category. Otherwise the spreadsheet will produce incorrect results.

This guideline gives some advice on units' conversion for some mercury source categories. For some mercury source categories, a simple conversion tool has been included as a separate sheet in the Inventory Level 1 calculation spreadsheet file. The Toolkit Reference Report also gives advice in some case in the relevant source subcategory description in section 5. Otherwise conversion of data have to be sought on the Internet or by help from relevant resource persons from universities, agencies, or similar. Always describe your data conversions carefully in your inventory report.

1.2 Using the spreadsheet

Using the Toolkit calculation spreadsheet requires basic experience with using the spreadsheet programme MS Excel. On Inventory Level 1, procedures are however relatively simple, so please do not make limited Excel experience stop you in trying out the spreadsheet. MS Excel (of MS Office 2010 or newer) must be installed on your computer before the spreadsheet file can be opened and work properly. For instructions in the use of MS Excel, use the Help functions of the programme or other user manuals.

The spreadsheet will use the decimal point or decimal comma according to your personal computer set-up (country selection). In this guideline and in the Toolkit Reference Report, decimal point is used. Make your choice of decimal separator in your inventory report, and assure consistency between text and data tables on this aspect.

We recommend saving your inventory spreadsheet file regularly throughout the working day to make sure new changes and additions are not lost.

As mentioned, the spreadsheet will not work correctly, if you enter data with another unit that stated in the spreadsheet at the appropriate cell for each mercury source subcategory.

Since the 2016 version of the Toolkit, it is possible to include the presence of mercury controls – relevant filters and management solutions – in the calculation of mercury release estimates in Inventory Level 1. To do so, enter "y" for yes in the columns named "Include Hg controls in estimation? (y/n)" for the mercury source sub-category in question. When doing so, the mercury controls relevant to this source category appear[6] in the relevant spreadsheet rows. You can try this out in for example Step 2-Energy in the calculation spreadsheet.

Should you prefer not to include controls in your calculations (for simplicity or to keep principles used in previous inventories) you simply answer "n" for no in the column named "Include Hg controls in estimation? (y/n)" for the mercury source subcategory in question. In this case, the standard mercury controls configurations described in Appendix 1 are applied automatically in the calculations.

To include controls in your calculations, ideally you need to get data for each individual facility on which of the relevant mercury controls they use (if any), and the specific activity rate for the facility (how much do they use or produce of the activity rate unit in question). Alternatively, sector experts may have knowledge of the use of mercury controls in the sector in question in the country. You can copy the relevant rows in the table below to your letters or emails to the facilities or experts.

For each of the mercury controls relevant in your country, in the calculation spreadsheet you need to enter the percent of the total national activity rate that is used in facilities with this type of controls. The controls option listed with the lowest mercury retention is calculated automatically, so the percentage for this cannot be entered.

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[6] For all sub-categories where background data have been sufficient to include mercury controls in the calculations.

Please make sure that the percentages entered in the spreadsheet do not exceed 100 percent in total.

1.3 Understanding the calculated results

Try opening the Inventory Level 1 calculation spreadsheet and open the page entitled "Step 2 Energy" by clicking on the page label with this title at the bottom of the screen window. You will first see a page as shown in Figure 1.

When you have entered "Y" to show that the source category in question is present in your country, and you have entered an input amount, say the annual consumption/use of diesel, gasoil, etc., the spreadsheet will automatically calculate the result types shown in the spreadsheet page. Remember, data can only be entered in the white cells.

As long as you have not entered Y, N or ? in column below "Source present? Y/N/?", the results columns say **"present ?"** to remind you to enter your indication of the presence of the source in the country. Once you have entered Y for "yes", and an amount in the "Annual consumption/production" column, the results appear in the results columns. As you may have noted in Figure 1, we have entered Y and a fictive amount of diesel oil (etc.) used annually, producing the fictive mercury release results shown to the right. Also shown, entering an N for no, gives the result "-", indicating that the mercury source is not present. Entering "?" gives "?" in the results cells to indicate that this knowledge is not yet established.

Figure 1-1 Example of an inventory spreadsheet page (Step 2 Energy).

Source category	Source pre-sent?			Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y						
Energy consumption	**Y/N/?**	Annual con-sumption /production	Unit	Standard estimate	Air	Water	Land	Impurity in products	General waste	Sector specific waste treatment /disposal	Cat. no.
Coal combustion in large power plants			t coal com-busted/y	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	5.1.1
Other coal uses			t coal used/y	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	5.1.2
Combustion/use of petro-leum coke and heavy oil			t oil product combusted/y	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	5.1.3
Combustion/use of diesel, gasoil, petroleum, kerosene	Y	10.000.000	t oil product combusted/y	55	55,0	0,0	0,0	0,0	0,0	0,0	5.1.3
Biomass fired power and heat production			t biomass combusted/y (dry weight)	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	5.1.6
Charcoal combustion			t charcoal combusted/y	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	5.1.6
Fuel production											
Oil extraction	N		t crude oil produced/y	-	-	-	-	-	-	-	5.1.3
Oil refining	?		t oil refined/y	?	?	?	?	?	?	?	5.1.3
Extraction and processing of natural gas			Nm3 gas/y	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	Present ?	5.1.4

The result types for the different mercury releases and outputs are described in the table below for a better understanding. The same description is given in the inventory report template to save you from providing these descriptions to your readers.

Table 1-1 Explanation to the types of results generated

Calculation result type	**Description**
Estimated Hg input, Kg Hg/y	The amount of mercury entering a source category with input materials, for example mercury amount in the amount of coal used annually in the country for combustion in large power plants.
Air	Mercury emissions to the atmosphere from point sources and diffuse sources from which mercury may be spread locally or over long distances with air masses; for example from: • Point sources such as coal fired power plants, metal smelter, waste incineration; • Diffuse sources as small scale gold mining, informally burned waste with fluorescent lamps, batteries, thermometers.
Water	Mercury releases to aquatic environments and to waste water systems: Point sources and diffuse sources from which mercury will be spread to marine environments (oceans), and freshwaters (rivers, lakes, etc.). for example releases from: • Wet flue cleaning systems from coal fired power plants; • Industry, households, etc. to aquatic environments; • Surface run-off and leachate from mercury contaminated soil and waste dumps

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

The "Cat. no."(the category number) shows the section number in the Toolkit Reference Report, where more detailed information on the source sub-category is given.

1.4 Enter country data and contact details

Open the spreadsheet page entitled "Step 1 - Country data" by clicking on the page label with this title at the bottom of the screen window.

The first data you need to enter in step 1 of the Inventory Level 1 procedure are the general descriptive data listed in table 1-2 for your country, as well as the listed contact data types for your institution(s) responsible for inventory development.

Table 1-2 Data collection

Data types needed	**Possible data sources and remarks**
General population data	This number is needed for several of the calculations to function. The number appears automatically when you select your country from the drop-down list (see below). If not, enter your country's population number manually in this cell. Should you wish to use another population number (normally not needed), an alternative number can be entered in the cell. Population data are available for most (or all) countries and areas in several international statistics available via the Internet, for example at the United Nations Statistics Divisions homepage at http://unstats.un.org/unsd/demographic/products/dyb/dyb2.htm In the calculation spreadsheet, be careful to not overwrite the formula in this cell (population number), unless you are sure that you want to use an alternative population number.
Population	
Year and reference for population data	
GDP (Gross Domestic product)	National Gross Domestic Product (GDP); a measure for the total national economic activity) can generally be found in national statistics. Otherwise, these data are available for most (or all) countries in several international statistics available via the Internet, for example the United Nations Statistics Divisions homepage at http://unstats.un.org/unsd/economic_main.htm
Year and reference for GDP data	
Main sectors in the economy of country (list)	Consult national country profiles, either from national sources or from international statistics available on the Internet.
Contact point responsible for inventory	Fill in relevant contact data.
Full name of institution	_
Contact person	_
E-mail address	_
Telephone number	_
Fax number	_
Website of institution	_

Estimates of mercury inputs and releases for some product types are, due to the complexity, calculated based on population number and electrification rate in the country in question. For dental amalgam, they are calculated from population and density of dental personnel. This is done based on authoritative data sources as described further in the Toolkit Reference Report sections of the relevant mercury uses.

To activate these calculations, you need to select your country in the part of Step 1 spreadsheet page shown below[7].

In case you make a mercury inventory for a country or area NOT specified in the list, select "other OECD country" or "other non-OECD country" as relevant, and enter the population number for the inventory area manually in cell B6.

Figure 1-2 Selection of country in the spreadsheet's Step 1.

BACKGROUND DATA FOR DEFAULT CALCULATIONS FOR DENTAL AMALGAM AND CERTAIN PRODUCT TYPES			
Compulsory: Click cell below and select country from list	Population in 2010 (or as recent as available data allow; UNSD, 2012)	Dental personnel per 1000 inhabitants	Electrification rate, % of population with access to electricity
1-Click here to select country	0	0,000	0

[7] If you do not select your country, the mercury use pattern will be considered similar to those developed countries where the default calculation factors were derived from. You should always enter your population number.

2 Step 2: Energy fuels, consumption and production

Open the spreadsheet page entitled "Step 2 - Energy" by clicking on the page label with this title at the bottom of the screen window.

2.1 Mercury release sources

This inventory step covers the use of fossil fuels and plant matter (biomass) for production of electricity and heat. Fossil fuels and biomass naturally contain trace concentrations of mercury, and this mercury is released when the fuel is burned. Most of this mercury is released to the atmosphere, but some is captured by flue gas cleaning systems and ends up in residues from this system. Mercury concentrations in fuel vary depending on the fuel source and the fuel type. Large coal fired power plants are generally equipped with air pollution reduction equipment which retain parts of the mercury from flue gasses and transfer them to solid or wet residues. This is generally not the case for other coal uses. During extraction, refining and treatment of oil and natural gas, some of the mercury in the fuel may be released to the environment. Due to the enormous amounts of coal combusted annually, coal fired power plants is the single largest emitter globally of mercury to the atmosphere.

The source sub-categories included in this inventory step are shown in the table below along with category references to the relevant Toolkit Reference Report sections, in case you wish to read more about the source sub-categories.

Table 2-1 Source sub-categories covered, with reference to the Toolkit Reference Report sections.

Fuel consumption	Category reference
Coal combustion in large power plants (typically with thermal boiler effect above 300 MW)	5.1.1
Other coal uses (sum for all other uses)	5.1.2
Combustion/use of petroleum coke and heavy oil	5.1.3
Combustion/use of diesel, gasoil, petroleum, kerosene	5.1.3
Combustion/use of natural gas	5.1.4
Biomass fired power and heat production (wood, etc.)	5.1.6
Charcoal combustion	5.1.6
Fuel production	
Oil extraction	5.1.3
Oil refining	5.1.3
Extraction and processing of natural gas	5.1.4

Are these source types present in your country?

Start your inventory for these source types by investigating preliminarily if these source types are present in your country. Start with the background knowledge of yourself and your colleagues, and supplement as needed by contacting relevant ministries, agencies and resource persons in your country. This will also help you to identify the right contacts for later work on the inventory. Remember to ask all, if they

know of other contact persons who might have relevance for your inventory for these sectors.

Report your findings in the inventory spreadsheet by filling in column B with "Y" for source types present in your country, "N" for source types which you have proven are not present in the country, and "?" for source types for which you have no indications of their presence or absence. Be confident with entering your immediate findings first and adjust later as you get more information. We recommend that you continue to search for data for any source types you are not sure are present in your country, until you have confirmation of its presence or absence. Source types with cells in this column left blank will be indicated in the spreadsheet summaries.

2.2 Data collection

The data types you need for mercury input and release estimation and hints on where to seek them are given in the table below.

Table 2-2 Data collection

Source sub-category	Input data types and units	Possible data sources
Energy consumption		
Coal combustion in large power plants	Coal combusted, t/y	For many countries, fuel consumption and production data are provided on the International Energy Agency's statistics website at http://www.iea.org/stats/. Study the many tables carefully to find the right numbers, make sure they have the right units, and add up contributing numbers carefully. For guidance on which IEA numbers to use, see Appendix 3 to this guideline. Otherwise, check any national climate inventories or contact your ministry of energy (or other ministry responsible for energy planning), or your national statistics bureau for these data. In some cases, it may be useful contacting individual power plants, etc. If possible, get advice for selecting the data from resource persons with knowledge of energy and fuels. If you need to convert energy units, EIA's unit converter may be useful (many other converters exist on the Internet also): http://www.iea.org/stats/unit.asp .
Other coal uses	Coal used, t/y	
Combustion/use of petroleum coke and heavy oil	Oil product combusted, t/y	
Combustion/use of diesel, gasoil, petroleum, kerosene	Oil product combusted, t/y	
Use of pipeline natural gas (consumer quality)	Gas used, Nm³/y	See advice above. Natural gas production data may be given as TJ (Terajoule), which can be converted to the unit needed in the Toolkit, Nm3 (normal cubic meters), by multiplying the TJ number with 25600 Nm3/TJ (an average gross calorific value of natural gas derived from http://www.iea.org/stats/docs/statistics_manual.pdf, p182) if no specific conversion values are available. If no details are available on the quality of the gas, consider it cleaned pipeline quality.
Use of raw or pre-cleaned natural gas	Gas used, Nm³/y	See advice above. If no details are available on the quality of the gas used, consider it cleaned pipeline quality.

Source sub-category	Input data types and units	Possible data sources
Biomass fired power and heat production (wood, etc.)	Biomass combusted, t (dry weight)/y	See advice above. Your ministry responsible for forestry will likely have estimates of the annual consumption of wood and charcoal for combustion purposes. Otherwise consult the FAO Yearbooks of Forest Products (entry: Wood Fuel, Including Wood for Charcoal) at http://www.fao.org/forestry/statistics/80570/en/). Make sure you do not count the wood used for domestic production of charcoal twice. This means that under "Biomass fired power and heat production" you should ideally subtract the wood amounts used for charcoal production. If you have data for wood consumption for combustion and charcoal, and you do not import charcoal, you can enter the whole amount under "Biomass fired power and heat production ". If you import all your charcoal, you simply enter the consumption under "Charcoal combustion", and you need not worry about double-counting.
Charcoal combustion	Charcoal combusted, t (dry weight)/y	
Fuel production		
Oil extraction	Crude oil produced, t/y	See advice above.
Oil refining	Crude oil refined, t/y	See advice above; refined crude oil amounts may be reported as "petroleum refineries" and "crude oil" usage.
Extraction and processing of natural gas	Gas produced, Nm^3/y	See advice above.

In countries which do not have aggregated national fuel statistics, remember to include data from all sectors where fuel consumption is taking place, for example power stations, industry, transport, households, etc.

2.3 Inclusion of mercury controls in the estimation

As described in Section 1.2, it is possible to include the presence of mercury controls in the calculation of mercury release estimates in Inventory Level 1. Simply enter "y" for yes in the column named "Include Hg controls in estimation? (y/n)" for the mercury source sub-category in question, and the mercury controls relevant to this source category appear[8] in the relevant spreadsheet rows. Here, you need to enter the percent of the total national activity rate that is used in facilities with this type of controls. The percentage for the controls option listed with the lowest mercury retention is calculated automatically and cannot be entered. Please make sure that the percentages entered in the spreadsheet do not exceed 100 percent in total.

[8] For all sub-categories where background data have been sufficient to include mercury controls in the calculations.

Should you prefer not to include controls in your calculations you simply answer "n" for no in the column named "Include Hg controls in estimation? (y/n)" for the mercury source sub-category in question. In this case, the standard mercury controls configurations described in Appendix 1 are applied automatically in the calculations.

For the current step, the mercury controls relevant are listed in Table 2-3. For a more detailed description of the controls, see the relevant sections in the Toolkit Reference Report. To include controls in your calculations, ideally you need to get data for each individual facility on which of these mercury controls they use (if any), and the specific activity rate for the facility (how much do they use or produce of the activity rate unit in question). Alternatively, sector experts may have knowledge of the use of mercury controls in the sector in question in the country. You can copy the relevant rows in the table below to your letters or emails to the facilities or experts.

Table 2-3 Relevant mercury controls that can be included in this inventory step.

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
Coal combustion in large power plants / Coal combustion in coal fired industrial boilers	0: No filters	
	1: Simple particle filters	Electrostatic precipitators (ESP), particle scrubbers (PS), cyclones (CYC) or similar particle filters with low mercury retention
	2: Fabric filters	Fabric filters (FF; also called bag filters)
	3: Efficient APC	Particle filters (PM) + spray dryer absorption (SDA) or wet flue gas de-sulphurisation (wFGD)
	4: Very efficient APC	Particle filters (PM) plus + flue gas de-sulphurisation (FGD) + selective catalytic reduction (SCR)
	5: Mercury specific	Activated carbon injection (ACI) or other mercury specific filters
Combustion/use of petroleum coke and heavy oil AND Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	ESP or scrubber	Electrostatic precipitators (ESP), particle scrubbers (PS), or other particle filters with similar performance
	cESP and FGD	Cold-side electrostatic precipitators (cESP) + flue gas de-sulphurisation (FGD), or other advanced filter configuration with similar performance
Extraction and processing of natural gas	Without mercury removal	
	With mercury removal	Cleaning of gas in fixed bed filters with mercury absorbants (or similar)

2.4 Key factors influencing mercury releases

On Inventory Level 1, the Toolkit spreadsheet uses medium input and output distribution factors for the calculation of the mercury inputs to a sector and releases to the environment from the same sector (see the introduction for more description). Actual in-

puts and releases in your country may be above or below the calculated standard estimates. The most important factors that can influence mercury inputs and mercury releases, besides the presence of mercury controls described above, are the following:

- The mercury concentrations in the fuels used in your country (coal, oil, gas, biomass). Concentrations may vary considerably; see examples in the Toolkit Reference Report in the sections noted in the source sub-category table above. Representative national data for this input must be obtained from power plants, oil and gas companies, etc., and documented carefully in your inventory report.

- In Inventory Level 1, the calculations are based on a general mix of coal types relevant for developing countries (see Appendix 1). Should you wish to make the calculations based on the specific coal mix used in your country, this can be done using the Inventory Level 2 calculation spreadsheet for this sector, using local well documented factors, or with default factors by coal type.

- In Inventory Level 1, default output distribution factors are used in the calculations. The actual output distribution in specific facilities may vary depending on mercury retention efficiency. Data on actual output distribution (on a full mercury input-output balance basis) can be used in Inventory Level 2. They must be obtained from the facilities in question and must be documented well in your inventory report.

- For oil and gas extraction, two mercury inputs may be present: Mercury naturally present in trace concentrations in the oil and gas, and in drilling fluids as a result of the mercury-containing mineral Barite which is commonly used. On Inventory Level 1, only the trace concentrations in fuel are included in the inventory.

Before initiating work on additional data collection for inventory refinement, we recommend reading relevant source description sections in the Toolkit Reference Report (see Table 2-1). If you can get the relevant national data from actual mercury sources, you can refine your inventory to Inventory Level 2 as described in Section 10. Details on default input and output distribution factors used on Inventory Level 1 which are differing from Inventory Level 2, are provided in Appendix 1; these details are useful for reference when refining your inventory on Inventory Level 2.

3 Step 3: Domestic production of metals and raw materials

Open the spreadsheet page entitled "Step3 - Metals-RawMat" by clicking on the page label with this title at the bottom of the screen window.

3.1 Mercury release sources

This step covers three groups of activities: 1) Industrial mining and primary processing of metals where the mercury source is trace concentrations in the ore material - also in ore for extraction of other metals than mercury; 2) small scale gold mining with mercury amalgamation, where mercury is added to extract the gold; and 3) industrial production of the large volume materials cement and paper.

The source sub-categories included in this inventory step are shown in the table below along with category references to the relevant Toolkit Reference Report sections, in case you wish to read more about the source sub-categories than described below.

Table 3-1 Source sub-categories covered, with reference to the Toolkit Reference Report sections.

Primary metal production (industrial)	Category reference
Mercury (primary) extraction and initial processing	5.2.1
Production of zinc from concentrates	5.2.3
Production of copper from concentrates	5.2.4
Production of lead from concentrates	5.2.5
Gold extraction by methods other than mercury amalgamation	5.2.6
Alumina production from bauxit (aluminium production)	5.2.7
Primary ferrous metal production (pig iron production)	5.2.9
Gold mining with mercury amalgamation	
Gold extraction with mercury amalgamation - without use of retorts	5.2.2
Gold extraction with mercury amalgamation - with use of retorts	5.2.2
Other high volume materials production with mercury releases	
Cement clinker production	5.3.1
Pulp and paper production	5.3.2

Modern metal extraction

Not only primary mercury extraction, but also extraction and processing of other non-ferrous and ferrous metals may be potent sources of mercury releases. Non-ferrous metal extraction ranks as the third largest emitter of mercury to the atmosphere globally. Ores for extraction of zinc, lead, copper, gold and other metals (mainly sulphide ore) contain trace amounts of mercury. In the process of extracting the desired metal from the ore, processes are used which release this mercury from the rock material. This mercury may evaporate and follow the gaseous streams in the extraction processes (in most cases) and/or follow wet (liquid) process streams, depending on the extraction technology used. Unless the mercury is captured by process steps dedicated to this purpose, major parts of it are likely released to the atmosphere, land and aquatic environments. Mercury retained in process steps for this purpose may be sold

in the form of metallic mercury or the inorganic mercury compound "calomel" (Hg_2Cl_2), for conversion to metal mercury elsewhere, or it may be stored or deposited as solid or sludgy residues, normally on-site. Marketing of recovered by-product mercury from extraction of non-ferrous metals accounts for a substantial part of the current global mercury supply. Besides these output pathways, part of the mercury input follows co-produced sulphuric acid at trace concentrations. Primary production of non-ferrous metals generally includes the following processes: Concentration of the ore to include only metal-rich particles (produced "concentrate"), oxidation (roasting, sintering or wet oxidation) of concentrate, production of the metal (by means of electrochemical or thermal processes), and refining of the metal. Several non-ferrous metals may be co-produced in the same facilities.

Artisanal and small scale gold mining (ASGM) with mercury amalgamation
Artisanal and small scale gold (and sometimes silver) mining with mercury amalgamation gives rise to substantial mercury releases on a global scale. Here, liquid metal mercury is added intentionally because it can dissolve gold present in the ore or concentrate, and the mix ("amalgam") can hereafter be separated from the rock material (called "tailings"), and the mercury can finally be heated off to produce the gold. Today, this ancient method is mainly used by "artisanal" and small-scale miners. When only the concentrate is amalgamated, the mercury consumption and releases are somewhat lower compared to whole ore amalgamation. In some cases so-called retorts are used to recover some of the mercury from the heating process for re-use. This reduces the mercury consumption and releases further. The Toolkit makes a distinction between gold produced with or without retorts.

ASGM is an activity with a lot of variation in methods and techniques. Only ASGM with mercury amalgamation should be counted here, whereas small-scale mining with heavy machinery where mercury is not used may be counted under the sub-category “Gold extraction by methods other than mercury amalgamation.“ Small-scale operations with heavy machinery may process significant amounts of ore material, where trace quantities of mercury naturally present in the ore is released.

Other high-volume materials production with mercury releases
This inventory step also includes the mercury release sub-categories cement clinker production and pulp and paper production.

The raw materials used for the production of cement clinker contains trace concentrations of mercury. The origin of this mercury is mercury naturally present in virgin raw materials and fossil fuels used (lime, coal, oil etc.) and other raw materials and alternative fuels, in which mercury content may be elevated compared to virgin materials, such as solid residues from other sectors; e.g. fly-ashes and gypsum from combustion of coal, and combustible wastes. In some cases, hazardous waste is incinerated (for destruction) in cement kilns and this may also contribute to mercury inputs. The use of waste products as feed materials may increase the total input of mercury to the cement clinker production. The primary output pathways of mercury fed in with raw materials are released to the atmosphere, and through trace mercury levels in the produced cement. Mercury contributions from fossil fuels are deducted in the calculations here, because they are accounted for under the fossil fuel sub-categories.

The original mercury sources in pulp and paper production is the mercury present in trace concentrations in wood, as well as trace concentrations in fuels and chemicals (NaOH, H_2SO_4, Cl_2) used.

Are these source types present in your country?
Start your inventory for these source types by investigating preliminarily, if these source types are present in your country. Start with the background knowledge of yourself and your colleagues, and supplement as needed by contacting relevant ministries, agencies and resource persons in your country. This will also help you identifying the right contacts for later work on the inventory. Remember to ask all, if they know of other contact persons who might have relevance for your inventory for these sectors.

Report your findings in the inventory spreadsheet by filling in column B with "Y" for source types present in your country, "N" for source types which you have proven are not present in the country, and "?" for source types for which you have no indications of their presence or absence. Be confident with entering your immediate findings first and adjust later as you get more information. We recommend that you continue to search for data for source types you are not sure are present in your country, until you have confirmation of its presence or absence. Source types with cells in this column left blank will be indicated in the spreadsheet summaries.

3.2 Data collection

The data types you need for mercury input and release estimation and hints on where to seek them are given in the table below.

Table 3-2 Data collection

Source sub-category	Input data types and units	Possible data sources
Primary metal production (industrial)		
Mercury (primary) extraction and initial processing	Mercury produced, t/y	Primary mercury mines are only operating in a few countries today. For data, contact the mining company or the ministry responsible for mining activities (ministry of mining, industry, natural resources, or other), or resource persons in universities, institutes
Production of zinc from concentrates	Concentrate used, t/y	For data, contact the mining company or the ministry responsible for mining activities (ministry of mining, industry, natural resources, or other), or resource persons in universities, institutes. As a beginning, or if you have no other data, U.S Geological Survey publishes annual mineral yearbooks with information on minerals production for many countries at http://minerals.usgs.gov/minerals/pubs/country/index.html#pubs. In most cases, these reports also mention individual facilities by name and can thus be used to identify such facilities in a point source approach. In cases of co-production of zinc, copper and/or lead from the same concentrate, enter the amount of concentrate

Source sub-category	Input data types and units	Possible data sources
		used annually in the spreadsheet under the metal produced in largest quantities and make a note on this in the inventory report. If different concentrates are used for different metals, enter annual data for each concentrate input. In case you cannot get data for amounts of concentrates used, but you have access to data for total production of raw zinc in the country, you can use the unit conversion sheet now featured in the Inventory Level 1 spreadsheet.
Production of copper from concentrates	Concentrate used, t/y	See advice above
Production of lead from concentrates	Concentrate used, t/y	See advice above; also on data conversion.
Gold extraction by methods other than mercury amalgamation	Gold ore used, t/y	See advice above; also on data conversion. Remember to count gold produced by small-scale cyanidation and traditional panning, that has been confirmed to not use mercury amalgamation, in this sub-category.
Alumina production from bauxit (aluminium production)	Bauxit processed, t/y	For data, contact the mining company or the ministry responsible for mining activities (ministry of mining, industry, natural resources, or other), or resource persons in universities, institutes. The data conversion mentioned above is also available for raw aluminium production. See also advice on data sources for zinc above.
Primary ferrous metal production (pig iron production)	Pig iron produced, t/y	Production of pig iron (raw iron) may be found in national production statistics held at the ministry of industry or in the national statistics bureau; otherwise contact companies. Only pig iron production is deemed relevant for the mercury inventory in this Inventory Level 1. See also advice on data sources for zinc above.
Gold mining with mercury amalgamation		
Gold extraction with mercury amalgamation - without use of retort	Gold produced, kg/y	Production of gold may be found in national production statistics held at the ministry responsible for mining or in the national statistics bureau. If you have both large scale industrial and small scale gold mining in your country, you need to contact resource persons in ministries, universities or gold trading companies to make a (rough) estimate of the share of the national gold production from artisanal and small scale miners using the amalgamation method. Ask larger gold mining companies, if they also use mercury amalgamation. Studying statistics on import of mercury metal may give you a hint if large mercury amounts used in gold mining with amalgamation are imported (for example, if they are much larger than dental mercury use calculated in this Toolkit). Ask gold mining resource persons if small scale miners generally use retorts (vapour hoods with mercury condensation), or not. Note that in 2012, these are not used widely, so a general use will be rare or a new development. If both of these techniques (retorts/no retorts) are used in parallel in the country, form a rough estimate of the share of gold used with each technique, or simply assume that all gold is produced with no retort. Report your data and assumptions clearly in your inventory report.
Gold extraction with mercury amalgamation - with use of retorts	Gold produced, kg/y	

Source sub-category	Input data types and units	Possible data sources
Other high volume materials production with mercury releases		
Cement clinker production	Cement produced from nationally produced clinker, t/y	Production data may be available in national production statistics, consult the national statistics department or the ministry of industry. Otherwise, contact the company or resource persons in universities, institutes. See also advice on USGS data above. In all cases, make sure to count only cement produced from clinker made in the country (cement final product from imported clinker should not be included in IL1).
Pulp and paper production (with own pulp production)	Biomass used for production, t/y	Contact the companies for information on their biomass consumption (principally wood).

Help for data collection

Note that templates for data collection letters for mining industry and cement/paper and pulp industry are available at UN Environment 's mercury Toolkit homepage https://www.unenvironment.org/explore-topics/chemicals-waste/what-we-do/mercury/mercury-inventory-toolkit.

3.3 Inclusion of mercury controls in the estimation

As described in Section 1.2, it is possible to include the presence of mercury controls in the calculation of mercury release estimates in Inventory Level 1. Simply enter "y" for yes in the column named "Include Hg controls in estimation? (y/n)" for the mercury source sub-category in question, and the mercury controls relevant to this source category appear[9] in the relevant spreadsheet rows. Here, you need to enter the percent of the total national activity rate that is used in facilities with this type of controls. The percentage for the controls option listed with the lowest mercury retention is calculated automatically and cannot be entered. Please make sure that the percentages entered in the spreadsheet do not exceed 100 percent in total.

Should you prefer not to include controls in your calculations you simply answer "n" for no in the column named "Include Hg controls in estimation? (y/n)" for the mercury source sub-category in question. In this case, the standard mercury controls configurations described in Appendix 1 are applied automatically in the calculations.

For the current Step, the mercury controls relevant are listed in Table 3-3. For a more detailed description of the controls, see the relevant sections in the Toolkit Reference Report. To include controls in your calculations, ideally you need to get data for each individual facility on which of these mercury controls they use (if any), and the specific activity rate for the facility (how much do they use or produce of the activity rate

[9] For all sub-categories where background data have been sufficient to include mercury controls in the calculations.

unit in question). Alternatively, sector experts may have knowledge of the use of mercury controls in the sector in question in the country. You can copy the relevant rows in the table below to your letters or emails to the facilities or experts.

Table 3-3 Relevant mercury controls that can be included in this inventory step.

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
Production of zinc from concentrates / Production of copper from concentrates / Production of lead from concentrates	No filters used or coarse, dry PM retention	No filters or coarse, dry PM retention such as electrostatic precipitators (ESP) and cyclones (CYC)
	Wet gas cleaning	Wet gas cleaning of the off-gas from roasting of concentrate
	Wet gas cleaning and acid plant	Wet gas cleaning of the off-gas from roasting of concentrate + removal of acid gasses (normally sold as by-product)
	Wet gas cleaning, acid plant and Hg specific filter	Wet gas cleaning of the off-gas from roasting of concentrate + removal of acid gasses + dedicated mercury removal (acid is normally sold as by-products, mercury or produced mercury compounds like calomel may be sold or deposited on-site or elsewhere)
Gold extraction with mercury amalgamation - from concentrate	No retorts used	
	Use of retorts	Use of retorts or similar devices that prevent the mercury from evaporating when burning the amalgam, and collects it for possible re-use (sometimes after a simple cleaning procedure called "re-activation")
Cement production 1) WITH WASTE USED as fuel (>3% of energy) / Cement production 2) WITH NO/LOW WASTE use as fuel	No filter	
	Simple particle control (ESP / PS / FF)	Simple particle control with electrostatic presipitators (ESP), particle scrubbers (PS) or fabric filters (FF = bag filters)
	Optimized particle control (FF+SNCR / FF+WS / ESP+FGD / optimized FF)	"Optimized" particle control with fabric filters (FF) + selective non-catalytic reduction (SNCR) OR Fabric filters (FF)+ wet scrubbers (WS) OR Electrostatic precipitator (ESP) + flue gas de-sulphurisation (FGD) OR Optimized fabric filters (FF)

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
	Efficient air pollution control (FF+DS / ESP+DS / ESP+WS / ESP+SNCR)	Efficient air pollution control with fabric filters (FF) + dry scrubber (DS) OR Electrostatic precipitator (ESP) + dry scrubber (DS) OR Electrostatic precipitator (ESP) + wet scrubber (WS) OR Electrostatic precipitator (ESP) + selective non-catalytic reduction (SNCR)
	Very efficient Hg pollution control (wet-FGD+ACI / FF+scrubber+SNCR)	Very efficient Hg pollution control with wet flue gas de-sulphurisation (wetFGD) + activated carbon injection (ACI) OR Fabric filter (FF) + scrubber + selective non-catalytic reduction (SNCR)
Pulp and paper production	No filters used	
	PM control with general ESP, or PS	Dust filters such as electrostatic precipitators (ESP), particle scrubbers (PS), or similar

3.4 Key factors influencing mercury releases

On Inventory Level 1, the Toolkit spreadsheet uses medium input and output distribution factors for the calculation of the mercury inputs to a sector and releases to the environment from the same sector (see the introduction for more description). Actual inputs and releases in your country may be above or below the calculated standard estimates. The most important factors which can influence mercury inputs and mercury releases, besides the presence of mercury controls described above, are the following:

Industrial mining

- The mercury concentrations in the ores and concentrates actually used in your country. Concentrations may vary considerably; see examples in the Toolkit Reference Report in the sections noted in the source sub-category table above. For more detailed input data, contact the mining companies, and document the data you use carefully in your inventory report.

- The use of wet extraction processes instead of pyrometallic (heating) processes may have much lower air emissions, yet more of the mercury follows wastes, sludges and waste water discharges. For more detailed input data contact the mining companies.

Artisanal and small scale mining

- Mercury releases from small scale gold mining may vary significantly depending on local conditions and processing techniques. Refining the estimates may require substantial field research work, for advice see the relevant Toolkit Reference Report section (see section number in table 4.1). Retorts recovering some of the mercury and reducing air emissions are assumed used on concentrates only.

  If you cannot find data on gold production, estimates for mercury consumption for gold mining are available for many countries at www.mercurywatch.org. These data can be used in your mercury release quantification on Inventory Level 2.

Cement production

- If waste or chemical waste is combusted/used as fuel in cement kilns, the amount and type of waste may have significant influence on the mercury releases. Dust filters may be used, but generally they do not retain much mercury as the collected dust is often fed back into the process, and mercury, being on gas form at these temperatures, may not be held back effectively. Contact the companies for a dialogue on mercury releases.

Before initiating work on additional data collection for inventory refinement, we recommend reading relevant source description sections in the Toolkit Reference Report (see Table 3-1). If you can get specific data on these issues, you can refine your inventory to Inventory Level 2 as described in Section 10. Details on default input and output distribution factors used on Inventory Level 1, which are differing from Inventory Level 2, are provided in Appendix 1; these details are useful for reference when refining your inventory on Inventory Level 2.

4 Step 4: Domestic production and processing with intentional mercury use

Open the spreadsheet page entitled "Step 4 - Industrial Hg use" by clicking on the page label with this title at the bottom of the screen window ("Hg" is the chemical designation for mercury).

4.1 Mercury release sources

This step covers two groups of activities: 1) Industrial production of chemicals, and 2) industrial production of mercury added products.

The source sub-categories included in this inventory step are shown in the table below along with category references to the relevant Toolkit Reference Report sections, in case you wish to read more about the source sub-categories than described below.

Table 4-1 Source sub-categories covered, with reference to the Toolkit Reference Report sections.

Production of chemicals and polymers	Category reference
Chlor-alkali production with mercury-cells	5.4.1
Vinyl chloride monomer (VCM) production with mercury catalyst	5.4.2
Acetaldehyde production with mercury catalyst	5.4.3
Fire gilding (gold plating) with mercury	5.4.5
Production of products with mercury content	
Hg thermometers (medical, air, lab, industrial etc.)	5.5.1
Electrical switches and relays with mercury	5.5.2
Light sources with mercury (fluorescent, compact, others)	5.5.3
Batteries with mercury	5.5.4
Manometers and gauges with mercury	5.6.2
Biocides and pesticides with mercury	5.5.5
Paints with mercury	5.5.6
Skin lightening creams and soaps with mercury chemicals	5.5.7
Traditional Asian medicines	5.6.4.1

Production of chemicals

Much of the chlorine (Cl_2 gas), caustic soda (NaOH) and potassium hydroxide (KOH) sold today is still produced in chlor-alkali production plants using mercury in an electrolytic process sometimes called the "mercury-cell" process. These large volume base chemicals are however also produced with other techniques (membrane process and diaphragm process), where mercury is not used. The share of national production capacity based on the mercury-cell process varies between countries, and is slowly decreasing seen in a global perspective. In many countries it has been agreed not to base new chlor-alkali facilities on the mercury-cell process, and in some countries/regions conversion/shut-down of mercury-cell facilities are planned or ongoing. Mercury is released to the environment with air emissions, water releases, in solid wastes,

in production equipment and production buildings and to a minor degree in products (such as NaOH).

VCM production with mercury compound catalysts is widespread in a few countries.

Acetaldehyde production with mercury compound catalysts is not common anymore, but may take place in a few countries.

Production of products with mercury added

A large number of traditional products make use of mercury's characteristics in their function. The major products groups in which mercury is added intentionally are thermometers, fluorescent light bulbs, some battery types, some traditional types of electrical switches, and traditional manometers and pressure gauges. The consumption of these products is declining in many countries because of mercury's adverse effects on health and environment, and because electronic equipment for the same purposes but with smart features has gained increasing shares of the market. Many glass thermometers are produced with alcohol liquid instead of mercury. A decline in consumption is not seen in all regions of the world, as the mercury added products are still cheaper, when waste and health expenses are not included. Mercury containing light sources (fluorescent and other discharge lamp types) is an exception, as their sales are rising due to their lower energy demand and the lack of sufficiently matured mercury-free low-energy alternatives. In some countries mercury containing latex paints (where mercury is a preservative), biocides/pesticides and skin lightening creams and soaps are also manufactured and used. Based on previous experience in USA and Europe, these mercury applications may give rise to substantial mercury consumption and releases.

The manufacture of mercury added products may give rise to mercury releases to air, waste water and production wastes. Publicly available mercury release data on such manufacture are scarce, and the estimation calculations here are based on a limited data base.

Are these source types present in your country?

Start your inventory for these source types by investigating preliminarily, if these source types are present in your country. Start with the background knowledge of yourself and your colleagues, and supplement as needed by contacting relevant ministries, agencies and resource persons in your country. This will also help you identifying the right contacts for later work on the inventory. Remember to ask all, if they know of other contact persons who might have relevance for your inventory for these sectors.

Report your findings in the inventory spreadsheet by filling in column B with "Y" for source types present in your country, "N" for source types which you have proven are not present in the country, and "?" for source types for which you have no indications of their presence or absence. Be confident with entering your immediate findings first and adjust later as you get more information. We recommend that you continue to search for data for source types you are not sure are present in your country, until you have confirmation of its presence or absence. Source types with cells in this column left blank will be indicated in the spreadsheet summaries.

4.2 Data collection

The data types you need for mercury input and release estimation and hints on where to seek them are given in the table below.

Table 4-2 Data collection

Source sub-category	Input data types and units	Possible data sources
Production of chemicals and polymers		
Chlor-alkali production with mercury-cells	Cl_2 produced, t/y	Production of chlorine (Cl_2) may be found in national production statistics held at the ministry of industry or in the national statistics bureau; otherwise contact companies. The share of chlorine production capacity based on mercury cells compared to total production capacity in a country is often known by industry associations, companies and resource persons. Production capacity can provide a reasonable estimate of the share of production produced with mercury cells. If not available in overview, production companies must be contacted individually to obtain production numbers based on mercury cells, and if possible mercury input and release data. Note that some companies producing rubber, PVC, vitamins and other chemicals may have their own internal chlor-alkali production plants for production of feedstock which is not sold externally. In such cases, the companies must be contacted to get data on their chlorine production and if possible their mercury input and release data. The Global Mercury Partnership group on chlor-alkali includes an overview of mercury-cell facilities globally, as well as other more recent documents that may inform the issue: https://www.unep.org/globalmercurypartnership/resources/report/global-estimate-global-mercury-cell-chlorine-capacity-global-inventory-updated.
VCM production with mercury catalyst	VCM produced, t/y	Production of VCM (vinyl chloride monomer) may be found in national production statistics held at the ministry of industry or in the national statistics bureau; otherwise contact companies. It may be needed to contact the companies to establish if mercury catalysts are used, or of the VCM is produced from other processes which do not use mercury. Note that some companies producing raw PVC plastic compound have their own internal VCM production plants for production of feedstock which is not sold externally. In such cases, the companies must be contacted to get data on their VCM production and if possible their mercury input and release data.
Acetaldehyde production with mercury catalyst	Acetaldehyde produced, t/y	See advice for VCM, the situation is similar for acetaldehyde.
Fire gilding (gold plating) with mercury	Products gilded with mercury produced, t/y	Fire gilding may take place in informal production settings and usually data collection at producers and importers is expected to be needed. Make sure to only count products produced with mercury, as alternative methods are available and may be more frequently used.

Source sub-category	Input data types and units	Possible data sources
Production of products with mercury content		
Hg thermometers (medical, air, lab, industrial etc.)	Mercury used for production, kg/y	Contact identified companies for production data and mercury input and release data.
Electrical switches and relays with mercury	Mercury used for production, kg/y	Contact identified companies for production data and mercury input and release data.
Light sources with mercury (fluorescent, compact, others)	Mercury used for production, kg/y	Contact identified companies for production data and mercury input and release data.
Batteries with mercury	Mercury used for production, kg/y	Contact identified companies for production data and mercury input and release data.
Manometers and gauges with mercury	Mercury used for production, kg/y	Contact identified companies for production data and mercury input and release data.
Biocides and pesticides with mercury	Mercury used for production, kg/y	Contact identified companies for production data and mercury input and release data.
Paints with mercury	Mercury used for production, kg/y	Contact identified companies for production data and mercury input and release data.
Skin lightening creams and soaps with mercury chemicals	Mercury used for production, kg/y	See advice above; in case this sector is largely informal and perhaps not reported in statistics, etc., you may try to form a rough estimate of the likely annual consumption of such creams and soaps by visiting and interviewing a representative number of shops selling this type of products. Note that only some skin-lightening creams and soaps contain mercury compounds. The estimated national sales in metric tons may be multiplied with a medium mercury content of 30 kg Hg/t skin lightening cream or soap.
Mercury use in traditional Asian medicines	Medicines produced, t/y (incl. those without Hg)	Contact producers and importers of traditional Chinese and Tibetan medicines, Indian Ayurvedic and Siddha medicines, and Unani medicine practiced in Middle East and South Asian countries. Make sure to include ALL medicines of these types, no matter if they a known to contain mercury or not (as a special case, this is the basis for the Toolkit calculations for these product types).

4.3 Key factors influencing mercury releases

On Inventory Level 1, the Toolkit spreadsheet uses medium input and output distribution factors for the calculation of the mercury inputs to a sector and releases to the environment from the same sector (see the introduction for more description). Actual inputs and releases in your country may be above or below the calculated standard estimates. The most important factors which can influence mercury inputs and mercury releases are the following:

- The production set-up and mercury management may vary considerably between facilities. For more detailed mercury input and release data contact the production companies. On Inventory Level 1, default output distribution factors based on limited data available for thermometers and batteries have been applied for all other product manufacturing facilities.

- Note that many chlor-alkali production facilities have difficulties in accounting for the fate of all mercury purchased. This is likely because other, not quantified losses take place, including fugitive emissions to air and absorption in production equipment and building materials at the facility. Ask therefore also for data on difference to balance with purchased mercury over the last few years. On Inventory Level 1, it is assumed that mercury unaccounted for is released (Inventory Level 2 output scenario "Hg unaccounted for is presented as releases" is used).

Before initiating work on additional data collection for inventory refinement, we recommend reading relevant source description sections in the Toolkit Reference Report (see Table 4-1). If you can get specific data on these issues, you can refine your inventory to Inventory Level 2 as described in Section 10. Details on default input and output distribution factors used on Inventory Level 1 which are differing from Inventory Level 2, are provided in Appendix 1; these details are useful for reference when refining your inventory on Inventory Level 2.

5 Step 5: Waste treatment and recycling

Open the spreadsheet page entitled "Step 5 - Waste treatment + recycling" by clicking on the page label with this title at the bottom of the screen window.

5.1 Mercury release sources

This step includes all types of waste treatment, landfilling, incineration, dumping, open burning and recycling activities.

The source sub-categories included in this inventory step are shown in the table below along with category references to the relevant Toolkit Reference Report sections, in case you wish to read more about the source sub-categories than described below.

Table 5-1 Source sub-categories covered with reference to the Toolkit Reference Report sections.

Recycling of metals	Category references
Production of recycled mercury ("secondary production")	5.7.1
Production of recycled ferrous metals (iron and steel)	5.7.2
Waste incineration	
Incineration of municipal/general waste	5.8.1
Incineration of hazardous waste	5.8.2
Incineration of medical waste	5.8.3
Sewage sludge incineration	5.8.4
Open waste burning (on landfills and informally)	5.8.5
Waste deposition/landfilling	
Controlled landfills/deposits	5.9.1
Informal dumping of general waste	5.9.4
Waste water treatment	5.9.5

General waste management set-up in the country

First, please answer the spreadsheets initial questions in Step 5 on general waste management set-up:

Please answer questions about the current waste treatment set-up in your country:	**Y/N**		**Y/N**	
a) Is more than 2/3 (two thirds = 67%) of the general waste collected and deposited on lined landfills or incinerated in closed incinerators?		**b)** Is more than 1/3 (one third = 33%) of the mercury-added products waste safely collected and treated separately?		**These two questions must be answered for product-related mercury releases to be calculated**

These answers are used in the automatic calculation of releases in the spreadsheet, so it is needed for the spreadsheet to work properly. Your best estimate of the situation is sufficient initially. If, during the further data collection on waste, you get indications that the actual situation may differ from what you initially thought, please change your answers accordingly. Once you have collected national data on general waste management, you can check the answer to question a) as follows and correct the answer in the spreadsheet if necessary:

Answer yes (y) to question a), if cells*:	(C13+C26) > 0.67*(C13+C23+C26+C27)
Answer no (n) to question a), if cells*:	(C13+C26) <= 0.67*(C13+C23+C26+C27)

* The C13, C23, etc. refers to cell names in the spreadsheet page "Step5-Waste treatment + recycling".

The answer to question b) you need to verify through detailed investigations of collection rates and treatment procedures for mercury-added products. In many countries worldwide, the answer is most likely "no", because even though separate collection may take place, collection rates over 33 percent are not so common.

Are these source types present in your country?

Thereafter, start your inventory for these source types by investigating preliminarily if the mentioned waste handling types and recycling activities are present in your country. Start with the background knowledge of yourself and your colleagues and supplement as needed by contacting relevant ministries, agencies and resource persons in your country. This will also help you identifying the right contacts for later work on the inventory. Remember to ask all if they know of other contact persons who might have relevance for your inventory for these sectors.

Report your findings in the inventory spreadsheet by filling in column B with "Y" for source types present in your country, "N" for source types which you have proven are not present in the country, and "?" for source types for which you have no indications of their presence or absence. Be confident with entering your immediate findings first and adjust later as you get more information. We recommend that you continue to search for data for source types you are not sure are present in your country, until you have confirmation of its presence or absence. Source types with cells in this column left blank will be indicated in the spreadsheet summaries.

5.2 Data collection

The data types you need for mercury input and release estimation and hints on where to seek them are given in the table below.

Table 5-2 Data collection

Source sub-category	Input data types and units	Possible data sources
Production of recycled mercury ("secondary production")	Mercury produced, kg/y	This may be reflected in some national production statistics, but generally it is needed to contact the recycling companies or consult resource persons with insight in the sector.
Production of recycled ferrous metals (iron and steel)	Number of vehicles recycled/y	See advice above;
Waste incineration		
Incineration of municipal/general waste	Waste incinerated, t/y	For these data, contact the ministry responsible for waste management. Some waste data may be available from existing studies, for example from national inventories for dioxins and furans (made with the UN Environment Toolkit), or from waste management planning activities. If aggregated national data does not exist, municipalities' departments for waste management or the waste management companies may have these data.
Incineration of hazardous waste	Waste incinerated, t/y	Incineration plants dedicated for hazardous waste are few, and may be identified through the ministry responsible for waste management. If they do not have data, identify and contact the waste management facilities. Hazardous waste may be incinerated along with general waste or in cement kilns (for destruction of hazardous properties). In such cases, contact facilities for data; see also cement sub-category in Section 3.
Incineration of medical waste	Waste incinerated, t/y	Two overall principles may be applied for controlled incineration of medical waste: Large scale facilities similar to hazardous waste incineration (see above), or small low-tech incineration chambers (focusing on sanitisation of the waste only) placed at individual hospitals. In the last case, the number of incinerators may be large, and data must be collected from the hospitals. Estimates can be formed by getting waste data and bed numbers from selected hospitals and extrapolate via the total number of hospital beds in the country (or similar). Report such assumptions and calculations in your inventory report.
Sewage sludge incineration	Waste incinerated, t/y	In some countries, sewage sludge is incinerated in dedicated facilities. The number of such facilities is likely low, and the most effective may be to contact the facilities individually. The ministry (or municipal departments) responsible for waste water treatment may be helpful in identifying relevant facilities.

Source sub-category	Input data types and units	Possible data sources
Open waste burning (on landfills and informally)	Waste burned, t/y	Open waste burning will generally be hard to quantify precisely, but as the mercury releases directly to the environment may be substantial, it is important to try and make a rough estimate for mercury release quantification. Some national waste data may be available from existing studies, for example from national inventories for dioxins and furans (made with the UN Environment Toolkit), from climate inventories, or from waste management planning activities. Otherwise try (maybe with help from resource persons) to estimate expected waste amounts generated per person in the country and compare to quantified waste amounts landfilled or incinerated under controlled conditions, and consider remaining waste amounts dumped and burned informally. Note that open burning of waste in municipal landfills is practised in many countries. This can be hard to estimate, but attempts can be made to interview personnel on selected major landfills on the applied practices and extrapolate to the national situation. Report your assumptions and calculations. If no national data can be found, national waste amounts burned, dumped and landfilled have been estimated for all or most countries by Wiedinmeyr et al (2014)[10].
Waste deposition/landfilling		
Controlled landfills/deposits	Waste landfilled, t/y	See incineration of municipal/general waste above.
Informal dumping of general waste	Waste dumped, t/y	See open fire waste burning above.
Waste water treatment	Waste water, m^3/y	For these data, contact the ministry responsible for waste water management. Some waste data may be available from existing studies on waste water management planning activities. If aggregated national data does not exist, municipalities' departments for waste water management may have these data. You may use data from major city facilities and extrapolate to the whole population. Report such assumptions and calculations.

5.3 Inclusion of mercury controls in the estimation

As described in Section 1.2, it is possible to include the presence of mercury controls in the calculation of mercury release estimates in Inventory Level 1. Simply enter "y" for yes in the column named "Include Hg controls in estimation? (y/n)" for the mercury source sub-category in question, and the mercury controls relevant to this source category appear[11] in the relevant spreadsheet rows. Here, you need to enter the percent of the total national activity rate that is used in facilities with this type of controls. The percentage for the controls option listed with the lowest mercury retention

[10] Wiedinmeyr C, Yokelson RJ, Gullet BK (2014): Global emissions of trace gases, particulate matter, and hazardous air pollutants from open burning of domestic waste. Environ. Sci. Technol., 2014, 48 (16), pp 9523–9530. Link: http://pubs.acs.org/doi/abs/10.1021/es502250z

[11] For all sub-categories where background data have been sufficient to include mercury controls in the calculations.

is calculated automatically and cannot be entered. Please make sure that the percentages entered in the spreadsheet do not exceed 100 percent in total.

Should you prefer not to include controls in your calculations you simply answer "n" for no in the column named "Include Hg controls in estimation? (y/n)" for the mercury source sub-category in question. In this case, the standard mercury controls configurations described in Appendix 1 are applied automatically in the calculations.

For the current Step, the mercury controls relevant are listed in Table 5-3. For a more detailed description of the controls, see the relevant sections in the Toolkit Reference Report. To include controls in your calculations, ideally you need to get data for each individual facility on which of these mercury controls they use (if any), and the specific activity rate for the facility (how much do they use or produce of the activity rate unit in question). Alternatively, sector experts may have knowledge of the use of mercury controls in the sector in question in the country. You can copy the relevant rows in the table below to your letters or emails to the facilities or experts.

Table 5-3 Relevant mercury controls that can be included in this inventory step.

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
Incineration of municipal/general waste /	No emission reduction devices	
Incineration of hazardous waste /	PM reduction; simple ESP, or similar	Particle filters such as simple electrostatic precipitators (ESP) or others
Incineration and open burning of medical waste	Acid gas control + high efficiency FF or ESP PM retention	Acid gas filters (usually wet, dry or semi-dry scrubbers) + high efficiency fabric filters (FF; also called bag filters) or electrostatic precipitators (ESP)
	Mercury specific absorbents + FF	Activated carbon injection (or fixed beds) + fabric filters (FF)
Waste water system/treatment	No treatment	
	Mechanical treatment only	Mechanical treatment (filtering of solid materials) only

	Mechanical and biological treatment; no land application of sludge	Mechanical treatment (filtering of solid materials) + biological treatment (reduction of organic substances with biological digestion in the waste water)
	Mechanical and biological treatment; with >40% of sludge used for land application	Mechanical treatment (filtering of solid materials) + biological treatment (reduction of organic substances with biological digestion in the waste water), where a substantial part (above 40%) of the waste water sludge is applied (as fertiliser) on land.

5.4 Key factors influencing mercury releases

On Inventory Level 1, the Toolkit spreadsheet uses medium input and output distribution factors for the calculation of the mercury inputs to a sector and releases to the environment from the same sector (see the introduction for more description). Actual inputs and releases in your country may be above or below the calculated standard estimates. The most important factors that can influence mercury inputs and mercury releases, besides the presence of mercury controls described above, are the following:

- Mercury concentrations in waste. This can be found in representative waste samples by sorting surveys and chemical analyses. It should be noted that it is difficult to get representative samples because waste composition generally vary so much (therefore much waste from various locations must be sampled). In the Toolkit, releases from the waste handling categories are based on examples of mercury contents in waste in other countries for which such data have been available. This may differ from actual waste in your country due to differences in the consumption pattern of mercury added products and materials with trace concentrations of mercury such as paper, plastics, and other large volume wastes. For waste and waste water, the default input factors were derived from data from developed countries only. You can make a simple test based on your Inventory Level 1 results, that will indicate if the default factors may over-estimate the mercury releases from waste and waste water treatment in your country. See Appendix 4 for more details.

Before initiating work on additional data collection for inventory refinement, we recommend reading relevant source description sections in the Toolkit Reference Report (see Table 5-1). If you can get the relevant national data from actual mercury sources, you can refine your inventory to Inventory Level 2 as described in Section 10. Details on default input and output distribution factors used on Inventory Level 1 which are differing from Inventory Level 2, are provided in Appendix 1; these details are useful for reference when refining your inventory on Inventory Level 2.

6 Step 6: General consumption of mercury in products, as metal mercury and as mercury containing substances

6.1 Mercury release sources

This step includes national consumption of a vide variety of consumer products (such as thermometers and fluorescent light bulbs), and product where mercury must be added for its function (such as dental amalgam and manometers). The included products may be produced domestically, but may also be imported, and therefore needs to be quantified separately. National annual consumption is defined as:

Consumption = production + import - export (in the same year)

The source sub-categories included in this inventory step are shown in Table 6-1 along with category references to the relevant Toolkit Reference Report sections, in case you wish to read more about the source sub-categories than described below.

Releases from mercury added products are significant in many countries and are thus important to quantify. Generally, most of the releases from products occur in the disposal phase of the products' life-cycle. Many of these products are used in large numbers by private consumers. They are therefore spread all over the country and may break during use, end up in waste, or simply be thrown away. Management solutions such as product marketing restrictions, separate waste collection of mercury added products and/or providing alternatives may be important to reduce these releases. As a basis for decision-making, releases from the disposal phase of mercury-added products are calculated individually in the Toolkit to indicate the relative importance of the various product categories. To avoid double counting with mercury release estimates for waste treatment, the releases from products are subtracted in the sums of total releases.

Note that for the spreadsheet calculations to work properly for several of these products, the number of inhabitants needs to be entered in Step 1, and the question on general waste management set-up in the country in Step 5 needs to be answered with "y" (for yes) or "n" as described under Step5.

For details on product types, see Table 6-2 further below.

Table 6-1 Source sub-categories covered with reference to the Toolkit Reference Report sections.

Use and disposal of products with mercury content	Category references
Dental amalgam fillings ("silver" fillings)	5.6.1
Preparations of fillings at dentist clinics	
Use - from fillings already in the mouth	
Disposal (lost and extracted teeth)	
Thermometers:	5.5.1
Medical Hg thermometers	
Other glass Hg thermometers (air, laboratory, dairy, etc.)	
Engine control Hg thermometers and other large industrial/speciality Hg thermometers	
Electrical switches and relays with mercury	5.5.2
Light sources with mercury:	5.5.3
Fluorescent tubes (double end)	
Compact fluorescent lamp (CFL single end)	
Other Hg containing light sources	
Batteries with mercury:	5.5.4
Mercury oxide (button cells and other sizes); also called mercury-zinc cells	
Other button cells (zinc-air, alkaline button cells, silver-oxide)	
Other batteries with mercury (plain cylindrical alkaline, permanganate, etc.)	
Polyurethane (PU, PUR) produced with mercury catalyst	5.5.5.
Paints with mercury preservatives	5.5.7
Skin lightening creams and soaps with mercury chemicals	5.5.9
Medical blood pressure gauges (mercury sphygmomanometers)	5.6.2
Other manometers and gauges with mercury	5.6.2
Laboratory chemicals	5.6.3
Other laboratory and medical equipment with mercury (porosimetry, pycnometry, hanging drop electrodes = polarimetry, etc.)	5.6.3, 5.6.5
Mercury use in traditional Asian medicines	5.6.4.1

Are these source types present in your country?
Start your inventory for these source types by investigating preliminarily if these source types are present in your country. Start with the background knowledge of yourself and your colleagues, and supplement as needed by contacting relevant ministries, agencies and resource persons in your country. This will also help you identifying the right contacts for later work on the inventory. Remember to ask all, if they know of other contact persons who might have relevance for your inventory for these sectors.

Report your findings in the inventory spreadsheet by filling in column B with "Y" for source types present in your country, "N" for source types which you have proven are not present in the country, and "?" for source types for which you have no indications of their presence or absence. Be confident with entering your immediate findings first and adjust later as you get more information. We recommend that you continue to search for data for source types you are not sure are present in your country, until you have confirmation of its presence or absence. Source types with cells in this column left blank will be indicated in the spreadsheet summaries.

6.2 Data collection

The data types you need for mercury input and release estimation and hints on where to seek them are given in the table below.

Table 6-2 Data collection

Source sub-category	Input data types and units	Possible data sources
Use and disposal of products with mercury content		
Dental amalgam fillings ("silver" fillings)	Number of inhabitants	No need to enter data in this step; calculations are based on population and density of dental personnel from step 1. Amalgam filling usage is in the decline in some countries, partly due to rising awareness of mercury adverse environmental effects, partly because white filling materials are considered cosmetically preferable in some countries and customer segments. Amalgam is however still generally less expensive than most alternatives, though prices of alternatives are falling, and some dentist prefer amalgam; especially for complex fillings.
Preparations of fillings at dentist clinics		
Use - from fillings already in the mouth		
Disposal (lost and extracted teeth)		
Thermometers:		

Source sub-category	Input data types and units	Possible data sources
Medical Hg thermometers	Items sold/y	Consumption (or data for production, import and export) of glass thermometers with mercury may be found in the national statistics bureau, or at the ministry of commerce. Make sure to use only numbers for medical glass thermometers, as also electronic fever thermometers exist. If there is no distinction in the statistics, consult producers, importers or resource persons and try to estimate a rough distribution. If these sources do not have data, identify and ask producers and importers of thermometers of their estimate for the total national consumption. Otherwise contact selected hospitals to get information on their annual purchase of medical glass thermometers and number of beds and extrapolate to national level via total number of beds in country. Add expert estimate of privately owned thermometers, for example as related to the supply to hospitals (importers of producers may have the knowledge to make an estimate). Data on import and export (but not production) may be available for your country in the UN Comtrade database available at http://comtrade.un.org/db/default.aspx (see Appendix 2).
Other glass Hg thermometers (air, laboratory, dairy, etc.)	Items sold/y	See above; this group of thermometers normally contain several times more mercury per unit (2-40 g/piece) than medical thermometers, but may be less in number supplied annually.
Engine control Hg thermometers and other large industrial/speciality Hg thermometers	Items sold/y	These are specialty thermometers which are generally sold in lower numbers than glass thermometers, but can contain up to 200 g mercury/unit. They are used for ship engine control among others. For data, contact identified producers or users (for example shipyards).
Electrical switches and relays with mercury	Number of inhabitants	No need to enter data; is based on population and electrification data from step 1.
Light sources with mercury:		
Fluorescent tubes (double end)	Items sold/y	Consumption (or data for production, import and export) of these light sources with mercury may be found in the national statistics bureau, or at the ministry of commerce. Otherwise identify and contact producers or importers and for their estimate for the total national consumption. Data on import and export (but not production) may be available for your country in the UN Comtrade database available at http://comtrade.un.org/db/default.aspx (see Appendix 2).
Compact fluorescent lamp (CFL single end)	Items sold/y	
Other Hg containing light sources (see guideline)	Items sold/y	See above. This group contains the following other types of mercury containing light sources which generally contain higher amounts of mercury: High pressure mercury vapour lamps (road and outdoor lighting, etc.); high-pressure sodium lamps (road and outdoor lighting, etc.); UV light for sun-tanning; and metal halide lamps. You only need to insert the total consumption of all these types.
Batteries with mercury:		

Source sub-category	Input data types and units	Possible data sources
Mercury oxide (button cells and other sizes); also called mercury-zinc cells	Batteries sold/y	Mainly used for certain specialised purposes; very high mercury concentrations, but sold in lower numbers; for details see Toolkit Reference Report. Consumption (or data for production, import and export) of these light sources with mercury may be found in the national statistics bureau, or at the ministry of commerce. Otherwise contact identified producers or importers and for their estimate for the total national consumption.
Other button cells (zinc-air, alkaline button cells, silver-oxide)	Batteries sold/y	For consumption data see above. Covers all other button size cells than mercury oxide button cells. Button cells generally contain mercury to reduce risk of breakage. Data on import and export (but not production) may be available for your country in the UN Comtrade database available at http://comtrade.un.org/db/default.aspx (see Appendix 2).
Other batteries with mercury (plain cylindrical alkaline, permanganate, etc., see guideline)	Batteries sold/y	For consumption data see above. These plain type batteries are sold in the largest quantities. Global brands generally do not anymore contain mercury, but some regional or national brands do contain mercury adding up to potentially large amounts due to the high numbers sold. To distinguish which parts of the national sales of these plain battery types contain mercury, you need to contact importers and producers and ask them what share of the battery supply contains mercury. Data on import and export (but not production) may be available for your country in the UN Comtrade database available at http://comtrade.un.org/db/default.aspx (see Appendix 2).
Polyurethane (PU, PUR) produced with mercury catalyst	Number of inhabitants	No need to enter data; is based on population and electrification data from step 1.
Paints with mercury preservatives	Paint sold, t/y	Contact identified paint producers and importers and ask them, which nationally marketed paint types may contain mercury (to prolong shelf life of the paint or prevent microbial growth on the painted surface), and what amounts such paint types are sold in annually.
Skin lightening creams and soaps with mercury chemicals	Cream or soap sold, t/y	Contact identified producers and importers and ask them, which nationally marketed cosmetic types may contain mercury, and what amounts such product types are sold in annually. If this is not possible, make rough estimates of potential amounts based on surveys in a number of shops and extrapolation to national conditions. Report your assumptions and calculations.
Medical blood pressure gauges (mercury sphygmomanometers)	Items sold/y	Consumption (or data for production, import and export) of medical blood pressure gauges may be found in the national statistics bureau, or at the ministry of commerce. Try to distinguish from supply of electronic blood pressure gauges. Otherwise, it may be possible to get data from importers, or from a representative number of hospitals, medical clinics and medical doctors and extrapolate to estimated national totals (via number of beds and number of doctors, respectively).
Other manometers and gauges with mercury	Number of inhabitants	No need to enter data; is based on population and electrification data from step 1.
Laboratory chemicals	Number of inhabitants	No need to enter data; is based on population and electrification data from step 1.
Other laboratory and medical equipment with mercury	Number of inhabitants	No need to enter data; is based on population and electrification data from step 1.

Source sub-category	Input data types and units	Possible data sources
Mercury use in traditional Asian medicines	Medicines sold, t/y	Contact producers and importers of traditional Chinese and Tibetan medicines, Indian Ayurvedic and Siddha medicines, and Unani medicine practiced in Middle East and South Asian countries. Make sure to include ALL medicines of these types, no matter if they a known to contain mercury or not (as a special case, this is the basis for the Toolkit calculations for these product types).
Fire gilding (gold plating) with mercury	Products gilded with mercury sold, t/y	Fire gilding may take place in informal production settings and usually data collection at producers and importers is expected to be needed. Make sure to only count products produced with mercury, as alternative methods are available and may be more frequently used in some countries.

Unit conversion
For medical Hg thermometers, fluorescent tubes (double end) and compact fluorescent lamp (CFL single end) you can use the new unit conversion sheet now included in the Inventory Level 1 spreadsheet to convert consumption numbers from statistics given in weight (kg/year) to the unit "items sold" needed in the mercury quantification calculations. For other product types, you need to search for data conversion factors on the Internet, or at relevant companies or institutions.

6.3 Key factors influencing mercury releases

On Inventory Level 1, the Toolkit spreadsheet uses medium input and output distribution factors for the calculation of the mercury inputs to a sector and releases to the environment from the same sector (see the introduction for more description). Actual inputs and releases in your country may be above or below the calculated standard estimates. The most important factors which can influence mercury inputs and mercury releases are the following:

- Mercury amounts per unit (piece) of product. These are quite well established for most of these product types, the main challenge is therefore to collect good data on the national supply of each product type. This may be resource intensive, but with some research it is should be possible to establish usable consumption estimates. The contact to data suppliers is also a way of raising awareness of the mercury issue, and as such has dual purposes. For additional advice on data collection, see Section 4.4 of the Toolkit Reference Report.

- Calculated results for releases to "general waste" and "land" for most of the product groups are dependent on the answer in Step 5 to the question “More than 2/3 of the waste is collected and treated under public control?“ (see Step 5). On Inventory Level 1, two fixed scenarios for informal waste treatment are applied, see appendix 1. The distribution of waste between informal and publicly controlled waste disposal/treatment in the country will influence the mercury output distribution from these products.

- In some countries, separate collection systems are established in which mercury containing waste is collected and treated as a separate waste stream which may

be deposited on special, safe deposits, or from which mercury is recycled. This may include products such as thermometers, batteries, and light sources, among others. Inventory Level 1 does not reflect such systems by default. To reflect them, additional data must be collected as described in Inventory Level 2.

- For dental amalgam, a relatively large mercury release source, the actual national consumption varies depending on dental service level and the prevalence of the mercury-free alternatives. In Inventory Level 1, a medium estimate based on examples from western countries is used. A closer study of the use of amalgam in the dental sector will cast light on these issues; for example by contacting dentist associations, dentist schools, relevant ministries, or if this does not produce results, via contact to a representative number of dentist and extrapolation to the national situation. Also, the use of high efficiency amalgam separators in the dental clinics' waste water system may retain much released mercury in wastes, which is otherwise released to water. On Inventory Level 1, it is assumed that only the less efficient dental chair filters/strainers are used in most clinics.

- Also for the other product types quantified from national population numbers, the default factors are based on data from western countries and the actual national consumption may deviate from this. Refining these estimates however require quite resource-demanding investigations.

Before initiating work on additional data collection for inventory refinement, we recommend reading relevant source description sections in the Toolkit Reference Report (see Table 6-1). If you can get specific data on these issues, you can refine your inventory to Inventory Level 2 as described in Section 10. Details on default input and output distribution factors used on Inventory Level 1 which are differing from Inventory Level 2, are provided in Appendix 1; these details are useful for reference when refining your inventory on Inventory Level 2.

7 Step 7: Crematoria and cemeteries

7.1 Mercury release sources

This step includes mercury releases from the cremation and burial of human corpses. The main original mercury source is dental amalgam fillings, and mercury is present as fillings in remaining teeth and also in the body tissue at minor concentrations. At cremation, the mercury is released with the flue gas. At burial the mercury is released to the cemetery soil or immediate surroundings. In western countries crematoria are mainly larger central facilities. In some western countries, release reduction devices for mercury retention have recently been applied to reduce releases to the atmosphere, and crematoria may be among the largest mercury sources to the atmosphere nationally. In many countries cremation takes place in a large number of local facilities according to religious traditions, often in open air or with limited confinement of the cremation process. Some countries may use one of the process types almost solely, while other countries have a mix of cremations and burials, depending on religious faiths present and other traditions and trends.

The source sub-categories included in this inventory step are shown in the table below along with category references to the relevant Toolkit Reference Report sections, in case you wish to read more about the source sub-categories than described below.

Table 7-1 Source sub-categories covered with reference to the Toolkit Reference Report sections.

	Category references
Crematoria	5.10.1
Cemeteries	5.10.2

Are these source types present in your country?

Start your inventory for these source types by investigating preliminarily, if these source types are present in your country. Start with the background knowledge of yourself and your colleagues, and supplement as needed by contacting relevant ministries, agencies and resource persons in your country. This will also help you identifying the right contacts for later work on the inventory. Remember to ask all, if they know of other contact persons who might have relevance for your inventory for these sectors.

Report your findings in the inventory spreadsheet by filling in column B with "Y" for source types present in your country, "N" for source types which you have proven are not present in the country, and "?" for source types for which you have no indications of their presence or absence. Be confident with entering your immediate findings first and adjust later as you get more information. We recommend that you continue to search for data for source types you are not sure are present in your country, until you have confirmation of its presence or absence. Source types with cells in this column left blank will be indicated in the spreadsheet summaries.

7.2 Data collection

The data types you need for mercury input and release estimation and hints on where to seek them are given in the table below.

Table 7-2 Data collection

Source sub-category	Input data types and units	Possible data sources
Crematoria	Corpses cremated/y	Data on annual mortality are usually available in national population statistics, otherwise see the UN Statistics Divisions homepage http://unstats.un.org/unsd/demographic/products/dyb/dyb2007.htm. In countries using both cremation and burial, statistics may be available on the annual split between the two processes; if not try to form an estimate of the distribution via overviews of religious faiths in the country or via contact to resource persons in relevant ministries, or via offices of heads of religious societies predominant in the country.
Cemeteries	Corpses buried/y	

7.3 Key factors influencing mercury releases

On Inventory Level 1, the Toolkit spreadsheet uses medium input and output distribution factors for the calculation of the mercury inputs to a sector and releases to the environment from the same sector (see the introduction for more description). Actual inputs and releases in your country may be above or below the calculated standard estimates. The most important factors which can influence mercury inputs and mercury releases are the following:

- The average number of amalgam fillings present in people at their death. This may vary considerably and is depending on general dental service level and prevalence of amalgam fillings versus mercury-free alternatives. A closer study of the use of dental amalgam will cast light on these issues (see also Step 6). On Inventory Level 1, a medium estimate based on examples from western countries is used.

- The presence of mercury specific release reduction devices on crematoria. For data, contact responsible ministries, municipal offices or representative crematoria. In Inventory Level 1, no release reduction devices are assumed.

Before initiating work on additional data collection for inventory refinement, we recommend reading relevant source description sections in the Toolkit Reference Report (see Table 7-1). If you can get specific data on these issues, you can refine your inventory to Inventory Level 2 as described in Section 10. Details on default input and output distribution factors used on Inventory Level 1 which are differing from Inventory Level 2, are provided in Appendix 1; these details are useful for reference when refining your inventory on Inventory Level 2.

8 Step 8: Miscellaneous mercury sources not quantified on Inventory Level 1

The list in Table 8-1 shows additional mercury release source types, which are not quantified in Inventory Level 1.

Are these source types present in your country?

Consider, on a preliminary basis only, if the mentioned mercury release source types are present in your country. Use your background knowledge and that of your close colleagues. As for other sources, report your findings in the inventory spreadsheet by filling in column B with "Y" for source types present in your country, "N" for source types which you have proven are not present in the country, and "?" for source types for which you have no indications of their presence or absence. It is acceptable that you invest less time in investigating if these source types are present than generally for other, quantifiable sources.

The produced list can be used in prioritisation of any further or future work on the national mercury inventory. For some of these source types, detailed source description is available in the Toolkit Reference Report. For others, limited information may be available, and any contributions to the knowledge base from your country will be valuable for global mercury inventory work.

Table 8-1 Mercury release source types not covered on Inventory Level 1

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

9 Step 9: Reporting your inventory

Use the Toolkit report template

Summaries of the results of your Level 1 Inventory can be seen in six spreadsheet summary pages in the calculation spreadsheet:

1 "Level 1 - ExecSummary" is an aggregated summary prepared for presentation in the executive summary of your inventory report;

2 "Level 1 - Charts" provides standardised charts for mercury inputs and each of the output pathways;

3 "Level 1 - Hg sources identified" it provides an automatically generated list of the mercury (= Hg) source category presence in your country which you have entered in previous inventory steps;

4 "Level 1 - Summary of Hg inputs" provides a summary of all calculated mercury input estimates from products, materials, etc.;

5 "Level 1 - Summary of releases" it provides a full summary of the calculated mercury release estimates, and

6 The last summary, named "Level 1 - Total summary" summarised all results; it is a good place to get an overview of your results during your inventory development.

For your convenience, and for attaining a standardised outline of mercury inventory reports developed with this Toolkit, we recommend using the report template which can be downloaded at the same website as this guideline (see front pages). The template is available in MS Word format, ready for entering your data and information, and in PDF format from which you can copy the outline, in case you do not have MS Word available.

Note that your final inventory spreadsheets comprises part of the documentation and reporting of your mercury inventory. Inventory Level 1 summary sheets are designed to be copied into the report document, and other spreadsheets are designed to be presented in an annex to your report. The report template indicates where to paste the copies of the Inventory Level 1 summary spreadsheet cells and where to place the appendix with all the detailed spreadsheet pages. Besides this, we recommend that the final spreadsheet file in MS Excel format is provided as a separate file along with the report file for reference.

Section 10 on refining your inventor on Inventory Level 2 describes how to incorporate selected Inventory Level 2 results in your report.

Decimal point or comma

The Toolkit spreadsheets will use the decimal point or decimal comma according to your personal computer set-up (country selection). In this guideline and in the Toolkit Reference Report, decimal point is used. Make your choice of decimal separator in

your inventory report, and assure consistency between text and data tables of your report on this aspect.

Keep notes and report your data origin

We recommend that while collecting data, you keep notes describing your contacts and the information they gave for later reference in your work and for background documentation of your reporting. This will also help you in preparing potential future updates of the mercury inventory. Description of your data sources and the data they provided are a part of your reporting. Note contact details, date and year contacted, data provided; see also the report template file.

Managing and reporting data uncertainty, approximations and data gaps

Most data from most sources are actually associated with uncertainty, smaller or larger, even if specific and detailed numbers are provided. Considering and discussing, as relevant, data uncertainty for obtained data in your inventory report is therefore seen as a strength and not as a weakness of the inventory work performed.

In the course of your inventory work, you may likely encounter source categories, where it is difficult to find the exact data types requested. This is a common phenomenon and in such cases, creative thinking in finding other related data types which can be used for an approximation is highly appreciated. Rather than omitting calculation of mercury inputs and releases for such a source category, it is recommended to use the best available approximations. A value calculated and reported with uncertainty is normally a much better help in understanding the mercury situation than a missing value. A basic and important principle is however to report explicitly which data you have used and how you made the approximations.

You may also likely encounter source categories, where it proves impossible to find the data types needed within the time and budget available for the inventory work. This is normal and should be reported explicitly in the inventory report. We recommend reporting it with the text on the mercury source category in question, and besides, major data gaps should be listed in the data gaps section by the end of the report.

Further inspiration on reporting principles is given in the Toolkit Reference Report's Section 4.5 (optional for inventories made on Inventory Level 1).

10 Step 10: Refining your inventory (optional)

As mentioned earlier, the Toolkit suggests two levels of inventory development, a simplified methodology called Inventory Level 1, and a more detailed Inventory Level 2. This guideline primarily describes Inventory Level 1, but this section provides basic guidance for refining your inventory work to Inventory Level 2, should you desire this for selected mercury source categories, or for your inventory as such.

Refining your inventory for selected categories

Besides providing background information, the Toolkit Reference Report describes the Inventory Level 2 methodology in detail. For performing Inventory Level 2 for selected source categories, it is recommended to start with reading the source category description section for the category in question. References to the relevant sections are given in the first tables of each of the previous inventory source category steps. This should give you a valuable insight in the fundamentals of the source category, including the original source of the mercury, a presentation of examples of mercury inputs and release patterns from literature, documentation for default factors used, and guidance for the source specific inventory work involved. Thereafter, it is recommended to read sections 2, 3 and 4 in the Reference Report, which describes the context and methodology of Inventory Level 2. Sub-sections 4.2 and 4.3 are not relevant, if you have completed the identification of sources present in your country in Inventory Level 1. Note that the sequence of steps and activities used in Inventory Level 2 and some sub-principles differ from those used in Inventory Level 1. This is because Inventory Level 1 has been designed to simplify the inventory work further than Level 2. The overall background principles are however the same.

You will observe that Inventory Level 2 demands more detailed data for most mercury source categories and that the procedures are more open, to allow for your selection of detailed approaches and your inclusion of national, specific data, which reflect the actual mercury situation for individual sources in your country.

The spreadsheet for Inventory Level 2 is provided as an open framework to facilitate your inventory calculations and provide possibility for making your own additions and changes in the calculations depending on your national and source-specific needs (as long as you explain such changes explicitly in your inventory report). The Inventory Level 2 spreadsheet pages are not self-explanatory, so it is very important to read the recommended sections of the Toolkit Reference Report and the spreadsheet page entitled "Level 2 - Introduction", before you start your work in the spreadsheet.

Insertion of Inventory Level2 results in Inventory Level 1 spreadsheet and report

If you have calculated inventory results for selected mercury source categories in Inventory Level 2, the results must be entered in the Inventory Level 1 spreadsheet to be included in the summary result tables and thus be easily incorporated in your reporting. Simply enter the input and release estimates generated in Inventory Level 2 in the corresponding cells in the Level 1spreadsheet page "Insert IL2 results"; see how it looks below. This is the only accepted way of incorporating Inventory Level 2 results in your Inventory Level 1 reporting, as it automatically takes care of neutralising double counting of results for waste categories and ensures adequate and correct summary table calculations.

Always document carefully and transparently the background for the Inventory Level 2 results introduced. This must be done in the notes column in the spreadsheet and with more detail in your inventory report. Make clear in your reporting that the input and release estimates for these specific mercury sources were calculated according to the Inventory level 2 methodology, and describe explicitly all data and sub-calculations made.

Note that for some source categories, the life cycle phases of the source category are grouped slightly differently in Inventory Level 1 to (facilitate data collection). In such cases the source category numbers in the spreadsheet page "Insert IL2 results" can be used for guidance.

For some source categories, all life cycle phases are aggregated under one entry in Inventory Level 1, but they are split in life cycle phases in Level 2. In such cases, enter the sum up the calculated releases to the same output pathway (for example all releases to air). In case of difficulties, make explicit notes in the IL1 spreadsheet page "Insert IL2 results" and in your report, on how you summed up the numbers.

Source presence (y/n/?) must always be entered in the appropriate Step page in the Inventory Level 1 spreadsheet, also when Inventory Level 2 results are introduced and used.

Important: The spreadsheet page "Insert IL2 results" is to be used ONLY for inclusion of inventory results calculated in Inventory Level 2. Any insertion there will disrupt summary presentation of otherwise calculated Inventory Level 1 results for the same source categories, and care should thus be taken to not introduce erroneous or irrelevant data in the spreadsheet cells.

Figure 10-1 Extract of the Inventory Level 1 spreadsheet page " Insert IL2 results".

Source category		Hg input	Enter calculated Hg releases in Kg Hg/y					
	Source Category no.	Enter calculated Hg input in Kg Hg/y	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
Energy consumption								
Coal combustion in large power plants	5.1.1							
Other coal uses	5.1.2							
Combustion/use of petroleum coke and heavy oil	5.1.3							
Combustion/use of diesel, gasoil, petroleum, kerosene	5.1.3							
Use of raw or pre-cleaned natural gas	5.1.4							
Use of pipeline gas (consumer quality)	5.1.4							
Biomass fired power and heat production	5.1.6							
Charcoal combustion	5.1.6							
Fuel production								
Oil extraction	5.1.3							
Oil refining	5.1.3							
Extraction and processing of natural gas	5.1.4							
Primary metal production								
Mercury (primary) extraction and initial processing	5.2.1							

Performing your whole inventory on Inventory Level 2

In case you should decide to perform your whole inventory in Inventory Level 2, either as a choice for your first mercury inventory, or as a later follow-up activity for refining your initial Level 1 inventory, we recommend that you start by reading sec-

tions 1-4 (about 50 pages) of the Toolkit Reference Report, which describes the context and methodology of Inventory Level 2. Thereafter it is recommended to read the individual source description sections as you need them during the course of your inventory work. Most likely, not all source categories are relevant for your country.

As mentioned above, the spreadsheet for Inventory Level 2 is provided as an open framework to facilitate your inventory calculations and provide possibility for making your own additions and changes in the calculations depending on your national and source-specific needs. The Inventory Level 2 spreadsheet pages are not self-explanatory, so it is very important to read the recommended sections of the Toolkit Reference Report and the spreadsheet page entitled "Level 2 - Introduction", before you start your work in the spreadsheet.

11 Abbreviations and acronyms

%	percent;
*	multiplied by;
/	divided by;
/y	per year;
<	less than;
>	greater than;
°C	degree Celsius (centigrade);
APC	Air pollution control;
ESP	Electrostatic precipitator; equipment used to reduce emissions of certain pollutants from combustion flue gases;
EU	European Union. Starting May 1st, 2004, the European Union has 25 member states (Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, The Netherlands, United Kingdom), establishing an area of more than 4 million square kms with a population of approximately 460 mil-lion inhabitants; later expanded with two additional member states to 27;
FF	Fabric filter; filter type used to capture particulate matter (here: from combustion flue gases);
g	gram;
kg	kilogram;
m	meter;
metric ton	1000 kg;
mg	milligram (10^{-3} gram);
MW	Megawatt;
OECD	Organization for Economic Cooperation and Development;
PM	Particulate material; particulate matter;

PS	Particle scrubber; equipment designed to reduce emissions of particles from combustion flue gases
PVC	Polyvinylchloride;
Releases	In the Toolkit, the term "releases" covers both emissions and releases the way these words are used in the Minamata Convention on Mercury.
t	tonne (= metric ton = 1000 kg);
UN	United Nations;
UN Environment	United Nations Environment Programme;
UNEP	United Nations Environment Programme (old designation used for historical reference here);
USA	United States of America;
VCM	Vinylchloride monomer;
WHO	World Health Organization;

Appendix 1 - Notes to calculation spreadsheet for Inventory Level 1

For users wishing to refine their inventories on Inventory Level 2: This note provides details of the relationship between Inventory Level 1 and Inventory Level 2 as regards default input and output distribution factors and input/output scenarios. The scenarios mentioned here, are applied automatically in the calculations, if users do not include mercury controls in their estimations.

General remark: As mentioned elsewhere in this guideline, some choices of default factors are made by the authors to simplify the inventory development in Level 1. The default factors selected are made with the aim of reflecting the conditions in developing countries and countries in economical transition. The notes here only pertain to such specific choices made for Inventory Level 1. In many other cases, the general default factors are used, and if nothing else is mentioned below, mid of range input factors and standard output distribution factors are used. The ranges of default input factors and general output distribution factors, as well as the Inventory Level 2 scenarios referred to, can be seen in the Toolkit Reference Report (or in overview in the Inventory Level 2 spreadsheet).

Step 2: Energy consumption and fuel production

Coal combustion in large power plants: An output scenario based on a coal mix of 1/3 bituminous, 1/3 sub-bituminous and 1/3 lignite, all assumed to be in the output scenario "Particulate matter simple APC: ESP/PS/CYC". The default input factor is based on a medium value of 0.15 g Hg/t coal combusted. The output distribution factors for this mix are for air: 0.88 and sector specific treatment/disposal: 0.12.

Coal fired industrial boilers: An output scenario based on a coal mix of 1/3 bituminous, 1/3 sub-bituminous and 1/3 lignite, all assumed to be in the output scenario "None" (no filter used). The default input factor is based on a medium value of 0.15 g Hg/t coal combusted.

Other coal use: An output scenario based combustion of a coal mix of 1/3 bituminous, 1/3 sub-bituminous and 1/3 lignite, all assumed with no air pollution controls. The default input factor is based on a medium conglomerate value of 0.13 g Hg/t coal combusted. Coke production is here included in "other coal use".

Combustion/use of petroleum coke and heavy oil: The default input factor is based on a value of 55 mg Hg/ton heavy petroleum product. The output scenario “No emission controls” is used for determination of the default output distribution factors.

Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates: The default input factor is based on a medium value of 5.5 mg Hg/ton light distillate petroleum product. The output scenario “No emission controls” is used for determination of the default output distribution factors.

Use of natural gas: The default input factor for pipeline natural gas is based on a medium value of 0.2 μg Hg/Nm3 gas. The default input factor for raw or pre-cleaned natural gas is based on a medium value of 100 μg Hg/Nm3 gas.

Biomass fired power and heat production: On the basis of wide data range on mercury in biomass a default input factor of 0.03 g Hg/t biomass burned is applied (dry weight basis).

Charcoal production: On the basis of wide range of data on mercury in biomass a default input factor of 0.12 g Hg/t produced charcoal is applied considering that 4 metric tons of biomass is used for production of 1 metric tons of charcoal.

Extraction and refining of oil: The default input factor is based on a value of 3,4 mg Hg/ton crude oil.

Extraction and processing of natural gas: The default input factors are based on a medium value of the unprocessed gas of 100 μg Hg/Nm3 gas. Default output distribution factors are estimated by assuming that 50% of the gas is processed in accordance with the output scenario "Gas processing without mercury removal" and 50% in accordance with "Gas processing with mercury removal".

Step 3: Domestic production of metals and raw materials

Production of zinc from concentrates: An intermediate mercury concentration in concentrates of 65 g/metric ton is used on Inventory Level 1. The output scenario "Smelters with wet gas cleaning and acid plant" is used for determination of the default output distribution factors based on an assessment of the industry globally. For some countries, less efficient filter configurations are however used and this should be a focus in any follow-up inventory work. Actual filter configurations present in a country can be mirrored by using Inventory Level 2 for this sector.

Production of copper from concentrates: An intermediate mercury concentration in concentrates of 30 g/metric ton is used on Inventory Level 1. The output scenario "Smelters with wet gas cleaning and acid plant" is used for determination of the default output distribution factors based on an assessment of the industry globally. For some countries, less efficient filter configurations are however used and this should be a focus in any follow-up inventory work. Actual filter configurations present in a country can be mirrored by using Inventory Level 2 for this sector.

Production of lead from concentrates: An intermediate mercury concentration in concentrates of 30 g/metric ton is used on Inventory Level 1. The output scenario "Smelters with wet gas cleaning and acid plant" is used for determination of the default output distribution factors based on an assessment of the industry globally. For some countries, less efficient filter configurations are however used and this should be a focus in any follow-up inventory work. Actual filter configurations present in a country can be mirrored by using Inventory Level 2 for this sector.

Gold extraction by methods other than mercury amalgamation: A medium mercury concentration in ore of 15 g/metric ton is assumed on Inventory Level 1.

Gold extraction with mercury amalgamation: The output scenario "no retort use" is used for determination of the default output distribution factors.

Aluminium production: The default input factor for production of alumina is based on a medium value of 0.5 g Hg/t bauxite used for the production.

Cement production: The quantities of cement produced are distributed 50:50% between the two categories "/without co-incineration of waste" and "/with co-incineration of waste". A mixed output scenario of 50% with "No filters" and 50% "Simple particle control (ESP / PS / FF)" with dust recycling is used for determination of the default output distribution factors. The mercury input from fossil fuels is assumed equally distributed on all relevant fossil fuel types on this inventory level. To avoid double counting with other fossil fuels sub-categories, the mercury contributions from fossil fuels to cement production are automatically subtracted in the totals lines of all inventory summary sheets in the Inventory Level 1 Excel calculation spreadsheet.

Pulp and paper production: On the basis of wide range of data on mercury in biomass a default input factor of 0.03 g Hg/t biomass used for production is applied (dry weight basis). No presence of flue gas release reduction devices is assumed on Inventory Level 1.

Step 4 – Domestic production and processing with intentional mercury use

Chlor/alkali production: Default input factor based on a medium value of 100 g Hg/t Cl2 produced. The output scenario "Hg unaccounted for is presented as releases" is used for determination of the default output distribution factors.

Production of products with mercury content: If nothing else is indicated in the toolkit, the following default output distribution factors based on limited data available for thermometers and batteries have been applied for all production of processes, except battery production, on Inventory Level 1: Air (0.01), Water(0.005), Land (0.1), Impurity in products (0), General waste (0.1) Sector specific treatment/disposal (0.01). For battery production, original Inventory Level 2 defaults are applied.

Acetaldehyde production with mercury catalyst: Default input and output distribution factors are identical to the factors for VCM production as no specific data on acetaldehyde production have been available.

Step 5- Waste treatment and recycling

Waste incineration (general / hazardous): For Incineration of municipal/general waste and Incineration of hazardous waste the output scenario "PM (particulate matter) reduction, simple ESP, or similar" is used for determination of the default output distribution factors. A medium mercury content in waste of 5 g/t is assumed for all general waste, while for hazardous waste a medium of 24 g/t is assumed.

Incineration and open burning of medical waste: The output scenario "No emission reduction devices" is used for determination of the default output distribution factors. A medium mercury content in waste of 24 g/t is assumed for all general waste.

Sewage sludge incineration: Based on examples from the literature cited in the Reference Report, a medium input factor of 2 g Hg/metric ton of sludge was used on Inventory Level 1.

Landfilling: A medium mercury content in waste of 5 g/t is assumed for all general waste. Available data are not sufficient to form input-correlated output distribution factors as generally used in this Toolkit. The Reference Report provide a summary of data on emissions to air and via leachate water. The limited data available indicate that mercury air emissions from landfills may be relatively modest compared to major mercury sources such as coal fired power plants, etc. To signal that landfills are a relevant mercury release source however, artificial output distribution factors were on Inventory Level 1 set as signal values as follows: To air: 0.01 of mercury in waste landfilled annually (meaning that 1 percent of the mercury landfilled is calculated as released to air during the entire life of the landfill; a realistic yet maybe underestimated fraction). To water (via leachate): 0.0001 of mercury in waste landfilled annually.

Informal dumping of general waste: A medium mercury content in waste of 5 g/t is assumed for all general waste on Inventory Level 1.

Production of recycled ferrous metals (iron and steel): A medium mercury content of 1 g per vehicle recycled is assumed on Inventory Level 1 to signal possible significance.

Waste water system/treatment: For waste water treatment the output scenario "Mechanical treatment only" is used for determination of the default output distribution factors. On Inventory Level 1, mechanical treatment with minor mercury retention in sludge is assumed.

Step 6 – Hg products and substances

Default output distribution factors for most of the product groups are dependent on the answer to the question "More than 2/3 of the waste is collected and treated under public control". If "Y" is answered, the scenario "(a1) No separate collection. Waste

handl. controlled" is applied. If "No" is answered, the scenario " (a2) No separate collection. Informal waste handl. widespread" is applied.

Dental fillings: In the light of the adjusted approach described below, a default input factor was based on an input with new fillings of 0.2 g Hg per inhabitant per year mirroring the Danish situation in 2001, where mercury free fillings had a substantial market share, but mercury fillings were still used to some degree; a situation which has since become more prevalent globally. To adjust approximately for the frequency of dental restoration in the country of interest, the calculated mercury input is further reduced with a factor describing the access to dental care in the country. The factor is calculated as the number of dental personnel per inhabitant, divided by the same number for Denmark (from which the adjusted default input factor was derived). The number of dental personnel per country was derived by the WHO in 2006. To reduce the vulnerability of the calculations to the possible reporting errors, all national dental personnel densities below the 20% percentile for non-OECD countries, were however calculated as equal to the same 20% percentile (see the Toolkit Reference Report for details and references). Default output distribution factors for disposal were based on the scenario: "In countries where only dental chair filters/strainers are used in most clinics".

Thermometers: Two categories of thermometers have been merged. The number of items of "Other glass Hg thermometers (air, laboratory, dairy, etc.)" is considered distributed 50:50% between "Ambient air thermometers" and "Other glass Hg thermometers".

Electrical switches and relays with mercury: Default input factor based on a medium value of 1.4 g Hg per inhabitant per year. To adjust approximately for 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 (electrification rate as derived by IEA, 2009; see the Toolkit Reference Report for more details).

Light sources with mercury: Three categories of light sources have been merged. The number of items of "Other Hg containing light sources" is equally distributed (1/3 to each) between the High-pressure sodium lamps, UV light for tanning and metal halide lamps.

Batteries with mercury: Three categories of batteries have been merged. The number of items of "Other button cells (zinc-air, alkaline button cells, silver-oxide)" is distributed equally (1/3 to each) between the zinc-air button cells, alkaline button cells and silver oxide button cells.

Polyurethane with mercury catalyst: Default input factor based on current consumption in the European Union. As described in the Reference Report, the EU consumption of mercury with catalysts in polyurethane in 2008 was 20-35 tonnes corresponding to 0.04-0.07 g Hg/inhabitant. Global estimates indicate a lower average. On this basis a default value of 0.03 g Hg per inhabitant per year is applied. To adjust approximately for 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 (electrification rate as derived by IEA, 2009. See the Toolkit Reference

Report for more details). Polyurethane is not only used as part of technical installations, but electricity access was however selected as an indirect indicator of technological development relevant for this material.

Paint with mercury: Default input factor based on a medium value of 2.6 kg Hg/t paint

Skin lightening creams and soaps with mercury chemicals: Is included as representing the main use within the category "Cosmetics and related products with mercury". Default input factor based on a medium value of 30 kg Hg/t skin lightening cream or soap.

Medical blood pressure gauges (mercury sphygmomanometers): Included in the category "6.5.2. Manometers and gauges with mercury" but is here represented separately as data on the sale of blood pressure gauges may be more readily available. The input factor is based on a medium value of 80 g Hg/item. Outputs are assumed distributed as for medical thermometers.

Other manometers and gauges with mercury: Includes the remaining equipment within the category "6.5.2. Manometers and gauges with mercury". A default input factor is derived from European experience as described in the Reference Report to be approximately 0.005 g Hg per inhabitant per year. To adjust approximately for 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 (electrification rate as derived by IEA, 2009; see the Toolkit Reference Report for more details). Mercury outputs from the sector are assumed distributed as for medical thermometers.

Laboratory chemicals: Included in the category "5.6.3. Laboratory chemicals and equipment". The default input factor is based on current consumption in the European Union. As described in the Reference Report, the mercury input to pharmaceutical industry in 2008 in the European Union was 3-10 tonnes corresponding to 0.006-0.02 g Hg/inhabitant. On this basis a default input factor of 0.01 g Hg/inhabitant is applied. To adjust approximately for 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 (electrification rate as derived by IEA, 2009; see the Toolkit Reference Report for more details). As no data are available on mercury outputs from the sector, an equal output distribution on water, general waste and sector specific waste disposal/treatment (safe collection and treatment) is used to signal potential releases.

Other laboratory equipment: Includes the remaining equipment within the category "5.6.3. Laboratory chemicals and equipment". In the European Union the main mercury use for other laboratory equipment is mercury in analysis of pose size characteristics (porosimetry and pycnometry) and hanging drop electrodes. As described in the Reference Report, the EU27 use of mercury in laboratories for porosimetry and pycnometry in 2008 was estimated at 10-100 tonnes while the use of for hanging drop electrodes was estimated at 0.1-0.5 tonnes. Later information indicated that the actual consumption for porosimetry and pycnometry is most likely in the lower end, and 20 tonnes will be used as best estimate. On this basis a default value for other laboratory

equipment is estimated at 0.04 g Hg/inhabitant. To adjust approximately for 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 (electrification rate as derived by IEA, 2009; see the Toolkit Reference Report for more details). As no data are available on mercury outputs from the sector, an equal output distribution on water, general waste and sector specific waste disposal/treatment (safe collection and treatment) is used to signal potential releases.

Level 1 summaries

Calculated input totals from waste related mercury sources: To avoid double counting of mercury inputs with waste products in the input total, only 10% of the mercury input to waste incineration sources, general waste deposition and informal dumping is included in the total for mercury inputs. These 10% represent approximately the mercury input to waste from materials which were not quantified individually in Inventory Level 1 of this Toolkit. These materials include such things as food wastes, paper, plastic, etc. which generally have very low mercury concentrations but very high volumes. The actual fraction of mercury from such materials, of the total inputs of mercury to waste, will vary between regions and very little data on this issue is available in the literature. Limited data from a Danish substance flow analysis (for 2001) for mercury indicate however, that this mercury fraction is small, in the range of some 2-20% of total mercury inputs to general waste.

Appendix 2 - Guidance in the use of the UN Comtrade database available on the Internet

The UN Comtrade database

In cases where national statistics for import and export of products cannot be made available for mercury inventory work, the UN Comtrade database can be used to get import and export data for certain product types. The UN Comtrade database does however not include data on national production, so this element of the national supply cannot be covered via this database and need to be described with data collected nationally. In cases where it has been positively verified that production of the type products in question does not take place in the country, the annual net import (import minus export) of a product will be equal to the annual national supply.

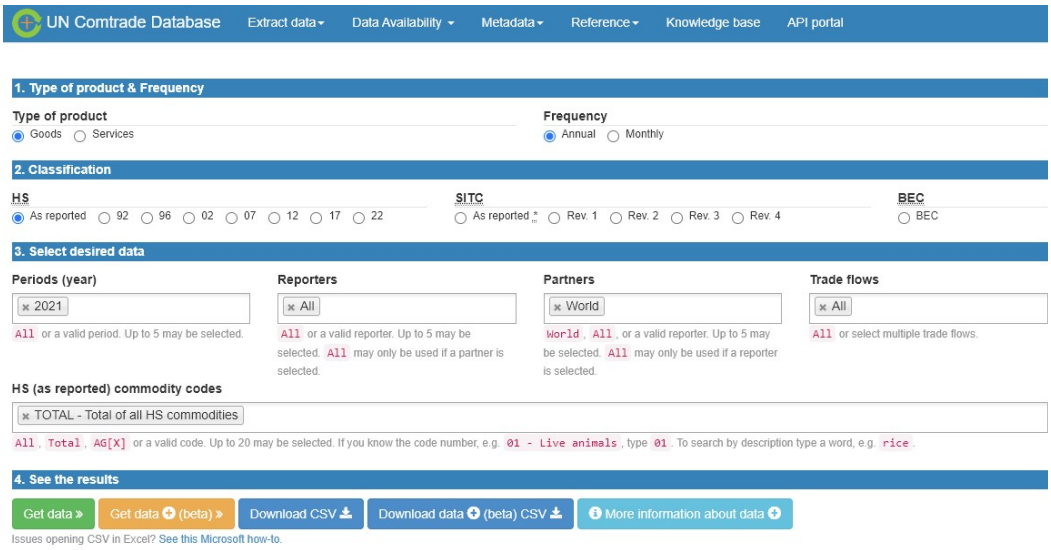
It is emphasised that the UN Comtrade database does not cover all the data types needed to make a mercury inventory for the product in question, and generally it is needed to collect additional data nationally.

This is particularly the case for product types where the UN Comtrade statistics do not cover exactly the mercury containing product in question. For example, the “Harmonised System” (HS) customs codes reported (among others) by UN Comtrade have an entry on thermometers designated "Thermometers & pyrometers, not combined with other instr., liquid-filled, for direct reading [HS as reported code 902511] ", which cover all liquid-filled thermometers. But as the thermometers may be filled with several types of liquids: ethanol, mercury, or – more rarely – a gallium/indium/tin mixture, only some of these thermometers are of interest for our mercury inventory. For such products, it is recommended to contact a few large importers, and ask them about their assessment of the distribution of products in the category on mercury-containing versus non-mercury products. Look for advice on the relevant product types below and in other section of this guideline, or if needed in the relevant section of the Toolkit Reference Report.

More mercury-specific HS 10-digit customs codes were suggested under the Minamata Convention in 2021 for product types targeted in the Convention, see below. But it must be expected that it may take a number of years before the new codes find general use. Note also that the UN Comtrade database currently only displays 6 digit codes, whereas national statistics may display relevant 8, 9 or 10 digit codes; please make sure to search carefully for relevant products in your national trade statistics databases.

Data search in UN Comtrade

The UN Comtrade data search page can be found at https://comtrade.un.org/data/. The initial search picture looks like below (extract as seen June, 2022;).Should the display be different from this when you visit the page, try to find the same entry fields from the homepage https://comtrade.un.org:

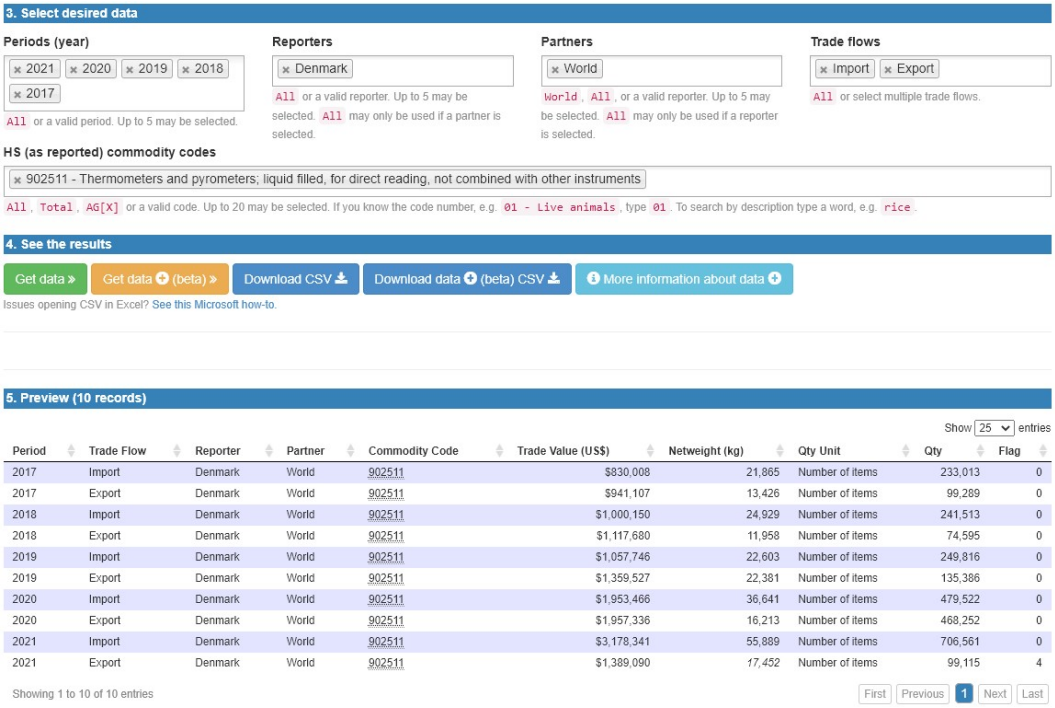


To find the import of a product type, for example thermometers, enter the following:

- “Type of product”: Select “Goods”
- “Frequency”: Select “Annual”.
- “Classification”: Select “HS”, “As reported”
  (If you do not find the desired products, you may wish to try the “SITC” and “BEC” options, but be careful to check if the codes match specifically what you look for).
- “Periods”: Enter the last 5 years
  (if you search is done in the first half of the current year, omit the latest year – data may not yet be reported).
- “Reporters”: Delete the pre-entered “All” by clicking the “x” before “All” and enter your own country name.
- “Partners”: Keep the pre-entered “World” (or select “World").
- "Trade flows": Delete the pre-entered “All” and enter "import" and export (we do not need the other two options for our inventory).
- " HS (as reported) commodity codes": Delete the pre-entered “TOTAL—Total of all HS commodities”. Write a search word you think will cover the product type; in our example, write "thermometer", and select the code number and name you wish to get data for in the automatically generated list; get advice on search words and relevant code numbers in the table below in this appendix. You can easily enter all the relevant product codes at the same time. If you get an error message, reduce the number of products and try again.

- Click the "Get data" button.

After a little while, the database returns with the data available for the choices you made. In the example with thermometers (and Denmark) it returned the following list:



3. Select desired data

Periods (year): 2021, 2020, 2019, 2018, 2017 — All or a valid period. Up to 5 may be selected.

Reporters: Denmark — All or a valid reporter. Up to 5 may be selected. All may only be used if a partner is selected.

Partners: World — World, All, or a valid reporter. Up to 5 may be selected. All may only be used if a reporter is selected.

Trade flows: Import, Export — All or select multiple trade flows.

HS (as reported) commodity codes: 902511 - Thermometers and pyrometers; liquid filled, for direct reading, not combined with other instruments

All, Total, AG[X] or a valid code. Up to 20 may be selected. If you know the code number, e.g. 01 - Live animals, type 01. To search by description type a word, e.g. rice.

4. See the results

Get data » | Get data (beta) » | Download CSV | Download data (beta) CSV | More information about data

Issues opening CSV in Excel? See this Microsoft how-to.

5. Preview (10 records)

Show 25 entries

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value (US$)	Netweight (kg)	Qty Unit	Qty	Flag
2017	Import	Denmark	World	902511	$830,008	21,865	Number of items	233,013	0
2017	Export	Denmark	World	902511	$941,107	13,426	Number of items	99,289	0
2018	Import	Denmark	World	902511	$1,000,150	24,929	Number of items	241,513	0
2018	Export	Denmark	World	902511	$1,117,680	11,958	Number of items	74,595	0
2019	Import	Denmark	World	902511	$1,057,746	22,603	Number of items	249,816	0
2019	Export	Denmark	World	902511	$1,359,527	22,381	Number of items	135,386	0
2020	Import	Denmark	World	902511	$1,953,466	36,641	Number of items	479,522	0
2020	Export	Denmark	World	902511	$1,957,336	16,213	Number of items	468,252	0
2021	Import	Denmark	World	902511	$3,178,341	55,889	Number of items	706,561	0
2021	Export	Denmark	World	902511	$1,389,090	17,452	Number of items	99,115	4

Showing 1 to 10 of 10 entries

First | Previous | 1 | Next | Last

Now simply mark all relevant headings and data on your computer screen and copy them (Ctr C) to your spreadsheet for further data analysis. Observe that data may be displayed in several pages (see below the table displayed) and use “next” to display and copy all relevant data. It is easiest to copy the headings each time and then remove the heading rows in your won spreadsheet. Make sure you copy all relevant data and that they are pasted in a consistent and easily editable format.

When you hover your mouse cursor over the product code (here 902511) in the Comtrade results table, the name of the product code is displayed; you can use this when making your table on import/export data for your own calculations and for your inventory report. Adding the code name makes the table much more explicit and hence useful.

Once the data are copied to your spreadsheet (for example to an extra tap in your spreadsheet file), you can manipulate the data to calculate net imports (import minus export) and averages over 3 (or 5) years around your base year, depending on the need. Note that the data may in some cases display clear decreasing or increasing trends that you may wish to mirror in your inventory. If not, it is recommended to use averages over 3 years (or 5 years if the data are very scattered). Remember to write clearly in your report what the displayed data represent.

The data you use should preferably be in the unit stated in the Inventory spreadsheet, if available. In our example, we need imported number of items of thermometers. If the data are not available in the desired unit, you need to convert the trade data. For some product types, this can be done in the Toolkit spreadsheet's "Unit conversion" tab. For other, you may be able to derive conversion factors from similar data sets from 2-3 neighbouring countries, where data in all units are available, or from other Internet sources. Such conversion may of course introduce some uncertainty, but it is still better than having no data at all. Explain explicitly and with all relevant data how you made the conversion, in your inventory report.

Data for (at least) the following product/material groups can be sought with meaningful results in UN Comtrade. Note that new relevant customs codes may emerge, as mentioned above, but likely with 8 or 10 digits, not freely available at UN Comtrade (check with your national statistics bureau for such data).

Product/material name in Toolkit Inventory Level 1	**Use this search word**	**Examples of product name(s) and code(s) in Comtrade (others may exist)**	**Remarks**
Ore concentrates			
Zinc concentrates	Zinc concentrates	…Zinc ores and concentrates [HS as reported code 260800]	
Lead concentrates	Lead concentrates	…Lead ores and concentrates [HS as reported code 260700]	
Copper concentrates	Copper concentrates	… Copper ores and concentrates [HS as reported code 260300]	
Cement		… Portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers. [HS as reported code 2523]	This is generic category that includes both cement and cement clinker. Remember that in the Toolkit context, you only need data for national PRODUCTION based on nationally produced clinker. But trade data may help you establish such relevant amounts.
Cement	Cement	…White cement, whether or not artificially coloured [HS as reported code 252321] + …Other than white [HS as reported code 252329] + …Aluminous cement [HS as reported code 252330] + …Other hydraulic cements [HS as reported code 252390]	Remember that in the Toolkit context, you only need data for national PRODUCTION data for CEMENT based on nationally produced clinker. But trade data may help you establish such relevant amounts.

Product/material name in Toolkit Inventory Level 1	**Use this search word**	**Examples of product name(s) and code(s) in Comtrade (others may exist)**	**Remarks**
Cement clinker	Cement clinker	…Cement clinkers [HS as reported code 252310]	While imported clinker is not relevant for our mercury inventory development, it may help derive the relevant production amounts, see note above.
Thermometers	thermo- mo- meter	….Thermometers & pyrometers, not combined with other instr., liquid-filled, for direct reading [HS as reported code 902511]	May include thermometers with other types of liquids, most likely alcohol-filled ambient air thermometers. You need to ask major importers about the likely fraction of mercury-filled thermometers.
Batteries	battery cell	…..Primary cells and primary batteries. [HS as reported code 8506]	This is a generic customs code that include all types of non-rechargeable batteries, including several without mercury
Other button cells (zinc-air, alkaline button cells, silver- oxide, mercuric oxide)		….Primary cells & primary batteries, air-zinc [HS as reported code 850660] + …Cells and batteries; primary, silver oxide [HS as reported code 850640] + Cells and batteries; primary, mercuric oxide [HS as reported code 850630]	Includes only part of the battery types in the Toolkit category, as there is no separate 6 digit HS code for button cell alkaline batteries (may be available in national 8 digit HS codes)
Other batteries [potentially] with mercury (plain cylindrical alkaline, permanganate)		… Manganese dioxide [HS as reported code 850610]	Most of these larger alkaline batteries are today likely without mercury, but this needs to be checked with battery importers and any national producers
Light sources with mercury	lamp		
Fluorescent tubes (double end) and Compact fluorescent lamp (CFL single end)		……Electric discharge lamps (excl. ultra-violet lamps), fluorescent, hot cathode [HS as reported code 853931]	For some countries, this 6 digit HS code may include both "Fluorescent tubes (double end)" and "Compact fluorescent lamp (CFL single end)", but not the distribution on the types; distribution on types must be based on data from importers. See also code 853939 below.
		…..Electric discharge lamps (excl. ul- tra-violet lamps; excl. of 853931 & 853932) [HS as reported code 853939]	Note that some countries use this code for compact fluorescent lamps (CFLs or "energy-savers"), so it must be analysed in conjunction with code 853931. If code 853939 has large imports, it may likely represent CFLs and can be

Product/material name in Toolkit Inventory Level 1	Use this search word	Examples of product name(s) and code(s) in Comtrade (others may exist)	Remarks
			incorporated as such in the inventory. Always make sure to report HS codes with the data displayed in your report.
		…..Ultra-violet/infra-red lamps [HS as reported code 853949]	Includes such mercury containing ultra- violet fluorescent lamps used for tanning beds as well as infra-red lamps which do not contain mercury. For some countries, a specific code is used for infra-red lamps, and these (non-mercury) lamps can then be deducted.
Other Hg containing light sources (see guideline)		…..Electric discharge lamps (excl. ul- tra-violet lamps), mercury/sodium va- pour lamps; metal halide lamps [HS as reported code 853932]	Includes some of the lamps with high mercury contents, but not all.
Other relevant product/material groups that can potentially be used for cross-checking of mercury inputs			
Metal mercury	Mercury	Mercury [HS as reported code 280540]	
Mercury compounds	Mercury compounds	…Inorganic or organic compounds of mercury, excluding amalgams, whether or not chemically defined [HS as reported code 2852] + …Inorganic or organic compounds of mercury, excluding amalgams, chemically defined [HS as reported code 285210] + …Inorganic or organic compounds of mercury; excluding amalgams, not chemically defined [HS as reported code 285290]	
Dental amalgams	Dental amalgams	….Pharmaceutical goods; dental cements and other dental fillings, bone reconstruction cements [HS as reported code 300640]	There is no distinct code for mercury amalgam. This code may include other types of dental fillings
Gold (for all extraction techniques)	Gold	… Metals; gold, non-monetary, unwrought (but not powder) [HS as reported code 710812] + …Metals; gold, semi-manufactured [HS as reported code 710813]	This includes bars which for the purposes of marketing have a smooth surface and a hallmark. Grains of silver and its alloys are classified in this code, provided that they are not powdered. This codes exclude bars obtained by drawing or rolling.

HS customs codes proposed under the Minamata Convention (COP4.1)

The tables below list proposed statistical codes of more than six digits for mercury-added products listed in annex A to the Minamata Convention (codes based on the Harmonized System)[12]. These codes may, if promoted by Parties to that Convention, become available in the future in national – and perhaps international – trade statistics.

In the following table, the first column shows existing codes used by some parties and the second column provides proposed codes to distinguish mercury-added products from other products. The proposed codes and descriptions are shown in shaded cells.

Batteries

Existing code	*Proposed statistical codes*	*Description*
8506.10.10		Alkaline manganese dioxide primary cells
	8506.10.10.10	With added mercury
	8506.10.10.90	Others
8506.10.20		(Other) manganese dioxide primary cells
	8506.10.20.10	With added mercury
	8506.10.20.90	Others
8506.10.30		Manganese dioxide batteries
	8506.10.30.10	With added mercury
	8506.10.30.90	Others
8506.30.00		Mercuric oxide batteries
	8506.30.00.00	Mercuric oxide primary cells and batteries (excluding spent)
8506.40.10		Silver oxide primary cells with external volume less than or equal to 300 cm^3
	8506.40.10.10	With added mercury
	8506.40.10.11	Button batteries with mercury content less than 2% by weight
	8506.40.10.90	Others
8506.40.90		(Other) silver oxide primary cells
	8506.40.90.10	With added mercury
	8506.40.90.90	Others
8506.60.10		Air-zinc primary cells (with external volume less than or equal to 300 cm^3)
	8506.60.10.10	With added mercury
	8506.60.10.11	Button batteries with mercury content less than 2% by weight
	8506.60.10.90	Others
8506.60.90		(Other) air-zinc batteries
	8506.60.90.10	With added mercury
	8506.60.90.90	Others
8506.80.01		Other primary cells and batteries
	8506.80.10.10	With added mercury
	8506.80.10.90	Others

[12] Source: UNEP/MC/COP.4/27, dated 9 August 2021: Customs codes. Note by the secretariat.

Switches and relays

Existing code	*Proposed statistical codes*	*Description*
		Isolating switches and make-and-break switches, for a voltage exceeding 1,000 volts
8535.30.01		Make-and-break switches
	8535.30.01.10	With added mercury
	8535.30.01.90	Others
8535.30.13		Switches for rated current less than or equal to 1,600 amps, vacuum cut-off without actuating device (vacuum bottles or ampoules)
	8535.30.13.10	With added mercury
	8535.30.13.90	Others
8535.30.18		Disconnectors and switches for rated current less than or equal to 1,600 amps and others with automatic actuation device except for contacts immersed in liquid medium
	8535.30.18.10	With added mercury
	8535.30.18.90	Others
8535.30.19		Other disconnectors and switches for rated current less than or equal to 1,600 amps
	8535.30.90.10	With added mercury
	8535.30.90.90	Others
8535.30.27		Switches for rated current greater than 1,600 amps and others with non-automatic actuation device
	8535.30.27.10	With added mercury
	8535.30.27.90	Others
8535.30.28		Switches for rated current greater than 1,600 amps and others with automatic actuation device except for contacts immersed in liquid medium
	8535.30.28.10	With added mercury
	8535.30.28.90	Others
		Electrical apparatus for switching, protecting or making connections for a voltage exceeding 1,000 volts
8535.90.04		Starter relays
	8535.90.04.10	With added mercury
	8535.90.04.90	Others
8535.90.05		Thermal or induction relays
	8535.90.05.10	With added mercury
	8535.90.05.90	Others
8535.90.06		High sensitivity relays, with laminated core, inverting monopole, as exclusively designed for telephone equipment
	8535.90.06.10	With added mercury
	8535.90.06.90	Others
8535.90.13		Secondary electromagnetic relays, powered exclusively through current and / or voltage transformers
	8535.90.13.10	With added mercury
	8535.90.13.90	Others
8535.90.14		Automatic differential relays, up to 60 amps with differential protection up to 300 milliamps
	8535.90.14.10	With added mercury
	8535.90.14.90	Others

Existing code	*Proposed statistical codes*	*Description*
8535.90.22		Relays other than those included in subheadings 8535.90.04, 8535.90.05, 8535.90.06, 8535.90.13 and 8535.90.14.
	8535.90.22.10	With added mercury
	8535.90.22.90	Others
		Relays, for a voltage not exceeding 1,000 volts
	8536.40.00.10	With added mercury
	8536.40.00.90	Others
		Relays for a voltage not exceeding 60 volts
8536.41.01		For speakers
	8536.41.01.10	With added mercury
	8536.41.01.90	Others
8536.41.02		6- and 12-volt solenoids, for automotive starter motors
	8536.41.02.10	With added mercury
	8536.41.02.90	Others
8536.41.03		Thermal or induction
	8536.41.03.10	With added mercury
	8536.41.03.90	Others
8536.41.04		Certified for aircraft
	8536.41.04.10	With added mercury
	8536.41.04.90	Others
8536.41.05		High sensitivity, with laminated core, inverter monopole, designed and certified for telephone equipment
	8536.41.05.10	With added mercury
	8536.41.05.90	Others
8536.41.06		Electromagnetic secondaries, powered exclusively through current and / or voltage transformers
	8536.41.06.10	With added mercury
	8536.41.06.90	Others
8536.41.07		Automatic differential, up to 60 amps with differential protection up to 300 milliamps
	8536.41.07.10	With added mercury
	8536.41.07.90	Others
8536.41.08		Photoelectric relays
	8536.41.08.10	With added mercury
	8536.41.08.90	Others
8536.41.09		Directional indicators for manoeuvring indicator lights, for automotive use
	8536.41.09.10	With added mercury
	8536.41.09.90	Others
8536.41.10		For start-up functions, other than those included in section 8536.41.02
	8536.41.10.10	With added mercury
	8536.41.10.90	Others
8536.41.11		Manual or electrical reset multiple contact lockout auxiliary relays rated less than or equal to 60 amps
	8536.41.11.10	With added mercury
	8536.41.11.90	Others
8536.41.99		Other

Existing code	*Proposed statistical codes*	*Description*
	8536.41.99.10	With added mercury
	8536.41.99.90	Others
		Relays for a voltage greater than 60 volts and not exceeding 1,000 volts
8536.49.01		For start-up functions
	8536.49.01.10	With added mercury
	8536.49.01.90	Others
8536.49.02		Thermal or induction
	8536.49.02.10	With added mercury
	8536.49.02.90	Others
8536.49.03		Electromagnetic secondaries, powered exclusively through current and / or voltage transformers
	8536.49.03.10	With added mercury
	8536.49.03.90	Others
8536.49.04		Automatic differential, up to 60 amps with differential protection up to 300 milliamps
	8536.49.04.10	With added mercury
	8536.49.04.90	Others
8536.49.05		Multi-contact block auxiliary relays, manual or electrical reset, rated less than or equal to 60 amps and 480 volts maximum voltage
	8536.49.05.10	With added mercury
	8536.49.05.90	Others
8536.49.99		Other
	8536.49.99.10	With added mercury
	8536.49.99.90	Others
		Switches, for a voltage not exceeding 1,000 volts
8536.50.01		Switches other than those included in subheadings 8536.50.05, 8536.50.06, 8536.50.07, 8536.50.10, 8536.50.11 and 8536.50.15
	8536.50.01.10	With added mercury
	8536.50.01.90	Others
8536.50.05		Certified for aircraft
	8536.50.05.10	With added mercury
	8536.50.05.90	Others
8536.50.06		Switches, by pressure of liquids for level controls in washing machines for domestic use
	8536.50.06.10	With added mercury
	8536.50.06.90	Others
8536.50.07		Thermoelectric automatic switches for priming the discharge in fluorescent lamps or tubes
	8536.50.07.10	With added mercury
	8536.50.07.90	Others
8536.50.10		Switches designed and certified exclusively for radio or television, other than those included in section 8536.50.15
	8536.50.10.10	With added mercury
	8536.50.10.90	Others

Existing code	*Proposed statistical codes*	*Description*
8536.50.11		Loose or grouped switches, actuated by buttons, weighing up to 250 grams, or single or multiple push-button or key-board switches, designed and certified exclusively for electronics, other than those included in section 8536.50.15
	8536.50.11.10	With added mercury
	8536.50.11.90	Others
8536.50.15		Dual, foot or pull-type light switches; start button; designed and certified exclusively for automotive use
	8536.50.15.10	With added mercury
	8536.50.15.90	Others

Thermostats[a]

HS reference	*Proposed statistical codes*	*Description*
9032.10.20		Electronic thermostats
9032.10.80		Other thermostats
	9032.10.80.10	Containing mercury
	9032.10.80.90	Others

Linear fluorescent lamps

Existing code	*Proposed statistical codes*	*Description*
		Fluorescent, hot cathode discharge lamps, other than ultraviolet lamps
8539.31.00.10		Linear fluorescent lamps (LFLs) for general lighting purposes
	8539.31.00.11	Triband phosphor less than 60 watts with a mercury content not exceeding 5 mg per lamp
	8539.31.00.12	Halophosphate phosphor less than 40 watts with a mercury content not exceeding 10 mg per lamp
8539.31.00.90		Other

Compact fluorescent lamps

Existing code	*Proposed statistical codes*	*Description*
8539.31.00		Discharge lamps, fluorescent and hot cathode
8539.31.10		Compact fluorescent lamps (CFLs) for general lighting purposes
	8539.31.10.10	CFLs less than 30 watts with a mercury content not exceeding 5 mg per lamp
	8539.31.10.90	Other CFLs

High-pressure mercury vapour lamps

Existing code	*Proposed statistical codes*	*Description*
8539.32.00		Mercury or sodium vapour lamps; metal halide lamps
	8539.32.00.10	High-pressure mercury vapour lamps for general lighting purposes

Cold cathode and external electrode fluorescent lamps

Existing code	*Proposed statistical codes*	*Description*
8539.39.00		Electrical discharge lamps, other than fluorescent (hot cathode), mercury or sodium vapour, metal halide or ultraviolet lamps
	8539.39.00.10	Cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays: short length (less than 500 mm) with mercury content no more than 3.5 mg per lamp
	8539.39.00.20	Cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays: medium length (greater than 500 mm and less than 1,500 mm) with mercury content no more than 5 mg per lamp
	8539.39.00.30	Cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays: long length (greater than 1,500 mm) with mercury content no more than 13 mg per lamp

Cosmetics

Existing code	*Proposed statistical codes*	*Description*
3304.10.01		Lip make-up preparations
	3304.10.01.10	With mercury content less than or equal to 1 ppm
	3304.10.01.20	With mercury content more than 1 ppm
3304.20.01		Eye make-up preparations
	3304.20.01.10	With mercury content less than or equal to 1 ppm
	3304.20.01.20	With mercury content more than 1 ppm and mercury is used as a preservative
	3304.20.01.30	With mercury content more than 1 ppm and mercury is not used as a preservative
3304.30.00		Manicure or pedicure preparations
	3304.30.00.10	With mercury content less than or equal to 1 ppm
	3304.30.00.20	With mercury content more than 1 ppm
3304.90.00		Other
	3304.90.00.10	With mercury content less than or equal to 1 ppm
	3304.90.00.20	With mercury content more than 1 ppm
3304.91.01		Powders, including compacts
	3304.91.01.10	With mercury content less than or equal to 1 ppm
	3304.91.01.20	With mercury content more than 1 ppm
3304.99.01		Skin creams
	3304.99.01.10	With mercury content less than or equal to 1 ppm
	3304.99.01.20	With mercury content more than 1 ppm
3304.99.99		Other
	3304.99.99.10	With mercury content less than or equal to 1 ppm
	3304.99.99.20	With mercury content more than 1 ppm
		Soap and organic surface-active products and preparations, in the form of bars, cakes, moulded pieces or shapes, and paper, wadding, felt and nonwovens, impregnated, coated or covered with soap or detergent
		For toilet use (including medicated products)
3401.11.01		Soaps for toilet use (incl. medicated)
	3401.11.01.10	With mercury content less than or equal to 1 ppm

Existing code	*Proposed statistical codes*	*Description*
	3401.11.01.20	With mercury content more than 1 ppm
3401.19.00		Other
	3401.19.00.10	With mercury content less than or equal to 1 ppm
	3401.19.00.20	With mercury content more than 1 ppm
3401.20.01		Soap in other forms
	3401.20.01.10	With mercury content less than or equal to 1 ppm
	3401.20.01.20	With mercury content more than 1 ppm
3401.30.01		Organic surface-active products and preparations for washing the skin, in the form of liquid or cream and put up for retail sale, whether or not containing soap
	3401.30.01.10	With mercury content less than or equal to 1 ppm
	3401.30.01.20	With mercury content more than 1 ppm

Pesticides, biocides and topical antiseptics

Existing code	*Proposed statistical codes*	*Description*
		Other medicaments consisting of mixed or unmixed products for therapeutic or prophylactic uses, for retail sale
3004.90.1000		Containing antigens or hyaluronic acid or its sodium salt
	3004.90.2000	[Topical antiseptics] containing mercury compounds
		Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant growth regulators, disinfectants and similar products
3808.50.01		Goods containing a range of substances as specified in Subheading Note 1 to Chapter 38, of which one is mercury compounds
3808.50.10		Specified goods containing any aromatic or modified aromatic pesticide
	3808.50.10.10	Containing mercury compounds
	3808.50.10.90	Not containing mercury compounds
3808.50.50		Other pesticides
	3808.50.50.10	Containing mercury compounds
	3808.50.50.90	Not containing mercury compounds
3808.91.00		Insecticides
	3808.91.00.10	Containing mercury compounds
	3808.91.00.90	Not containing mercury compounds
3808.92.00		Fungicides
	3808.92.00.10	Containing mercury compounds
	3808.92.00.90	Not containing mercury compounds
3808.93.00		Herbicides, anti-sprouting products and plant-growth regulators
	3808.93.00.10	Containing mercury compounds
	3808.93.00.90	Not containing mercury compounds
3808.99.00		Other
	3808.99.00.10	Containing mercury compounds
	3808.99.00.90	Not containing mercury compounds
	[To be considered][b]	Paints and varnishes to which a mercury compound has been added for its biocidal or fungicidal properties

3208.00	Paints and varnishes, including enamels and lacquers, based on synthetic polymers, dispersed or dissolved in a non-aqueous medium (excluding those based on polyesters and acrylic or vinyl polymers)
3209.00	Paints and varnishes, including enamels and lacquers, based on synthetic polymers or chemically modified natural polymers, dispersed or dissolved in an aqueous medium

Measuring devices

Existing code	*Proposed statistical codes*	*Description*
		Other instruments and appliances, including sphygmomanometers
9018.90.92		Devices for measuring blood pressure
	9018.90.92.10	Sphygmomanometers containing mercury
	9018.90.92.90	Other
9025.11.10		Clinical thermometers, liquid filled, for direct reading
	9025.11.10.10	Containing mercury
	9025.11.10.90	Other
9025.11.40		Liquid-filled thermometers, for direct reading, not combined with other instruments, other than clinical thermometers
	9025.11.40.10	Containing mercury
	9025.11.40.90	Other
9025.80.01		Other instruments, including barometers
	9025.80.01.10	Barometers containing mercury
	9025.80.01.90	Other
9025.80.02		Other instruments: hygrometers
	9025.80.02.10	Hygrometers containing mercury
	9025.80.02.90	Other
9026.20.10		Instruments and apparatus for pressure measurement or control, manometers
	9026.20.10.10	Manometers containing mercury
	9026.20.10.90	Other

Dental amalgam

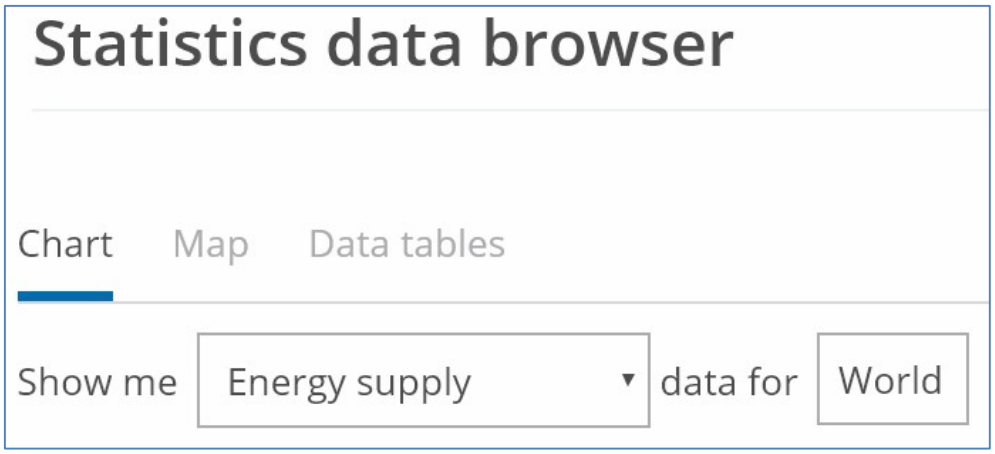
Existing code	*Proposed statistical codes*	*Description*
2843.90.00		Amalgams of precious metals; etc.
	2843.90.00.10	Amalgams [containing mercury] of precious metals in capsule or other form for dental use
	2843.90.00.90	Other amalgams of precious metals
2853.90.00		Amalgams, other than amalgams of precious metals; etc.
2853.90.90		Other
	2853.90.90.10	Amalgams [containing mercury], other than amalgams of precious metals, in capsule or other form for dental use
	2853.90.90.90	Other amalgams not containing precious metals

[a] Mercury-added thermostats used to control room temperature use a mercury-added switch to turn on and off heating and cooling equipment, and thus the switch is the sole mercury-added component of the product. Parties may therefore consider such thermostats to be included under the listing of switches and relays in annex A. On the other hand, other Parties may consider such products a measuring device, in which case parties may not consider such thermostats to be included in the products listed in annex A.

[b] Customs codes for paint and varnishes are subdivided into those using non-aqueous or aqueous medium, etc. Further information is needed on which types of products are likely to contain mercury compounds.

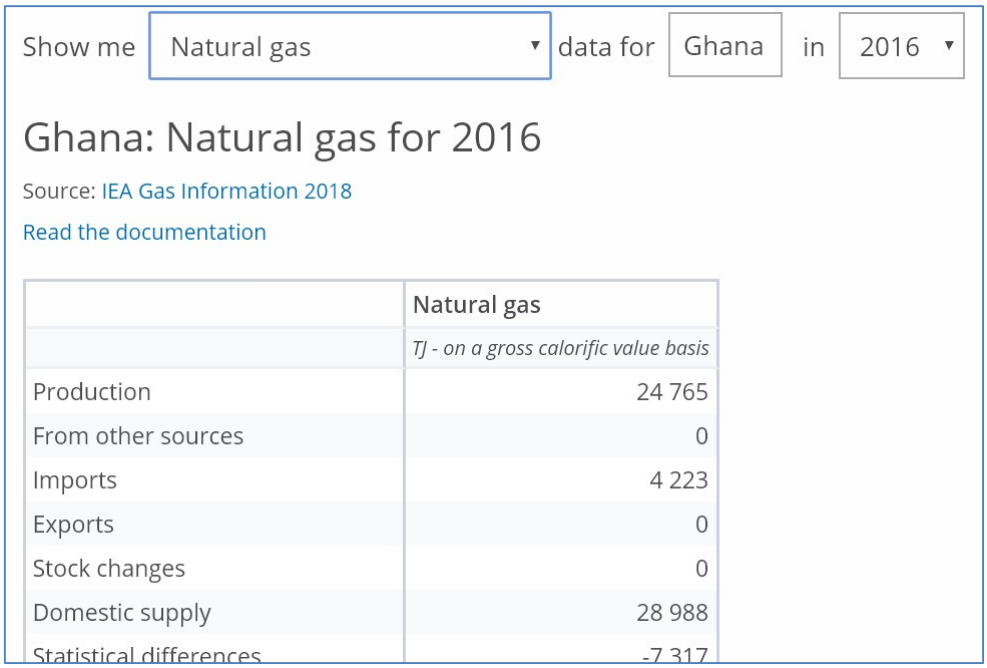
Appendix 3 - Guidance in the use of the IEA energy statistics database on the Internet

Country-specific data on fuel use can be found on the International Energy Agency's website on statistics. Go to the IEA site at www.iea.org. In the menu at the top, click “Statistics & Data”, you will see a search fields that can help you finding energy information about your country. Click on “Data tables”. In the “data for” field, enter your country name, in the “Show me” field, select the fuel type you are looking for from the drop-down menu.



In the “in” field, select the year you need data for (the base year of your inventory). The data are free under certain conditions. If you need it, the IEA has newer data than those displayed here, but they need to be purchased from another IEA site.

If I for example choose Ghana, natural gas and 2016, I get the data below (extract shown only). Make sure to check the units of the data given, and convert them as needed, using the Toolkit spreadsheets’ Unit conversion tab.



Show me Natural gas data for Ghana in 2016

Ghana: Natural gas for 2016

Source: IEA Gas Information 2018

Read the documentation

	Natural gas
	TJ - on a gross calorific value basis
Production	24 765
From other sources	0
Imports	4 223
Exports	0
Stock changes	0
Domestic supply	28 988
Statistical differences	-7 317

For mercury inventories done in the Toolkit, the IEA statistics have data for most countries on the following issues:

Toolkit fuel/energy entry (and unit used in Toolkit)	**Unit in IEA statistics (to be converted to Toolkit unit)**	**IEA data entries that should be included in your inventory**
Combustion of coal in large power plants (t coal combusted/ y:	TJ (can be converted in the Toolkit's unit conversion tab)	Sum of consumption for Electricity plants and CHP plants for the coal types Anthracite + Other bituminous coal + Sub-bituminous coal + Lignite (+ coking coal if reported for these uses)
Other coal uses	TJ (can be converted in the Toolkit's unit conversion tab)	Sum of consumption for Heat plants, Other transformation, Industry, Transport, Residential, Agriculture/Forestry, Fishing, Other non-specified and Non-energy use for the coal types: Anthracite + Coking coal + Other bituminous coal + Sub-bituminous coal + Lignite + Patent fuel + BKB (brown coal briquettes)
Combustion/use of petroleum coke and heavy oil	TJ (can be converted in the Toolkit's unit conversion tab)	Domestic supply: Fuel oil (Toolkit sub-category "heavy fuel" only; petroleum coke consumption must be found elsewhere)
Combustion/use of diesel, gasoil, petroleum, kerosene and other light to medium fractions	TJ (can be converted in the Toolkit's unit conversion tab)	Domestic supply of Natural gas liquids + Naphtha + Liquefied petroleum gases + Motor gasoline + Aviation gasoline + Jet kerosene + Other kerosene + Gas/diesel
Oil extraction (t crude oil produced/y)	TJ (can be converted in the Toolkit's unit conversion tab)	Production, Crude oil

Oil refining (t crude oil refined/y)	TJ (can be converted in the Toolkit's unit conversion tab)	Oil refineries, Crude oil
Consumption of natural gas (Nm^3 used/y)	TJ (can be converted in the Toolkit's unit conversion tab)	Domestic supply
Production of natural gas (Nm^3 produced/y)	TJ (can be converted in the Toolkit's unit conversion tab)	Production
Biomass fired power and heat production (Biomass combusted, t (dry weight)/y)	TJ (can be converted in the Toolkit's unit conversion tab)	Primary solid biofuels (includes also other solid biofuels than wood). (Alternatively you may consult other sources for biomass data, for example the FAO Yearbooks of Forest Products (entry: Wood Fuel, Including Wood for Charcoal) at http://www.fao.org/forestry/statistics/80570/en/), which reports cubic meters wood consumption per year, but does not include other biomass fuels).
Charcoal combustion (Charcoal combusted, t (dry weight)/y)	Data for charcoal may be available in some cases, but need to be purchased.	Data specifically for charcoal may be available in some cases, but need to be purchased.

Appendix 4 – Test of waste and waste water default input factors

In the Toolkit, default factors used for calculation of mercury releases from the waste handling categories are based on examples of mercury contents in waste and wastewater in countries for which such data have been available. This may differ from actual waste in your country, primarily due to differences in the consumption pattern of mercury-added products and intentional use of mercury in processes. The default input factors used in this Toolkit for waste and wastewater were derived from data from developed countries only. You can make a simple test based on your Inventory Level 1 results, that will indicate if the default input factors for general waste treatment may over-estimate the mercury releases in your country. The tests are calculated automatically in the Inventory Level 1 spreadsheet, tab "Step5-Waste treat+recycling", provided that all data needed for the test are available and reliable[13].

Is the sum of the calculated INPUTS to all general waste sub-categories more than 2 times the sum of WASTE OUTPUTS from intentional mercury uses in products plus processes (and these are well covered in the inventory)? If so, please describe this in your inventory report (with sum numbers) and state that mercury flows to general waste sub-categories may be over-estimated, and that more detailed investigations may be needed on this issue.

In the IL1 spreadsheet the test is done as follows: Select the tab "Level 1-total summary", check if cells

$$(E61+E65+E67+E68) > 2*(J26+J27+\sum(J32 \text{ to } J56)).$$

A similar test should be performed and discussed in the report for wastewater treatment: Is the sum of the calculated INPUTS to waste water treatment is more than 2 times larger than the sum of OUTPUTS TO WATER from intentional mercury uses in products plus processes (and these are well covered in the inventory)? If so, please describe this in your inventory report (with sum numbers) and state that mercury flows to waste water treatment may be over-estimated, and that more detailed investigations may be needed on this issue.

In the IL1 spreadsheet the test is done as follows: Select the tab "Level 1-ExecSummary", check if cell

$$B19 > 2*(D8+D10+D11+D12+D13+D14).$$

In the inventory report template, a suggestion for text discussing these issues is pre-entered. If the tests are negative, simply erase the proposed discussion text (see the report template).

These tests should not be understood as giving certain evidence that the default factors are overestimated, but they do give an indication of this. In principle, mercury flows to waste and wastewater from other sectors (without intentional

[13] If an error message occurs, for example "Value?", please check if you have answered all source presence questions (y/n/?). To make sure that the test is made on a firm background, please re-check that all activity rates and other input data are entered correctly.

mercury use) could also contribute, but they would more often not contribute to the general waste/wastewater stream, but rather to sectors specific streams.

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