UNITED NATIONS

UNEP

BC

UNEP/CHW.13/INF/22*

Distr.: General
10 April 2017

English only

BASEL CONVENTION

Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal
Thirteenth meeting
Geneva, 24 April–5 May 2017
Agenda item 4 (b) (iv)

Matters related to the implementation of the Convention: scientific and technical matters: national reporting

Draft practical guidance for the development of inventories of used lead-acid batteries, waste electrical and electronic equipment and waste oils

Note by the Secretariat

1. As referred to in the note by the Secretariat on national reporting (UNEP/CHW.13/8), the annexes to the present note set out the following documents:

(a) Annex I: draft practical guidance for the development of inventories of used lead-acid batteries;

(b) Annex II: draft practical guidance for the development of inventories of waste electrical and electronic equipment;

(c) Annex III: draft practical guidance for the development of inventories of waste oils.

2. The present note, including its annexes, has not been formally edited.

* Reissued for technical reasons on 13 July 2017.

Annex I

Draft practical guidance for the development of inventories of used lead-acid batteries

Contents

1 Introduction

1. Parties to the Basel Convention are required under Article 13, paragraph 3, of the Convention to transmit each year to the Conference of the Parties a national report on information related to the measures taken towards its implementation. Undertaking inventories can be an effective way of gathering information on the generation, transboundary movements and management of hazardous and other wastes for the purpose of national reporting. Such information and others are to be submitted, through the Secretariat of the Convention, using the national reporting format.[1]

2. This guidance aims to provide practical instructions to assist Parties and others in developing an inventory of waste lead-acid batteries. It is meant to be used in conjunction with the Methodological guide for the development of inventories of hazardous wastes under the Basel Convention [1] which provides complementary guidance on the methods of developing national inventories for the preparation of national reports. Accordingly, this guidance proposes an approach for developing an inventory that is consistent with the one contained in the Methodological guide.

3. The main objective of developing an inventory of waste lead-acid batteries is to obtain information on the amount of such waste generated in a country, its disposal and transboundary movement. Knowledge of the amount of waste generated provides a sound basis for their environmentally sound management (ESM) [2]. This information can be used to develop appropriate policies and strategies for the collection and disposal of waste lead-acid batteries and is an important input into the planning of recycling facilities that require substantial financial investment and regular throughputs of wastes. In addition, the development of the inventory can provide insight into the effectiveness of the system in place in a country to control the transboundary movements of waste lead-acid batteries.

2 Description of lead-acid batteries and their wastes

2.1 Classification of waste lead-acid batteries

4. For developing the inventory, establishing a classification of wastes that is used consistently will help ensure comparability of inventory information collected from various sources and over the years. Wastes should also be classified in a way that serves the objectives of developing the inventory, such as for the planning of disposal facilities. The format for national reporting under the Basel Convention requires that some of the information provided be categorized according to Annex I or Annex VIII codes. Therefore, in developing the inventory, using a classification of ULAB that is harmonized with the annexes of the Basel Convention will make it easier to integrate the outputs of the inventory into the national report.

5. The Technical Guidelines on the management of waste lead-acid batteries contains a detailed description of lead-acid batteries (LAB) and their operation [3]. The lifetime of a battery is the period of time during which a battery is capable of being discharged and recharged, and retains the charge applied. Once the battery is no longer capable of being recharged or cannot retain its charge, it has reached the end of its useful lifetime and becomes a “used battery” for the application for which it was designed. Such batteries are referred to as used lead-acid batteries (ULAB) in this guidance.

6. ULAB, the substances they contain and their components are included in Annex I and VIII to the Basel Convention as follows:

Annex I:

Y31: lead; lead compounds

Y34: acidic solutions or acids in solid form

Annex VIII:

A1160: waste lead-acid batteries, whole or crushed

A4090: waste acidic or basic solutions, other than those specified in the corresponding entry on list B (note the related entry on list B B2120)

2.2 Lead-acid batteries and their applications

7. Understanding of the patterns of use of LAB helps to determine the potential generators of LAB wastes. LAB are best known for their use in automotive vehicles as the electrical power supply for

[1] UNEP/CHW.12/INF/16/Rev.1; available through the electronic reporting system at http://www.basel.int/Countries/NationalReporting/ElectronicReportingSystem/tabid/3356/Default.aspx

Starting, Lights and fuel Ignition (The SLI Battery) but they serve many other uses. LAB can be classified in the following main categories:

(a) Automotive: supply power to the starter and ignition system to start the engine in vehicles powered by gasoline, such as cars, motorcycles, planes, etc. They are typically known as starting, lighting and ignition (SLI batteries).

(b) Motive: supply power to the motor and other parts of electric vehicles e.g. electric cars and fork lift trucks.

(c) Stationary storage applications in the industrial and commercial sectors: used for energy storage in an industrial and commercial setting and typically not meant to be mobile.

(d) Stationary storage applications in the domestic sector: used for energy storage in a home or office setting and typically not meant to be mobile.

8. Increasingly, LAB are being used to make energy generation more efficient, through load shedding and peak loading provisions. In this context, LAB are also the main choice of storage media for renewable energy, such as solar, hydro and wind, including for home systems in developing countries. There is also a growing interest in the use of electric vehicles to reduce pollution; the most common ones powered by LAB are public buses and small taxis. An overview of the main categories of LAB, their applications and users is provided in **table 1**. Users of LAB are potential sources of information on the generation of ULAB. Actors involved in the management of ULAB are also potential data sources for the inventory. Figure 1 illustrates the flow of materials and waste among the actors of a closed-loop system for the management of ULAB.

Table 1. Main applications of LAB

Category of LAB	LAB applications	Main users
Automotive	Cars, trucks, buses, motorcycles, etc	Individuals, businesses, public transport sector
Motive power	Light electric vehicles (electric cars and hybrids, bicycles, etc)	Individuals, businesses, public transport sector
	Heavy duty vehicles e.g., fork trucks, airport plane tractors	Transport businesses, warehouses, airports
Stationary storage applications: industrial and commercial	Electricity supply: back-up power systems and load levelling for grid supply networks	Electricity supply companies
	Renewable energy storage (solar, hydro and wind) systems	Electricity supply companies
	Emergency services: back-up power systems to supply electric power in the event of power outage for critical services	Police, hospitals and government institutions
	Large-scale Uninterrupted Power Supply (UPS) systems: back-up power to protect against power outage	Banks, shops, hotels, factories, providers of IT and financial services
	Telecommunications systems: back-up power systems for mobile phone towers and field facilities	Mobile phone / telecommunications providers
	Energy storage for street lighting systems powered by solar panels	Urban agglomerations, towns, villages.

Category of LAB	LAB applications	Main users
Stationary storage applications: domestic	Desktop UPS systems	Houses and small businesses
	Renewable energy storage systems (solar, hydro and wind) supplying voltages from 110 – 220 volts	Houses and small businesses in remote areas
	Back-up power systems (usually consisting of a bank of LAB connected to an inverter/charger and is connected to the electric grid for recharging): provides electrical power when grid supply fails	Houses and small businesses
	Back-up power for security systems	Houses, businesses

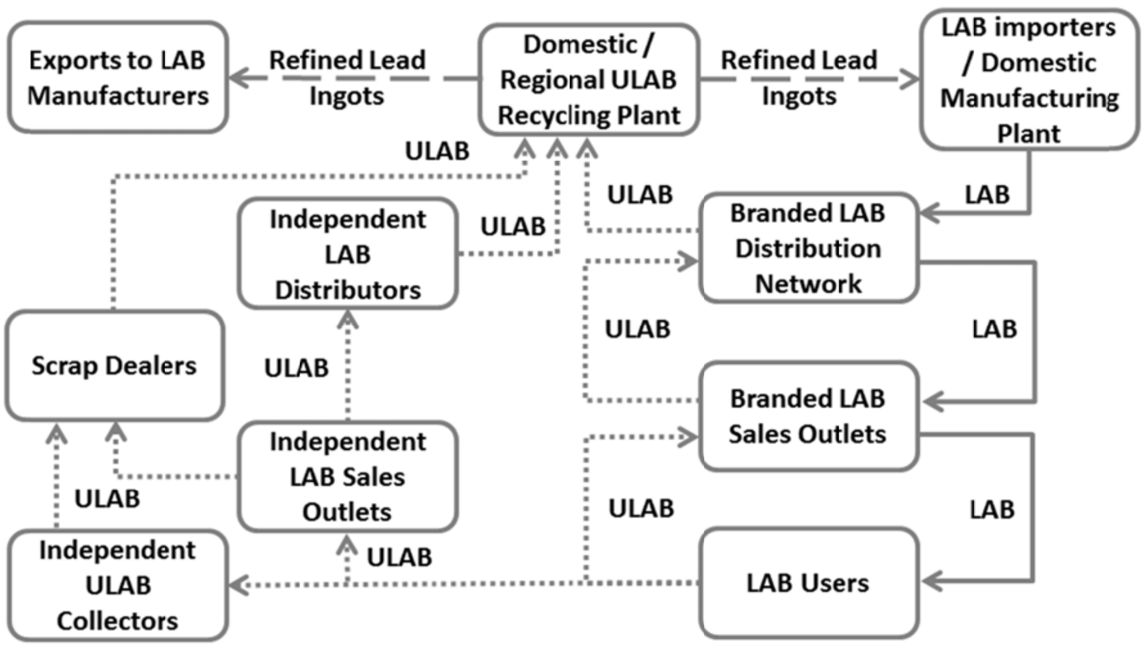

Figure 1. An example of the closed-loop system showing the generation and management of ULAB. The boxes represent the main actors involved in the life-cycle of LAB. The dashed lines show the flow of lead ingots, the solid lines show the flow of LAB and the dotted lines show the flow of ULAB.

3 Defining the scope of the inventory

9. Important questions to be answered in defining the scope of the inventory include: its purpose (including for completing the national report under the Basel Convention), desired outcomes, category of ULAB to be included (see table 2 and section 4.1.1), geographical area to be covered and specific exclusions and limitations due to e.g. access to information sources. When data will be collected from a defined geographic area, the results of the inventory will have to be extrapolated to the entire country to compute a national estimate.

4 Methodologies for developing the inventory

10. This guidance provides a methodology for developing a first generation inventory of ULAB. This methodology is appropriate for the early stages of development of a national system for the environmentally sound management of ULAB when a national system for collecting data from waste generators is not yet fully developed.

11. The methodology for developing the inventory relies on readily available statistics on the use of LAB and estimates of other key parameters needed for calculating the amount of ULAB generated. A more detailed and comprehensive inventory will require data collected from waste generators and other stakeholders through surveys and field visits. Progressing towards a more detailed inventory requires a larger investment of resources but also results in more accurate outputs.

12. The inventory of ULAB is developed in two steps. First, data is collected on the amount of LAB in use for each LAB application (section 4.1.1). In the second step, the amount of ULAB generated is estimated based on the lifespan of the LAB and their respective weight (section 4.1.2).

4.1 Collecting information on LAB use

13. A cost-effective way to gather data on LAB use is to request information from stakeholders using standard questionnaires. These should be designed to obtain data in a consistent manner that will allow the ULAB amount to be estimated for each LAB application. Questionnaires should contain an explanation of how the data should be entered. The annex to this guidance contains an example of a questionnaire for collecting information on LAB use for energy storage applications in the industrial and commercial sectors. It can be adapted for other categories of LAB. Follow-up phone calls to stakeholders after they receive the questionnaires can help ensure a high response rate.

14. Likely sources of information for various applications of LAB and the information to be requested are provided in **table 2**. The information collected for the inventory can be recorded in a database that will set a baseline for future updates. **Table 3** provides an example of a format for such a database. This format can also be used to compute the total amount of ULAB generated.

15. When developing a strategy for data collection, the following considerations are helpful:

(a) In many countries, for the first generation inventory, data on the use of some applications of LAB can be obtained indirectly from national or local authorities rather than from LAB users. For example, in most countries motor vehicles that use the public roads must be registered with a designated government agency that can be contacted to obtain data on the total number of vehicle registrations. Since each motor vehicle contains a LAB unit, the total number of LAB units used in the transport sector can easily be estimated.

(b) For some applications, it will be necessary to contact a number of different sources. If information is lacking from one source, such as the number of vehicle registrations from the ministry of transport, the information may be available from another source, such as the finance ministry, which should have records of vehicle imports and domestic sales in order to collect tax revenues.

(c) In some countries without a LAB manufacturing industry, for certain applications such as renewable energy storage systems for domestic use, there may be only a few importers/suppliers of LAB who can be asked to provide sales data.

(d) The applications listed in table 2 may not be important for all countries. For example, there may be very few solar street lights that use LAB for energy storage in a given country or geographic area.

16. When possible, the following information should also be collected from LAB users, either through the questionnaire or interviews:

Number of LAB used per system or equipment: for some applications, it is important to request information on the actual number of LAB being used in each system or equipment or plant. Individual automobiles usually contain a single LAB, but depending on the electric load requirements, a home solar system, for example, may contain bank of 2 to 12 LAB. The number and the weight of LAB used for industrial stationary storage applications vary across countries.

Average weight of each LAB: Table 3 provides information about the average weights of LAB units for various applications. For most LAB applications, however, there is a range of weights due to variations in the amount of lead and acid in the battery. For example, the average weight of a 12 volt SLI LAB is 14 kilos, but the best quality SLI LAB will weigh 17 kilos. The information provided in table 3 can serve as a guide for an initial inventory but more precise information on the weight of LAB used in a country should be collected from users, importers and manufacturers of LAB in the course of the inventory.

Useful life factor (ULF): This is the average useful life that the users obtain from the LAB and is calculated as the inverse of the lifespan of the LAB. It provides the proportion of LAB that has the probability of becoming waste in any period of 12 months. For example, for a type of LAB that needs replacing every five years on average, the ULF will be 0.2, implying that 20% of this type of LAB will be replaced in any 12 month period. Because of wide variations in the ULF depending on battery quality, climate and use pattern, country-specific information should be obtained from users of LAB in the course of the inventory.

Table 2. Information to be requested for developing the inventory and their likely sources

Category of LAB	LAB Applications	Information requested	Possible information sources
Automotive and motive	Motor vehicles (cars, buses, etc) and electric vehicles.	Number of vehicles registered	Ministry of transport (or other vehicle registration agency)
Stationary storage applications: Industrial	Electricity supply: back-up power systems	• Number of LAB per system • Lifespan and weight of LAB	Electricity supply companies; ministry of energy or natural resources
	Renewable energy storage systems	• Number of LAB per system • Lifespan and weight of LAB	Electricity supply companies
	Emergency services: back-up power systems	• Number of LAB per system • Lifespan and weight of LAB	Ministries and local authorities responsible for education, health care and emergency services.
	Telecommunication and mobile phone facilities	• Number of LAB per system • Lifespan and weight of LAB	Telecommunications and mobile phone companies
	Street lighting	• Number of streetlights in operation • Lifespan and weight of LAB	Municipal authorities in charge of maintenance
Stationary storage applications: Domestic	Uninterrupted Power Supply (UPS) units	• Number of LAB per system • Lifespan and weight of LAB	Major suppliers of computer equipment
	Renewable energy storage systems	• Number of home solar systems sold • Number of LAB system • Lifespan and weight of LAB units	Ministries of energy, environment and natural resources, renewable energy systems suppliers

Category of LAB	LAB Applications	Information requested	Possible information sources
	Back-up power systems	• Number of home back-up power systems sold • Number of LAB per system • Lifespan and weight of LAB	Ministries of energy, environment and natural resources, home power systems suppliers
	Security systems	• Security systems installed • Number of LAB used per system • Lifespan and weight of LAB	Major security system suppliers

4.2 Estimating the amount of ULAB generated

17. For each application of ULAB listed in the database, the amount of ULAB generated per year is calculated according to the following formula:

Step 1: Number of LAB in use = number of systems/equipment in use[a] x number of LAB per system/equipment[b]

Step 2: Amount of LAB in use (kg) = Number of LAB in use x average weight of LAB unit[c] (kg)

Step 3: Amount of ULAB **generated** (kg) = Amount of LAB in use (kg) x Useful life factor[d]

Step 3b: Amount of ULAB **generated** (metric tons) is equivalent to amount of ULAB **generated** (kg) x 0.001

a, b, c and d refer to data in the respective columns of table 3

18. Example calculation:

In a country with 3 telecommunications stations, each using 1 back-up system that contain 12 LAB with a lifespan of 8 years (i.e, a ULF of 0.125). Assuming an average weight of 30 kg for each LAB (see table 3), the amount of ULAB generated annually will be calculated as follows:

1. Number of LAB in use = 3 x 12 = 36
2. Amount of LAB in use = 36 x 30 kg = 1080 kg
3. Amount of ULAB generated annually= 1080 x 0.125 = 135 kg which is equivalent to 0.135 metric tons

19. After the quantities of ULAB generated have been calculated for each category and application of LAB listed in the database, they are summed up to provide the total amount of ULAB generated.

Table 3. An example of a format for the database on ULAB

LAB Category	LAB Applications	No. of systems (a)	No. of LAB per system (b)	No. of LAB in use	Average LAB weight (kg) (c)	Amount of LAB (metric ton)	Lifespan (years)	ULF (d)	Amount of ULAB generated (metric ton)
Automotive	Cars		1		14				
	Trucks		1		30				
	Buses		1		30				

LAB Category	LAB Applications	No. of systems (a)	No. of LAB per system (b)	No. of LAB in use	Average LAB weight (kg) (c)	Amount of LAB (metric ton)	Lifespan (years)	ULF (d)	Amount of ULAB generated (metric ton)
	Motorcycles		1		5				
Motive power	E-bikes and scooters		1		10				
	Electric vehicles – Cars		1		40				
	Electric vehicles – Three Wheelers		1		30				
	Heavy duty electric vehicles – buses airport plane tractors, etc		1		60				
Stationary storage: Industrial & commercial	Electricity supply – Back-up and load levelling systems				70				
	Solar energy systems				65				
	Wind turbine power systems				65				
	Back-up-Emergency services				65				
	Back-up UPS units – Commercial				65				
	Telecommunication/mobile phone stations				30				
	Street lighting		1		5				
Stationary storage: Domestic	Desktop - Uninterrupted Power Supply (UPS) units		1		11				
	Renewable energy systems				30				
	Back-up power systems		1		30				
	Security systems		1		2				
								Total	

4.3 Refining the first generation inventory

20. For an initial inventory, the amount of ULAB generated can be estimated for the automotive sector only. Since this sector accounts for the largest share of the market for LAB in most countries, the inventory output will provide an estimate of the bulk of ULAB generated. Information on vehicle registration can be obtained directly from government authorities. A small survey of key actors such as vendors of automobile and LAB as well as repair shops can provide information on the lifespan of LAB for various types of vehicles.

21. To refine the first generation inventory, data can be collected from additional sources of information such as those listed in table 3 if these are relevant for the country. Field visits and interviews to collect more detailed information for the most important applications will also provide a more complete and accurate picture of the amount of ULAB generated nationally.

5 Preparing national summaries and forecasts

22. If the inventory has been developed based on information from a limited geographic area, then the estimated amount of ULAB generated in that area has to be extrapolated to the whole country to obtain a national estimate. Forecasting in the early years following the development of an initial inventory of ULAB may be difficult. If policies affecting the transport sector, renewable energy generation and telecommunications are well established, then forecasting the changes in LAB use can be performed with a degree of certainty. However, if these policies are unknown or changing, then it

will be necessary to prepare historical databases for the previous 5 or 10 years and examine the trends in LAB use in the various categories in order to prepare a forecast.

23. Information on the total amount of hazardous wastes generated is requested in table 6 of the national reporting format. Parties have the option of providing detailed information concerning specific hazardous wastes categorized according to the codes of Annex I or VIII to the Basel Convention or national codes. Further instructions can be found in the Manual for completing the format for national reporting under the Basel Convention [4].

6 Obtaining data on options for waste disposal and recovery

24. Information on options for the final disposal and recovery of hazardous wastes and other wastes available in a country are to be provided in table 2 and table 3 of the national reporting format, respectively. It is therefore important to collect on existing facilities for the disposal and recycling of ULAB in the course of developing the inventory. Information on the amount of ULAB processed by these facilities can also be cross-checked against the amount of ULAB generated to assess the accuracy of the latter (see section 9). When such facilities do not yet exist, information collected on alternative disposal practices will help in devising an appropriate strategy for the ESM of ULAB

7 Obtaining data on the transboundary movements of ULAB

25. Parties to the Basel Convention have the obligation to designate one or more authorities (competent authorities) for approving the transboundary movements of hazardous and other wastes. Competent authorities should therefore maintain a record of annual imports and exports of ULAB. Parties should provide this information in table 4 (export) and table 5 (import) of their national report.

8 Updating the Inventory

26. Applying the methodology described in section 4 provides an estimate of the amount of ULAB generated in a given year. To monitor the amount of ULAB generated every year it is recommended to establish a procedure for collecting the needed information from sources on a regular basis so that the inventory can be updated. For instance, a procedure could be established to send out the questionnaires to the data sources at a given date each year. Similarly since information on the import and export of ULAB will likely vary from year to year, the data can be updated by obtaining it from the competent authorities on an annual basis (see section 7).

9 Assessment of results and conclusions

27. It is important to assess the results of the inventory to identify measures that can make it more complete. Key elements to be assessed include the reliability of the data collected and the accuracy of the results. The assessment may also identify potential gaps in the control system for the implementation of the Basel Convention.

28. On approach to assessing the accuracy of the ULAB inventory is to compare the amount of ULAB generated to independent information on the flows of the ULAB in the country. For a country where secondary lead smelters operate, assuming that all ULAB are recycled by these facilities, the amount of ULAB processed by the smelters should be equal to the sum of the amount imported and generated domestically subtract the amount exported, if any. If a country exports all the domestically generated ULAB for disposal (recycling), the amount of ULAB generated should be close to the amount exported.

29. Licensed lead smelters should keep records of the amount of ULAB recycled. As described above, information on the amount of ULAB imported and/or exported legally should be available from the competent authorities for the Basel Convention. However, depending on how ULAB are classified and notified to the competent authorities, the information provided may not be easily translated into quantities of ULAB (in tons) and directly compared to the amount of ULAB generated. For example, the following descriptions are used by various countries for waste shipments classified under Y31: lead waste, scrap from used lead acid batteries, lead compounds, lead plates. Furthermore, if ULAB is shipped together with other wastes, the competent authority may record the weight of the consignment but not of each waste within.

30. Discrepancies between the amount of ULAB generated and the amount disposed/recycled domestically and/or exported could be due to a number of reasons that are worth investigating. They could indicate inaccuracies in the data collected, poor record keeping, differences in classification, missing data, etc. In some cases, consulting other sources of information may also help to resolve

discrepancies; for instance, information on the transboundary flows of ULAB could also be obtained from customs authorities and the Comtrade database[2].

31. Discrepancies could also point to potential gaps in the control system for the transboundary movements of ULAB and areas where measures are needed to ensure the environmentally sound management of this waste. For example, deficits in the export of ULAB could be an indication that some ULAB is exported illegally, without notification to the competent authorities. In some countries, a proportion of ULAB generated is disposed of through informal recycling rather than licensed lead smelters.

10 References

[1] ICC (Committee for Administering the Mechanism for Promoting Implementation and Compliance of the Basel Convention). 2014. Methodological guide for the development of Inventories of hazardous wastes and other wastes under the Basel Convention. Available at: http://www.basel.int/portals/4/download.aspx?d=UNEP-CHW.12-9-Add.1.English.pdf

[2] UNEP. 2017. Revised factsheets on specific wastestreams. UNEP/CHW.13/INF/7

[3] UNEP. 2003. Technical Guidelines for the Environmentally Sound Management of Waste Lead-acid Batteries. Basel Convention series/SBC No. 2003/9. Available at: http://www.basel.int/Implementation/Publications/TechnicalGuidelines/tabid/2362/Default.aspx

[4] UNEP. 2017. Manual for completing the format for national reporting under the Basel Convention. Available at http://www.basel.int/Countries/NationalReporting/Guidance/tabid/1498/Default.aspx

[2] https://comtrade.un.org/

Annex

Example of a questionnaire for the survey of LAB use in stationary storage applications

Dear Sir/Madam,

This questionnaire is for collecting data on lead-acid batteries (LAB) to determine the amount of waste that results from their use. The information you provide will only be used for the purpose of developing an inventory of used lead-acid batteries. Thank you for your cooperation.

Section A: Respondent information

Name	
Role/title	
Organization	
Address	
Telephone	
E-mail	
Date of completion	

Section B: Information on the use of lead-acid batteries

1. Please check the application for which LAB are used in your organization. For each application, indicate the number of systems/equipment /plant that contain LAB.
2.

Applications	**Check if applicable**	**Number of systems/equipment**
Electricity supply: back-up power and/or load levelling systems		
Solar energy storage systems		
Telecommunication and mobile phone facilities		

3. For each system/equipment reported above, please provide answers to the following questions in the table below:

   a) How many LAB does the system/equipment contain?
   b) What is the average weight (in kilograms) of a LAB contained in the system/equipment?
   c) What is the lifespan of the LAB used? (The lifespan is the number of years between the time of first use of the LAB to the time of its disposal)

System/equipment	(a) Number of LAB	(b) Average weight (kg)	(c) Lifespan (years)
1			
2			
3			

Annex II

Draft practical guidance for the development of inventories of waste electrical and electronic equipment

Contents

1 Introduction

1. Parties to the Basel Convention are required under Article 13, paragraph 3, of the Convention to transmit each year to the Conference of the Parties a national report on information related to the measures taken towards its implementation. Undertaking inventories can be an effective way of gathering information on the generation, transboundary movements and management of hazardous and other wastes for the purpose of national reporting. Such information and others are to be submitted, through the Secretariat of the Convention, using the national reporting format.[1]

2. This guidance aims to provide practical instructions to assist Parties and others in developing an inventory of waste electrical and electronic equipment (e-waste). It is meant to be used in conjunction with the Methodological guide for the development of inventories of hazardous wastes under the Basel Convention [1] which provides complementary guidance on the methods of developing national inventories for the preparation of national reports. Accordingly, this guidance proposes an approach for developing an inventory that is consistent with the one contained in the Methodological guide.

3. The main objective of developing an inventory of e-waste is to obtain information on the amount of such waste generated in a country, its disposal and transboundary movement. Knowledge of the amount of waste generated provides a sound basis for their environmentally sound management (ESM) [2]. This information can be used to develop appropriate policies and strategies for the collection and disposal of waste e-waste and is an important input into the planning of recycling and disposal facilities that require substantial financial investment and regular throughputs of wastes. In addition, the development of the inventory can provide insight into the effectiveness of the control system in place in a country to regulate the transboundary movements of e-waste.

2 Description and classification of e-waste

4. For developing the inventory, establishing a classification of wastes that is used consistently will help ensure comparability of inventory information collected from various sources and over the years. Wastes should also be classified in a way that serves the objectives of developing the inventory, such as for the planning of disposal facilities. The format for national reporting under the Basel Convention requires that some of the information provided be categorized according to Annex I or Annex VIII codes. Therefore, using a classification of wastes that is harmonized with the annexes of the Basel Convention will make it easier to integrate the outputs of the inventory into the national report.

5. E-waste is included in Annex VIII to the Convention under the following entry for hazardous waste:

> "A1180 Waste electrical and electronic assemblies or scrap[2] containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III (note the related entry on list B B1110)."[3]

6. Further guidance on hazardous components or substances that may be contained in e-waste is provided in the Technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention [3].

7. E-waste is often misunderstood as comprising only waste of computers and related IT equipment. However, a diverse range of electrical and electronic equipment (EEE) is put on the market in most countries and eventually become waste. The main categories of EEE listed in WEEE directive[4] of the European Union is provided in table 1 as an example of the range of products that can be considered as EEE.

8. The diversity of EEE that exists on the market complicates the classification of e-waste for the purpose of developing an inventory. In an attempt to harmonize the collection and compilation of statistics on e-waste, a system has recently been developed that encompasses the majority of EEE and classifies them in categories based on similar function, comparable material composition and related

---

[1] UNEP/CHW.12/INF/16/Rev.1; available through the electronic reporting system at http://www.basel.int/Countries/NationalReporting/ElectronicReportingSystem/tabid/3356/Default.aspx

[2] This entry does not include scrap assemblies from electric power generation.

[3] PCBs are at a concentration level of 50 mg/kg or more.

[4] Directive 2012/19/EU, annex I; categories covered by the Directive until 14 August 2018.

end-of-life attributes [4]. In this system, each equipment is assigned a unique code known as the UNU key. An advantage of this classification system is that it is aligned with the codes of the Harmonized Commodity Description and Coding System[5] (HS) which is used globally for compiling statistics on trade. Using this system of classification will thus make it easier to use trade statistics for developing the national inventory (see section 4.1). Inventories developed using this system will also be comparable to one another and contribute to harmonizing statistics about e-waste on an international level.

Table 1. Categories of EEE listed in the European Union WEEE Directive

	Category
1.	Large household appliances
2.	Small household appliances
3.	IT and telecommunications equipment
4.	Consumer equipment and photovoltaic panels
5.	Lighting equipment
6.	Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
7.	Toys, leisure and sports equipment
8.	Medical devices (with the exception of all implanted and infected products)
9.	Monitoring and control instruments
10.	Automatic dispensers

9. For the development of an e-waste inventory and the assessment of its results, it is helpful to identify the main actors involved and understand their role in the e-waste management system, how they are organized and their impact on the flows of e-waste. Figure 1 provides an example of the flows of EEE and e-waste in a national management system.

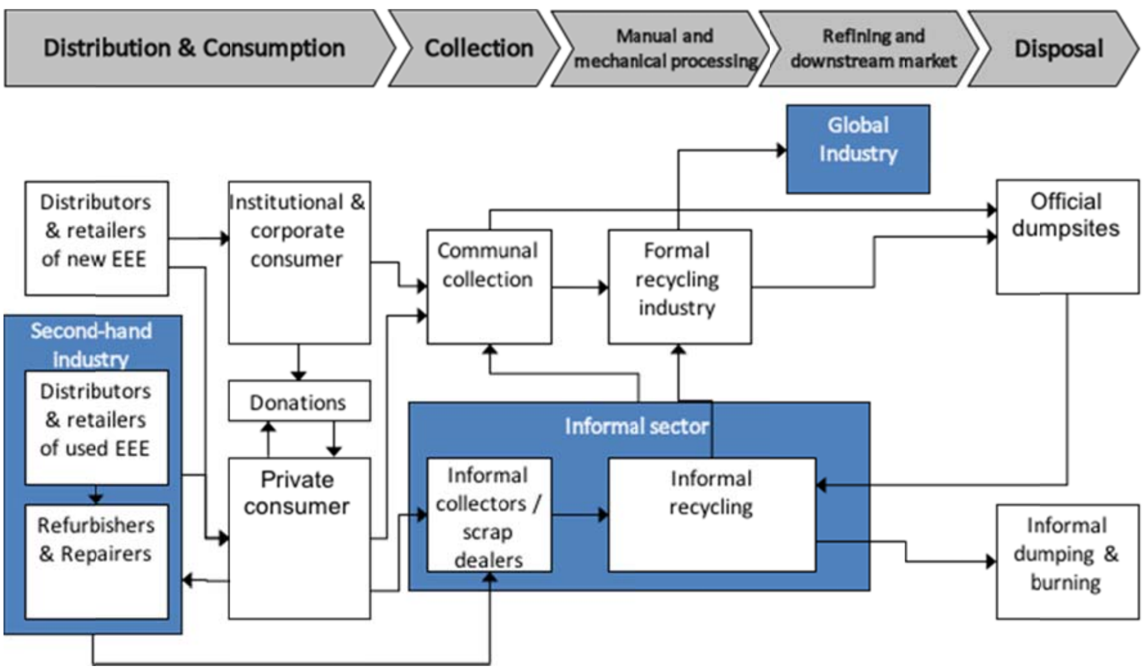

Figure 1: Example of a massflow chart, showing the key stakeholders in a (national) e-waste management system (adapted from [11])

[5] http://www.wcoomd.org/en/topics/nomenclature/instrument-and-tools/hs-nomenclature-2017-edition/hs-nomenclature-2017-edition.aspx

3 Defining the scope of the inventory

10. Important considerations in defining the scope of the inventory include: its purpose (including for completing the national report under the Basel Convention), desired outcomes, category of equipment to be included (see tables 1 and 2), geographical area to be covered and specific exclusions and limitations due to e.g. access to information sources and budget.

11. This document gives practical guidance on how to develop an inventory for the following categories of EEE: large household appliances, small household appliances, IT and telecommunications equipment and consumer equipment (categories 1-4 of table 1). The inventory methodology provided can be easily applied to any other category in case the national inventory needs to include additional ones.

12. The geographical focus defines which cities and/or regions will be targeted for data collection, and whether rural areas are considered. In the case the amount e-waste generated is estimated based on amount of EEE put on the market (section 4.1), this consideration is not relevant, since calculations rely on statistics of imports. In the case where the inventory will be developed based on field studies with questionnaires and surveys (section 4.2), data collection could initially concentrate on the main urban areas and results extrapolated to the entire country.

4 Methodologies for developing the inventory

13. This practical guidance proposes two approaches for the inventory of e-waste, to provide flexibility to a wide range of Parties with varying priorities and capacities. The two approaches present a different level of methodological complexity. Moving from the first to the second method implies a Party is opting for an approach that is progressively more demanding in terms of complexity and data requirements, and therefore more resources may be needed.

14. The first approach relies on readily available statistics in combination with estimates for key parameters (provided in this guidance) and possibly a few stakeholder interviews. The second approach involves more resource-intensive data collection activities but should also yield more accurate results. The proposed methodologies are useful for conducting a first-generation inventory in situations when a national system for collecting data from waste generators is not yet fully developed.

4.1 Estimate based on EEE put on the market

15. The methodology proposed in this section is derived from the market supply method**Error! Bookmark not defined.** and the approach developed by the United Nations University (UNU) under the Partnership for Measuring ICT for Development [4]. The method is based on historical data for the total amount of EEE put on the market. The e-waste generation potential in a given year is estimated by extrapolating the assumed life-span backwards in time.

16. The inventory is developed in two steps:

1. Estimation of **EEE put on the market** for the most relevant equipment categories based on import/export statistics;
2. Calculation of **e-waste generated** based on an average lifespan of each equipment category.

17. The methodology is appropriate for developing an inventory of e-waste in unsaturated EEE markets, which are typically found in developing countries. For saturated markets (as found in OECD countries) where only product replacement occurs, the average lifespan of a product becomes irrelevant. If the market supply method is to be applied to such situations, the numbers of obsolete appliances would equal the numbers of sales minus the number of reused items in the same year.

4.1.1 Data sources for the inventory

Data on EEE put on the market

18. Total EEE put on the market is defined as being equivalent to the domestic sales of equipment in a country. Sales data is usually collected by individual enterprises and often not publicly available. In that case, the amount of EEE put on the market has to be estimated through various statistics as follows:

Amount of EEE put on the market = domestic production + Import - Export

19. Data on domestic production may be available through national statistical information of economic activities, e.g, from the ministry of industry, commerce or finance and/or national statistical offices. However, for most countries the amount of domestic production is quite low when compared to

imports and therefore not very important for the estimate. The relative importance of production data has to be decided on a case by case basis.

20. Import and export of EEE can be assessed by analyzing trade statistics from international databases and national statistics and trade records compiled by customs and port authorities. The most widespread available international database is the UN Comtrade Database[6]. The database uses different classification systems to organize commodities, of which the most commonly used is the HS. For the first generation inventory it is recommended to concentrate on the types of equipment provided in Table . This represents the most relevant equipment in terms of (i) the total market size in terms of weight, (ii) hazardous components, and (iii) content of valuable resources, which would be lost if they are not recovered. Table 2 also links the HS codes to the corresponding UNU keys. A full list if all equipment types classified according to UNU keys and the corresponding HS codes can be found in UNU 2015 [4].

Table 2. Relevant product categories for the first generation inventory with reference to their UNU key and HS Code

UNU key	Equipment (according to UNU Key)	Corresponding HS Codes
0104	Washing machines	845012
0108	Fridge or combined fridge/freezer	841810, 841821, 841822, 841829
0111	Household Air conditioner	841510, 841581, 841582
0308	CRT monitors	852821, 852822, 852841, 852849
0407	CRT TVs	852812, 852813, 852873,
0303	Laptop, notebook, tablet	847130
0306	Mobile phones	851712, 851761, 851950, 852520
0309	Flat panel display for computer	852851, 852859, 853120
0408	Flat panels televisions	852872

21. Trade statistics only provide an indication of EEE that are officially imported into the country. The import of second-hand equipment, is often not officially reported and is therefore not captured by trade statistics. This information is crucial, however, as second-hand imports can comprise up to 70% of total imports in certain developing countries. The share of this type of import can be assessed by conduction interviews or surveys of importers and port authorities. Such surveys should clarify if import and export statistics (such as the UN Comtrade database) include second-hand equipment and should address at least the following key indicators:

(a) Type of imported products;

(b) Amount of imported products (e.g. in units, in tonnes, in full containers, etc.);

(c) The share of new imports relative to second-hand imports (e.g. in weight %).

22. If surveys cannot be conducted, data from countries with similar economic development and consumer behaviour (e.g. neighbouring countries) can be used. Table 3 present examples of such data, obtained from various field studies on e-waste flows. It is important to note this information is obtained from old reports and hence should be verified if used for developing an inventory.

Table 3. Import data of EEE (mainly for EEE in categories 1-4 of table 1), including rough estimations of the share of second-hand EEE for some African countries

Country	year	population	imports		Reference
		Millions	Units/year	Thereof secon-hand	
Ghana	2008	23.8	750,000	70%	[5]
Nigeria	2009	154.7	2,200,000	35-70%	[6]
Morocco	2009	32	900,000	<11%	[7]

[6] http://comtrade.un.org/db

South africa	2007	47.6	1,900,000	8%	[8]
Tanzania	2009	42.5	120,000	13%	[9]
Uganda	2007	28.8	29,000	14%	[10]

23. Data on the weight of equipment may also be needed to compute the total amount of EEE imported if only the number of units of imported equipment is known. An indicative list of the weight of selected equipment can be found in annex G of [11].

24. Table 4 below shows an example of the calculation of import of new and second-hand equipment in a country, based on analysis of trade statistics. In this example, the amounts of imported EEE, derived from UN Comtrade data, is adjusted by 30 % to account for second-hand imports that are not included in trade statistics. Data on imports was obtained for only four equipment types (so-called tracer products). On the assumption that these tracer products represent 43.5 % by weight of all imported EEE, the total amount of EEE imported could be calculated.

Table 4. Estimate of import of EEE based on the analysis of trade statistics (adapted from [5])

Product		No. of Units	Tons	Source
% for underdeclaration added	30%			
Refrigerator		983,654	34,428	UN comtrade 2008
Aircondition		919,908	17,018	UN comtrade 2008
Computer/laptop		984,317	17,718	UN comtrade 2008
Television		815,414	23,647	UN comtrade 2008
sum			92,811	
Products are % weight of all	43.5%			
Total imports			213,409	

Data on the lifespan of EEE

25. The average lifespan of an equipment is needed to calculate the amount of e-waste generated. Such data can be gathered from various sources and requires a small desk study. Table presents a sample lifespan data found in the literature based on studies from 1995 – 2017 in European and Latin American countries. It should be noted that such data can become outdated quickly, especially in growing markets, and should be verified for the specific geography in scope. Life-span data used for the inventory should preferably be obtained from recent reports and from national sources or from countries with similar economic development and consumer behaviour (e.g. neighbouring countries).

Table 5. Sample data for average the lifespan of various types of EEE

Equipment	Range (years)
camera	3.8 – 10.4
tv (cathode ray tube)	11.2 – 12.8
tv (flat panel)	7.3 – 11.3
desktop cumputer	4 – 10.7
laptop computer	2.9 - 7
mobile phone	1.5 - 9
printer	4 – 10.5
radio / hifi	9 – 13.8
video equipment	4.1 – 9.5
microwave	5.2 – 8.3
fridge / freezer	9.5 – 12.3
washing machine	7.6 – 10
oven	8.3 – 11.1

4.1.2 Estimating the amount of e-waste generated

26. The amount of e-waste generated is estimated on the premise that an equipment will become waste at the end of its lifespan. It follows that:

For each type of equipment, Amount of e-waste generated in year t = amount of EEE put on the market in year (t – average lifespan of equipment) Where t is the year of the inventory

27. The amount of EEE put on the market in the year (t - lifespan) is estimated as follows:

For each type of equipment, Amount put on the market (kg) = amount of domestic production + amount of new import + amount of second –hand import – amount of export

28. <u>Example calculation</u>

Assuming an average life-span of 7 years for desktop computers, the estimated amount of desktop computers generated as e-waste in 2016 = the amount of desktop computers put on the market in 2009 (= 2016 – 7).

4.2 Estimates based on consumption and use

29. The second methodology proposed in this guidance is based on the consumption and use method. It is derived from the approach used in E-Waste Assessment Methodology - Training & Reference Manual [11]. The inventory relies on field surveys to assess the behaviour of EEE consumers in a specific country. The inventory is developed in two steps:

1. Assessment of the amount of **EEE in use or stored at consumer level** (stocks) based on consumer surveys
2. Calculation of the amount of **e-waste generated**, also based on the survey

4.2.1 Data sources for the inventory

30. Data should be collected from main consumers of EEE (i.e, the main sources of e-waste generation) to assess the amount of EEE stockpiled (EEE in use or stored at consumer level) and the average lifespan (combined time of use and storage by the consumer) of the each equipment type. Additional information should be collected on parameters that will allow extrapolation of the collected data to a national level.

31. The main consumers of EEE are classified in two groups:

(a) Private consumers (households);

(b) Institutional and corporate consumers (public institutions, government, parastatals, health and educational sector, large businesses (industries), small and medium enterprises).

32. The data collection for this methodology is done through questionnaires that are targeted at these different types of consumers in order to assess the key indicators. Examples of questionnaires for the survey are provided in the annexes to this guidance and should be tailored to the scope and context of the inventory.

Surveys of private consumers (households)

33. Household surveys will produce data in the format of “per household”. National statistics on the number and average size of households (e.g. from census data) will be necessary to extrapolate data to the entire country, keeping in mind differences in rural and urban consumer behaviours and income classes. Therefore, household surveys could be carried out in both rural and urban areas, and among different income classes. The questionnaire should request information for the following key indicators:

(a) The type and amount of installed EEE in the household;

(b) Average lifespan of each individual equipment (distinguishing between how long an appliance is in use and how long it is stored before being given away/ entering the waste stream);

(c) Size of the household (number of persons);

(d) Demographic location of the household (rural or urban);

(e) Income class of the household (classified according to the official national income classification, in order to be compatible with national statistics).

Survey of institutional and corporate consumers

34. The questionnaires need to take into account different economic sectors that might feature different consumer behaviours, e.g. the banking sector might consume more ICT appliances than the manufacturing industry. The chosen economic sectors should be in accordance with national statistics about employee distribution levels between the different economic activities (i.e. sectors). This will make it possible to extrapolate from the survey results to the national level. The questionnaire should address the following key indicators:

(a) The type and amount of installed EEE in the organization;

(b) Average lifespan of each individual appliance (distinguishing between how long an appliance is in use and how long it is stored before being given away/entering the waste stream, respectively);

(c) Size of the organization (number of employees);

(d) Type of organization and main activity (institutional or corporate, economic sector).

4.2.2 Estimating the amount of e-waste generated

The amount of e-waste generated is calculated as follows:

For each type of equipment, Amount of e-waste generated (metric tons) annually = amount of equipment stockpiled (metric tons) / average lifespan of the equipment

<u>Example calculation</u>:

If in 2009, 5000 metric tons of television were timated to be stored by households, assuming an average lifespan of 7 years for televisions, the average amount of television to become waste per year is 5000/7 = 714 metric tons.

35. For a detailed understanding of the application of the methodologies presented in the guidance, including questionnaire use and compilation of the resulting data for inventory development, it is helpful to refer to reports of e-waste inventories developed using these methodologies (see references in table 3).

5 Preparation of national summaries

36. Translating the results of the inventory to a national estimate of the amount of e-waste generated is a complex task. The coverage of data sources may be incomplete due to limitations in data availability and quality and resource constraints. In cases where the amount of e-waste generated has been calculated on the basis of amount of EEE put on the market, the results represent a national estimate. As explained above, if the consumption and use method is used, data should be collected that allow extrapolation of the results to the national level. The underlying assumptions and limitations of the national estimate should be indicated when reporting on this information.

37. Information on the total amount of hazardous wastes generated is requested in table 6 of the national reporting format. Parties have the option of providing detailed information concerning specific hazardous wastes categorized according to the codes of Annex I or VIII to the Basel Convention or national codes. Further instructions can be found in the Manual for completing the format for national reporting under the Basel Convention [12].

6 Obtaining data on options for waste disposal and recovery

38. Information on options for the final disposal and recovery of hazardous wastes and other wastes available in a country is requested in table 2 and table 3 of the national reporting format, respectively. It is therefore important to collect information on existing facilities in the course of developing the inventory, through field studies and by holding interviews with key stakeholders of the waste sector. When such facilities do not yet exist, information obtained on e-waste collection and alternative disposal practices will help in devising an appropriate strategy for the ESM of this waste stream.

7 Obtaining data on transboundary movements

39. Parties to the Basel Convention have the obligation to designate one or more authorities (competent authorities) for approving the transboundary movements of hazardous and other wastes. Competent authorities should therefore maintain a record of annual imports and exports of e-waste. Parties should provide this information in table 4 (export) and table 5 (import) of their national report.

8 Updating the inventory

40. It is recommended that data collected in the course of the inventory and its results be managed in an appropriate database and be shared with governmental agencies responsible for statistics and resource and waste management. Establishing a procedure for requesting data from stakeholders on a regular basis will help ensure that the inventory is updated.

41. Over time, as a country progresses through iterations of the inventory, the data quality should become more reliable. It is assumed that countries establish and update inventories of e-waste for waste management and material recovery purposes and that this will result over time in more robust inventories.

9 Assessment of results and conclusions

42. An assessment of the results of the inventory, the strategy and process used and information collected are needed to identify further actions needed to make the inventory more complete. The assessment may also identify potential gaps in the control system for the implementation of the Basel Convention. A gap analysis in the execution of the first generation inventory could result in the need to consider alternative statistics, contact some of the stakeholders again to get more information or identify other stakeholders to be contacted to help fill the gaps.

43. The amount of e-waste generated can be compared to the flows of e-waste in the country. Discrepancies between the amount of e-waste generated and the amount disposed/recycled domestically and/or exported could be due to a number of reasons that are worth investigating. They could indicate inaccuracies in the data collected, poor record keeping, differences in classification, missing data, etc. They could also point to deficiencies in the management system of e-waste and the control of their transboundary movement.

10 Reference

[1] ICC (Committee for Administering the Mechanism for Promoting Implementation and Compliance of the Basel Convention). 2014. Methodological guide for the development of Inventories of hazardous wastes and other wastes under the Basel Convention. Available at: http://www.basel.int/portals/4/download.aspx?d=UNEP-CHW.12-9-Add.1.English.pdf

[2] UNEP. 2017. Revised factsheets on specific wastestreams. UNEP/CHW.13/INF/7

[3] UNEP. 2015. Technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention. UNEP/CHW.12/5/Add.1/Rev.1.

[4] UNU, 2015: E-waste statistics - Guidelines on classification, reporting and indicators. Partnership on measuring ICT for development. United Nations University, IAS - SCYCLE, Bonn, Germany.

[5] Green Advocacy, Empa. 2011. Ghana e-Waste Country Assessment. Report of component 1&2 of the UNEP SBC E-waste Africa Project for Ghana. Accra, Ghana.

[6] Ogungbuyi O, Nnorom I.C, Osibanjo O, Schluep M. 2011. Nigeria e-Waste Country Assessment. Basel Convention Coordinating Centre for Africa (BCCC-Nigeria) and Swiss Federal Laboratories for Materials Science and Technology (Empa), Ibadan,Nigeria

[7] Laissaoui SE, Rochat D. 2008. Technical report on the assessment of e-waste management in Morocco. Casablanca, Morocco: Moroccon Cleaner Production Center & Empa.

[8] Finlay A, Liechti D. 2008. e-Waste assessment South Africa. Johannesburg / South Africa: Openresearch, Empa.

[9] Magashi A, Schluep M. 2011. e-Waste Assessment Tanzania. UNIDO e-waste initiative for Tanzania. Cleaner Production Centre of Tanzania & Empa Switzerland.

[10] Wasswa J, Schluep M. 2008. e-Waste assessment in Uganda: A situational analysis of e-wastemanagement and generation with special emphasis on personal computers. Kampala/Uganda, St.Gallen/Switzerland: Uganda Cleaner Production Center, Empa.

[11] Schluep M., Müller E., Ott D. and Rochat D., 2012: e-Waste Assessment Methodology - Training & Reference Manual. Empa, Switzerland.

[12] UNEP. 2017. Manual for completing the format for national reporting under the Basel Convention. Available at http://www.basel.int/Countries/NationalReporting/Guidance/tabid/1498/Default.aspx

Annex 1

Example of a questionnaire for the survey of EEE used and stored by private consumers (adapted from [11])

Date:	Location:	Interviewer:

Interview introduction
I am ……………………….. (name of interviewer) coming from ….
We are collecting data on e-waste generation and management in order to ….
Can we ask you some questions about e-waste? / Thank you for participating in our survey

Interviewed person	
Name	
Suburb	
City & State	☐ **rural area** ☐ **urban area**
Telephone	
E-mail	

0. Introductory question
(Introduction & introductory question, answers will not be evaluated. First question should ideally be answered with yes in order to set up a positive atmosphere for the interview to be held.)
Do you know what e-waste or waste of electrical and electronic equipment is?
(describe to interviewed person what e-waste is, if necessary….)

1. Questions about awareness and behaviour		
1.1	Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed of?	☐ YES ☐ NO
1.2	Do waste collectors come and pick up waste at your door? Do they pick up e-waste too?	☐ YES, everything ☐ YES, but no e-waste ☐ NO

1.3	**a)** Is the current e-waste collection convenient to you? **b)** What could be improved?	a) ☐ YES ☐ NO	b)

2. Number (#) of electrical and electronic equipment in the household

How many appliances of each electric and electronic product do you have in your household (in use & stored)?

Large household appliances (category 1)	
Product	#
Fridges*	
Air conditioners*	
Washing machines*	
Freezers	
Clothes dryers	
Electric heaters	
Dish washers	
Grillers	
Electric/Gas stoves	
(Steam-)Ovens	
Electric hot plate	

Small household appliances (category 2)	
Product	#
Irons*	
Kettles*	
Blenders*	
Microwaves*	
Hair dryers	
Mixers	
Fans	
Vacuum cleaners	
Carpet sweepers	
Toasters	
Popcorn makers	
Rice cooker	
Water dispenser	
Cables	
Extension boxes (?)	
Soldering iron	
Electric lawn-mowers	
(Alarm) Clocks	

IT and telecommunications equipment (category 3)	
Product	#
PCs* (central unit)	
CRT monitors*	
LCD monitors*	
Laptops*	
Mobile phones*	
Phones	
Printers	
Copy machines	
Scanners	
Fax machines	
Modems	

Consumer equipment (category 4)	
Product	#
TVs (CRT)*	
TVs (flat panel)*	
Radios*	
Stereos*	
DVD players	
VCR players (video-cassette recorder)	
MP3-players	
Cameras	
Game consoles	

Lighting equipment (category 5)	
Product	#
Light bulbs*	
Fluorescent tubes*	
Long life light bulbs (energy saving)	
Rechargeable lamps	

Batteries	
Product	#
Accumulators	
Car batteries	
One-way batteries	

Other ____________________ ____________________	
Product	#

*** Tracer products**

3. Tracer products

3.1 Life span of the tracer product

a) From the <u>moment you buy</u> the product <u>until the moment you dispose it or give it away</u>: How many years do you have the product in your household, approximately?

b) For how many years do you use the product?

c) After its usage, for how many years do you store the product in your household?

note: adding up answer b) and c) should equal answer a) → b) + c) = a)

Cat.	*Product*	*a)*	*b)*	*c)*
		[in years]		
1	Fridge			
1	Air conditioner			
1	Washing machines			
2	Iron			
2	Kettle			
2	Blender			
2	Microwave			
3	PC (central unit)			
3	CRT monitor			
3	LCD monitor			
3	Laptop			
3	Mobile phone			
4	TV (CRT)			
4	TV (flat panel)			
4	Radio			
4	Stereo			
5	Light bulb			
5	Fluorescent tube			

3.2 Detailed information about tracer products					
If there is more than one device per product in a household, please ***list each device individually****.*					
Category	*Product*	**Where was it bought?** *(e.g. supermarket, second hand market, friends, etc.)*	**In what condition did you buy it?** **N** - new **U** – used+working **B** - broken	**How many years did you store the product before disposal?**	**In what condition was the product at the end of life?** **W** - working **B** - broken **F** - broken but fixable
1	Fridge				
1	Air conditioner				
1	Washing machines				
2	Iron				
2	Kettle				
2	Blender				
2	Microwave				
3	PC (central unit)				
3	CRT monitor				
3	LCD monitor				
3	Laptop				
3	Mobile phone				
4	TV (CRT)				
4	TV (flat panel)				
4	Radio				
4	Stereo				
5	Light bulb				
5	Fluorescent tube				

3.3 Disposal of tracer product[2] (please tick)

How do/did you dispose your electric and electronic products?

(if there is more than one device per product in a household, please ***list each device individually)***

Category	*Product*	Sell to a second hand dealer	Give or sell to a scrap dealer	Dispose with household waste	Hand over to e-waste collection	Put on the street	Store at home	Sell to individual	Donate	Other
1	Fridge									
1	Air conditioner									
1	Washing machines									
2	Iron									
2	Kettle									
2	Blender									
2	Microwave									
3	PC (central unit)									
3	CRT monitor									
3	LCD monitor									
3	Laptop									
3	Mobile phone									
4	TV (CRT)									
4	TV (flat panel)									
4	Radio									
4	Stereo									
5	Light bulb									
5	Fluorescent tube									

4. General information					
4.1	**Would you give out your e-waste to the waste collectors for free if you could be sure that the waste will be well taken care of in a way that is useful and that does not pollute the environment?** ☐ YES ☐ NO				

4.2	**Do you have further comments or suggestions concerning e-waste management?**	

4.3	**How many persons live in your household? (please tick)**				
	1 ☐	2 ☐	3-4 ☐	5-8 ☐	more than 8 ☐

4.4	**What is the monthly income in the household? (please tick)** *(in local currency $)*				
	< 200 $ ☐	200 – 500 $ ☐	500 – 1'000 $ ☐	1'000 – 2'000 $ ☐	> 2'000 $ ☐
Note: the income classes must be adapted to the official national income classification					

Interview closure

- **Thank you for participating in this survey**
- *The interviewer could also provide information about* *when & where* *the results of the survey will be available (if this is the case)*

Annex 2

Example of a questionnaire for the survey of EEE used and stored by institutional and corporate consumers (adapted from [11])

Date:	Location:	Interviewer:

Interview introduction
Before the beginning of the interview, the interviewer should localize the person which is responsible for the management of electrical and electronic equipment (EEE) or the waste/e-waste management in the organization. **I am ……………………….. (name of interviewer) coming from ….** **We are collecting data on e-waste generation and management in order to ….** **Can we ask you some questions about e-waste? / Thank you for participating in our survey**

General information about organization		
Name of organization		
Type of organization	☐ public authority ☐ educational organization ☐ private company ☐ NGO ☐ other: ……………………………………………………………………	
Address / City		
Number of employees		
Name and function of contact person		
Telephone		
E-mail		
Main activity		
For <u>private companies</u>: Economic activity of the company	☐ Mining ☐ Manufacture of industrial products ☐ Bank/Insurance ☐ Sales ☐ Telecommunication ☐ Tourism ☐ Other services ☐ other:	
Is your organization ISO 14001 certified? *(ISO 14001 is an international environmental certification)*		☐ YES ☐ NO

0. Introductory question
(Introduction & introductory question, answers will not be evaluated. First question should ideally be answered with yes in order to set up a positive atmosphere for the interview to be held.) **Do you know what e-waste or waste of electrical and electronic equipment is?** *(describe to interviewed person what e-waste is, if necessary….)*

1. Questions about awareness and behaviour			
	Question	*Answer*	*Enhance the replies with comments, suggestions, details, etc.*
1.1	**Are you aware about the environmental hazards caused by discarded electronic equipment?**	☐ YES ☐ NO	
1.2	**Are you aware that some electronic parts may be profitably recycled?**	☐ YES ☐ NO	
1.3	**Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed of?**	☐ YES ☐ NO	
1.4	**Does your organization have a policy or strategy for the management of e-waste?**	☐ YES ☐ NO	
1.5	**Does your organization keep inventories of the electric and electronic equipment it discards / stores?**	☐ YES ☐ NO	*(if yes, ask for a copy?)*

2. Number (#) of electrical and electronic equipment in the organization

a) How many appliances of each product do you totally have in your organization (in use and stored)?

b) How many of them are not in use (stored)?

IT and telecommunications equipment (category 3)		
Product	*a) total*	*b) not in use*
PCs* (central unit)		
CRT monitors*		
LCD monitors*		
Laptops*		
Mobile phones*		
Landline phones*		
Printers*		
Copy machines*		
Scanners		
Fax machines		
Modems		

Consumer equipment (category 4)		
Product	*a) total*	*b) not in use*
TVs (CRT)*		
TVs (flat panel)*		
Radios*		
Video projector		
DVD players		
Cameras		

Large household appliances (category 1)		
Product	*a) total*	*b) not in use*
Fridges*		
Air conditioners*		

Lighting equipment (category 5)		
Product	*a) total*	*b) not in use*
Light bulbs		
Fluorescent tubes		
Long life light bulbs (energy saving)		
Rechargeable lamps		

Small household appliances (category 2)		
Product	*a) total*	*b) not in use*
Kettles		
Microwaves		
Fans		
Water dispenser		

Other ________________ ____________________		
Product	*a) total*	*b) not in use*

*** Tracer products**

3. Tracer products

3.1 Life span of the tracer product

a) From the ***moment the product is bought until the moment it is disposed of or given away:***
How many years **does your organisation** ***have the product, approximately?***

b) For how many years is the product in use?

c) After its usage, for how many years is the product usually stored in your organisation?

note: adding up answer b) and c) should equal answer a) → b) + c) = a)

Cat.	*Product*	*a)*	*b)*	*c)*
		[in years]		
3	PC (central unit)			
3	CRT monitor			
3	LCD monitor			
3	Laptop			
3	Mobile phone			
3	Phone			
3	Printer			
3	Copy machine			
1	Fridge			
1	Air conditioner			
4	TV (CRT)			
4	TV (flat panel)			
4	Radio			

3.2 Detailed information about tracer products				
Category	*Product*	**Where does your organization buy its products?** *(e.g. supermarket, second hand market, friends, etc.)*	**How many new appliances does your organization buy per year?**	**How many years does your organization store a product before its disposal?**
	In general			
3	PC (central unit)			
3	CRT monitor			
3	LCD monitor			
3	Laptop			
3	Mobile phone			
3	Phone			
3	Printer			
3	Copy machine			
1	Fridge			
1	Air conditioner			
4	TV (CRT)			
4	TV (flat panel)			
4	Radio			

3.3 Disposal of tracer product (please tick)										
What does your company do with the electrical and electronic equipment which is not of use anymore?										
Category	*Product*	Sell to a second hand dealer	Give or sell to a scrap dealer	Dispose with general waste	Hand over to an e-waste collection	Sell via tender offer	Sell/hand over to employees	Sell to individuals	Donate	Other
	In general									
3	PC (central unit)									
3	CRT monitor									
3	LCD monitor									
3	Laptop									
3	Mobile phone									
3	Phone									
3	Printer									
3	Copy machine									
1	Fridge									
1	Air conditioner									
4	TV (CRT)									
4	TV (flat panel)									
4	Radio									

4. General questions			
	Question	*Answer*	*Enhance the replies with comments, suggestions, details, etc.*
4.1	**Are you aware of what happens to the equipment you have discarded?**	☐ **YES** ☐ **NO**	
4.2	**From your point of view, what are the main obstacles for a proper e-waste treatment?** *(e.g costs, lack of infrastructure and/or policy within your company, lack of legislation, absence of recycling solutions, absence of collection system, etc.)*		
4.3	**What should be done to facilitate e-waste management (to your organization)?**		
4.4	**Would you be willing to pay for your equipment to be collected and treated?**	☐ **YES** ☐ **NO**	**If yes: at what conditions?** *(e.g. pickup service, guarantuee of proper disposal, etc.)*
4.5	**Is your organisation working on a formal basis or is it an informal organisation?** ☐ **formal** ☐ **informal**		
4.6	**General remarks**		

Interview closure
• **Thank you for participating in this survey** • *The interviewer could also provide information about <u>when & where</u> the results of the survey will be available (if this is the case)*

Annex III

Draft practical guidance for the development of inventories of waste oils

Contents

1 Introduction

1. Parties to the Basel Convention are required under Article 13, paragraph 3, of the Convention to transmit each year to the Conference of the Parties a national report on information related to the measures taken towards its implementation. Undertaking inventories can be an effective way of gathering information on the generation, transboundary movements and management of hazardous and other wastes for the purpose of national reporting. Such information and others are to be submitted, through the Secretariat of the Convention, using the national reporting format.[1]

2. This guidance aims to provide practical instructions to assist Parties and others in developing an inventory of waste oil. It is meant to be used in conjunction with the Methodological guide for the development of inventories of hazardous wastes under the Basel Convention [1] which provides complementary guidance on the methods of developing national inventories for the preparation of national reports. Accordingly, this guidance proposed an approach for developing inventories that is consistent with the one contained in the Methodological guide.

3. The main objective of developing an inventory of waste oil is to obtain information on the amount of such waste generated in a country, its disposal and transboundary movement. Knowledge of the amount of waste oil generated provides a sound basis for their environmentally sound management (ESM) [2]. This information can be used to develop appropriate policies and strategies for the collection and disposal of waste oil and is an important input into the planning of oil recycling and disposal facilities. In addition, the development of the inventory can provide insight into the effectiveness of the control system in place in a country to regulate the transboundary movements of waste oil.

2 Description and classification of waste oils

4. For developing the inventory, establishing a classification of wastes that is used consistently will help ensure comparability of inventory information collected from various sources and over the years. Wastes should also be classified in a way that serves the objectives of developing the inventory, such as for the planning of disposal facilities. The format for national reporting under the Basel Convention requires that some of the information provided be categorized according to Annex I or Annex VIII codes. Therefore, in developing the inventory, using a classification of waste oils that is harmonized with the annexes of the Basel Convention will make it easier to integrate the outputs of the inventory into the national report.

5. Waste oils are oils which are unfit for the use for which they were originally intended. After a period of use, oils are no longer suitable for their original purpose due to the loss of their properties and/or the presence of contaminants such as water, metallic debris, dusts and degraded additives. Under the Basel Convention, waste oils unfit for their originally intended use are classified as hazardous wastes as follows:

Annex I:

Y8: Waste mineral oils unfit for their originally intended use

Y9: Waste oils/water, hydrocarbons/water mixtures, emulsions

Annex VIII:

A3020: Waste mineral oils unfit for their originally intended use

A4060: Waste oils/water, hydrocarbons/water mixtures, emulsions

6. Another important consideration in deciding on the classification of waste oils is how to ensure that the outputs of the inventory can be used to promote the ESM of waste oil. Classifying waste oils by type/application helps identify how the amounts generated should be managed; e.g., waste oil from transformers may contain polychlorinated biphenyls and should be managed differently from waste automotive engine oil.

2.1 Main uses of oils

7. Understanding of the uses of oils and the national oil market provides a useful premise for identifying potential generators of waste oils. Oils can be classified in two broad categories: automotive (consumer and commercial) and industrial sectors. The main product types within each sector are shown in table 1; the different types of oils are used in various applications. In these applications, oils perform

[1] UNEP/CHW.12/INF/16/Rev.1; available through the electronic reporting system at http://www.basel.int/Countries/NationalReporting/ElectronicReportingSystem/tabid/3356/Default.aspx

a variety of functions including lubrication, power transmission (hydraulic fluids), heat transfer and cooling. Irrespective of their function, oils are commonly referred to as lubricants, for example in industry publications. The different oil types have different formulations that are adapted to their diverse functions.

Table 1. Overview of main oil uses

Sector	**Types**
Automotive	Light-duty engine oils (including passenger car motor/engine oils)
	Heavy-duty engine oils (for on-highway vehicles e.g. trucks, and off-highway vehicles e.g., tractors)
	Transmission fluids
	Gear oils
	Hydraulic fluids
	Greases
Industrial	Process oils
	Engine oils
	Metalworking fluids
	Hydraulic fluids
	Other industrial oils (including compressor oils and heat transfer oils)
	Transformer oils
	Industrial greases

8. As shown in figure 1, the automotive sector accounted for about 53% of the global oil consumption in 2013 and industrial oils accounted for the remaining 47% [3]. The volume of oil used in each sector, and the amount of waste oil generated as a result, vary among countries, depending on the scale of the transport sector and industries present [4].

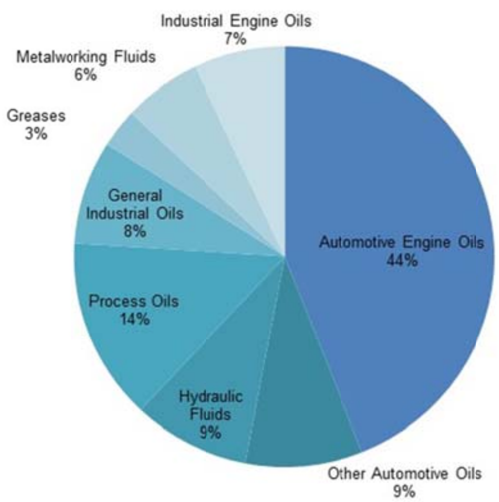

Figure 1. Distribution of the global oil market in 2013 [3]

2.2 Sources of waste oils

9. Waste oils are generated by a broad variety of sources, ranging from individuals who generate waste oil through the maintenance of their personal vehicles and equipment, to fleet operators and industrial operations. Determining the sources of waste oils is a crucial step in developing the inventory (see section 4). Table 2 lists the main sources of waste oil. Figure 2 presents a simplified schematic of flows of oil and waste oil among the main actors involved in the life-cycle of oil. As shown in this figure, passenger car engine oils are sold either through Do-It-Yourselves (DIY) or Do-It-For-Me (DIFM) channels. Industrial oils generally follow the same path as automotive oils except that they are handled

more directly by waste operators. A portion of automotive and industrial oils is lost during use and does not enter the waste stream.

Table 2. Summary of the main source of waste oil (adapted from [5])

Small sources	Description
Repair shops and back-yard mechanics	• Service stations, repair shops and other establishments that service automotive vehicles or that accept oil from do-it-yourselfers (DIYs; automobile owners who service their own vehicle) • In some countries, servicing is done by micro enterprises, which are often informal and thus not licensed or registered. Often they may service and repair just a few vehicles per day. Typically, several of these units are located together in hubs within particular areas of cities and towns, but also many are scattered around towns located in makeshift areas often by the side of the road.
The collective transport sector	• In most countries, small-scale providers dominate the public (collective) transport and may provide up to 80 % of the collective transport services. They often use imported second-hand vehicles that are poorly maintained and require frequent oil change. • Taxi and minibus drivers will often service their vehicles themselves.
Small power generators	In areas with irregular grid power supply, a larger number of small electricity generators may be installed within both domestic and commercial premises – each of which are likely to produce small amounts of waste oil.
Large sources	
Industries	Industries, such as breweries, food processing companies, construction companies and textile factories, will have engines, used for power generation or for pumping for example.
Large vehicle fleets	• Companies with a large fleet of vehicles, such as truck companies, bus companies, mines, construction companies, tourism companies are likely to have maintenance workshops where waste oil from engines, gearboxes and axles is generated. • Governments own a large vehicle fleet, which will be serviced in their own workshops or by private workshops.
Other sources	Other larger sources of waste oil include fishing and shipping, railway companies and power companies.

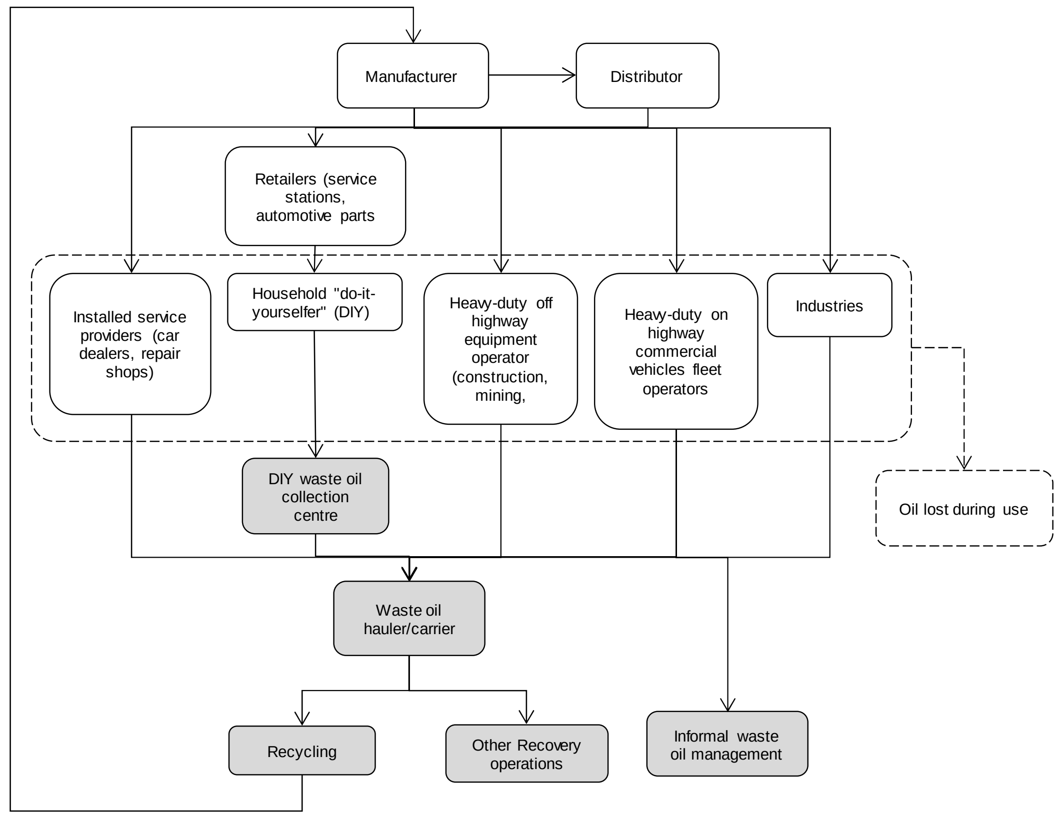

Figure 2. Example of a system showing the generation and management of waste oils and flows among the main actors of the system.

3 Defining the scope of the inventory

10. The scope of the inventory depends on factors such as its purpose (including for completing the national report under the Basel Convention), the level of accuracy required for the intended use of the results, and the time and budget allocated for the study. For example, order-of-magnitude estimates are necessary to establish that a problem exists and to justify the need for policy action.

11. Countries may choose to focus only on the activities or sectors which are most relevant for them (e.g., mining; manufacture of metal products; maintenance and repair of motor vehicles). In many countries, automotive engine oil is the largest single source of waste oil. In Europe, for example, engine oil represents more than 70% of the collectable waste oil; the balance is comprised of industrial oils, of which waste hydraulic oil is the main source. The geographic areas to be included in the inventory should also be carefully chosen, taking into account that it may be necessary to extrapolate the results to obtain a national estimate of waste oil generation.

4 Methodologies for developing the inventory

12. The methodology provided in this guidance is useful for developing a first generation inventory of waste oils in situations when a national system for collecting data from waste generators is not yet fully developed. The methodology relies mainly on administrative and other easily-accessible data sources such as vehicle registration data (section 4.2.1) and oil use and/or sales data (section 4.2.2).

13. Administrative data sources include existing information collected by government agencies in response to legislation or regulations, as well as by non-governmental organizations, such as trade associations. Existing information in a country can be gathered through a combination of desk research and semi-structured interviews with government and industry representatives, as well as other relevant stakeholders.

14. When using administrative data, it is important to pay special attention to their limitations. If the relevant data is available, the accuracy, frequency and consistency of the data production process should be assessed to validate whether it is the best data source to use.

4.1 Identifying major waste generators

15. As a first step, it is useful to establish a database of waste oil generators and other key stakeholders involved in the life cycle of oil such as importers and major suppliers of oil. Such a database is the core of developing the inventory and is useful for record keeping for first generation and eventually more complex inventories. The accuracy of the output of the inventory will depend in part on whether all major sources of waste oil generation have been identified. Sources of data in the database and methodologies used for their collection and the underlying assumptions should be clearly explained, to facilitate the replication and assessment of the inventory by users of the reported information.

4.2 Method for estimating waste oil generation

16. In general terms, the amount of waste oil generated is the difference between the amount used and the amount lost during use. Oil losses occur during use or handling as a result of leakage, spillage, combustion, disposal with equipment, and incorporation into finished products such as rubber.

17. A generic formula for calculating the estimate is:

Amount of waste oil generated per year (metric tons) = amount of oil consumed per year (metric tons) x Waste oil generation factor

Where Waste oil generation factor (WOF) = (1-LOSS) / (1-WATER)

LOSS indicates the oil loss as a proportion of annual oil consumption.

WATER indicates water content as a proportion of waste oil.

18. The proportion of oil lost during use varies according to the application and types of oil used (see annex 1 to this document).

19. Another factor to be accounted for in calculating WOF is the water content of waste oil. Water is incorporated into oil due to processes, such as combustion (in an engine) where water is a by-product. In some applications, like metalworking, oils may be mixed with water used for cooling. Because water is a common constituent of the amount of waste oil collected from engines, estimates should be corrected for moisture content. For example, in Australia, surveyed operators reported around 10-12% water in collected waste oil [6]; in California, United States, the typical moisture content of waste oil was estimated at 5% [7],[8].

20. Example calculation:

If 40% of oil is lost during use, assuming a water content of waste oil of 5%, the WOF is calculated as follows: (1-40/100) / (1- 5/100) = 0.63. If 200 tons of oil is consumed in a year, then the estimated amount of waste oil generated in that year is equal to 200 x 0.63 = 126 tons.

4.2.1 Estimates from vehicle stock and transport activity data

21. In many countries, a larger share of oil used in the automotive sector compared to the industrial sector. On this premise, data on automotive engine oil consumption can be used to derive an estimate of the amount waste oil generated.

22. Engine oil consumption data would ideally be obtained from sales data. When such information is not available, data on the national vehicle fleet and data on transport activity is instead used for the estimate. For each vehicle type (e.g., passenger cars, light commercial vehicles, heavy-duty vehicles, and motorcycles), the amount of engine oil consumed in a year can be estimated through the following steps:

Step 1: Number of oil changes per vehicle = Average distance travelled annually (km) / distance travelled between oil changes (km) Step 2: Volume of oil consumed per vehicle annually (L) = Number of oil changes per vehicle x engine oil capacity of the vehicle (L)

Step 3: Amount of oil consumed per vehicle annually (kg) = Volume of oil consumed per vehicle annually (L) x density of oil (kg/L) Step 4: Total amount of oil consumed annually (kg) = Amount of oil consumed per vehicle annually (kg) x number of vehicles Step 4b Total amount of oil consumed annually in metric tons is equivalent to total amount of oil consumed annually (kg) x 0.001

23. The total amount of waste oil generated by all vehicles can then be calculated by applying the generic formula described above. A model for recording the information for the inventory is provided in table 4.

24. Example calculation:

Assuming the following situation in a country: 800,000 passenger car registered in the year of the inventory; the average engine oil capacity for passenger cars is 5 litres; 20% of the vehicle fleet require 2 oil changes a year, while the remaining 80% require 1 oil change a year; that the density of new engine oil is 0.9 kg/L. The amount of waste oil generated by passenger cars annually is calculated as follows:

Step 1: Number of oil change per vehicle = (2×0.2) + (1×0.8) = 1.2

Step 2: Volume of oil consumed per vehicle annually = 1.2 x 5 = 6 L

Step 3: Amount of oil consumed per vehicle annually = 6 x 0.9 = 5.4 kg

Step 3b: Amount of oil consumed per vehicle annually in metric tons is equivalent to 0.0054 tons

If 13.8% of engine oil of passenger cars are lost during use and the water content of the oil is 2%, then, the amount of waste oil generated per vehicle per year = 0.0054 × (1-0.138) / (1 – 0.02) = 0.0047 tons

Total amount of waste oil generated per year = 0.0047 x 800,000 = 3760 tons

Data sources for the inventory

25. Data on vehicle stocks are generally readily available from government agencies in charge of vehicle registration (e.g. ministry of transport) and national statistical offices.

26. Data on engine oil capacity and the distance travelled between oil changes depend on the vehicle type and model and should be readily available from vehicle manufacturer's specifications. Some indicative values for these parameters are provided in Table 3 and may be used as a starting point. For greater accuracy of the inventory, it is better to use data representative of the national vehicle fleet which can be obtained from manufacturers, the automotive service and repair industry, fleet operators, and technical literature.

27. The frequency of oil change for off-road vehicles/equipment, such as tractors, is typically based on hours of engine operation e.g. one oil change every 300 hours of operation.

28. Information on the percentage of oil lost during use, for each vehicle type is needed to estimate the corresponding amount of waste oil generated. It can however be difficult to obtain reliable values for this parameter from administrative sources and desk studies. While estimates have been compiled through various studies (see annex 1), it is better to carry out actual data collection on a locally applicable and statistically representative basis so as to reflect the national situation (e.g., average age of the vehicle fleet, motorcycle usage, etc). For example, in developing countries, many vehicles are imported second-hand vehicles. They will lose more oil through leaks and burning in the combustion chamber than newer vehicles, even more so if they are poorly maintained.

29. It should be noted that the calculation shown above (paragraph 22) does not take into consideration the amount of oil added by vehicles owners between oil changes (topping-up). In the United Kingdom, oil used by DIY consumers that top up their own engine oil was estimated based on the assumption that 1 in 3 motorists added 1 litre to their vehicle once a year (representing 5.3% of the total estimated oil use by light-duty vehicles). In California, United States, topping-up was estimated to account for 2% of engine oil used in light-duty vehicles. In the case of heavy-duty vehicles, topping-up can account for 15% (e.g., in California). In older, second-hand vehicles, the oil added between changes may be significantly higher than in newer vehicles. The amount and frequency of topping-up cannot be estimated using data on vehicle fleet characteristics and has to be estimated from survey of vehicles

owners and experts. The amount of oil consumed by vehicles should be adjusted accordingly when calculating the amount of waste oil generated.

Table 3. Default oil consumption parameters[a] from the Highway Development and Management Model (HDM-4) developed by the World Bank

Vehicle description	Distance travelled between oil changes (km)	Oil filling capacity (L)
Motorcycles, scooters, mopeds	5,000	2
Passenger cars	10,000	4
Panel vans, pickup trucks	7,500	5
Two-axle rigid trucks	9,000	14
Multi-axle rigid trucks, articulated trucks	10,000	31
Minibuses	7,500	5
Buses	8,000	14
Multi-axle buses	8,000	20

Table 4. Example of a format for a database of waste automotive engine oil (adapted from [5])

Type of vehicle	No. of vehicles	Average distance travelled (km/yr)	Distance between oil changes (km)	Engine capacity (L)	No. of oil changes/ vehicle/y	Density of oil (kg/L)	Loss in use	Water content of oil	Amount of WO /vehicle/year (metric tons)	Total amount of WO generated (metric tons)
Cars	800,000	10200	8500	5	1.2	0.9	0.138	0.02	0.0047	3760
Motorcycles		8000	1000	1	8					
Vans		20000	5000	8	4					
Lorries/trucks		25000	5000	8-30	5					
Buses		60000	5000	15	12					
Other										
TOTAL										

4.2.2 Estimates based on oil sales

30. Information on actual oil consumption is difficult to obtain in many countries and usually require detailed surveys. Instead, the amount waste oil generated can be estimated based on the volumes of oil put on the national market.

31. Data on oil sale may be available from a number of sources such as the ministry of commerce and of finance (which records this information for taxation purposes) and trade associations. The information can also be collected from these sources can be cross-checked with data on oil sales obtained from direct survey of major oil suppliers/distributors (see e.g. [8]). Annex 2 to this guidance contains an example of a questionnaire for collecting information on oil sales from oil suppliers. It can be adapted for requesting information from other sources.

32. A national estimate for the amount of waste oil generated can be calculated on the basis of total oil consumption as shown in the following example:

Example calculation:

If a total of 250 million tons of oil is put on the market in a year in country X and the average percentage of oil lost during use is 50%, then the estimate of total waste oil generated in a year is equal to 250 x (1-50/100) = 125 million tons.

33. The average percentage of oil lost during use varies between countries, depending on the relative consumption of different types of oil. For example, this percentage varies between 68% and 40% among Member States of the European Union [10]. Surveys of experts can provide an estimate of this value that is appropriate for the national context.

34. The example calculation above is based on aggregated data on oil sales. When it is possible to obtain data on oil sales for specific sectors and/or oil types, an estimate of waste oil generated can be

calculated for each sector as shown in the example in table 5 below. WOF for each application is needed to estimate the corresponding amount of waste oil generated. Estimates of WOF from various studies are compiled in annex 1 to this document. However, when possible, it is recommended to obtain values applicable to the national context.

35. The total amount of waste oil generated computed as shown in table 5 should be further adjusted for water content which can be obtained by consulting waste management operators. Thus if the estimated average water content is 5%, the total amount of waste oil generated per year = 424193/0.95 = 446,519 tons.

36. Where possible, the data collection procedure should allow the data to be classified according to economic activity (for example, if the major oil purchasers are recorded). This would permit sector-specific comparisons which are useful for data validation purposes, and to monitor trends in waste prevention. To facilitate international comparability of data, it is recommended that economic activities be classified according to the United Nations' International Standard Industrial Classification of All Economic Activities (ISIC)[2], or other system

Table 5. Example of a format for the inventory of waste oil based on oil sales data

Sector	Type	Grade or Application	LOSS	1– LOSS	Amount sold (metric tons)	Amount of waste generated (metric tons)
Consumer Automotive	Passenger car motor oil	Multigrade	0.14 (14%)	0.86 (86%)	223,471	192,185
		Monograde	0.17	0.83	1,916	1,590
	Off-road	4-Stroke	0.25	0.75	12,113	9,085
	Automotive transmission fluid		0.12	0.88	20,045	17,640
	Gear oils		0.17	0.83	3,785	3,142
Commercial Automotive	Heavy-duty motor oil	Multigrade	0.20	0.80	100,928	80,743
		Monograde	0.23	0.77	2,655	2,044
	Hydraulic and transmission fluids	Hydraulic	0.12	0.88	21,594	19,003
		Tractor	0.20	0.80	11,735	9,388
		Other	0.15	0.85	4,186	3,558
	Gear oils		0.17	0.83	5,701	4,732
Industrial	Process oils	Electrical	0.13	0.87	24,192	21,047
		White oils	0.91	0.09	31,966	2,877
		Railroad	0.59	0.41	17,357	7,117
		Natural gas	0.15	0.85	3,429	2,915
		Other	0.30	0.70	6,814	4,770
	Metalworking fluids	Removal	0.10	0.90	13,249	11,924
		Forming	0.20	0.80	6,814	5,451
	Hydraulic Fluids	Non-synthetic	0.25	0.75	28,769	21,577
		Synthetic	0.10	0.90	3,785	3,407
					Total	424,193

5 Preparing national summaries

37. Translating the results of the inventory to a national estimate of the amount of waste oil generated is a complex task. The coverage of data sources is likely to be incomplete due to limitations in data availability and quality and resource constraints. To the extent possible, results obtained from a selected geographic area or number of waste generators should be extrapolated to the country level. In cases where the amounts of waste oil generated have been calculated on the basis of national data on e.g., vehicle registration or oil sales, the results represent a national estimate. The underlying assumptions and limitations of the national estimate should be indicated when reporting on this information.

38. Information on the total amount of hazardous wastes generated is requested in table 6 of the national reporting format. Parties have the option of providing detailed information concerning specific hazardous wastes categorized according to the codes of Annex I or VIII to the Basel Convention or national codes. Further instructions can be found in the Manual for completing the format for national reporting under the Basel Convention [11].

6 Obtaining data on options for waste disposal and recovery

39. Information on options for the final disposal and recovery of hazardous wastes and other wastes available in a country is requested in table 2 and table 3 of the national reporting format, respectively. It is therefore important to collect information on existing facilities in the course of developing the

[2] https://unstats.un.org/unsd/cr/registry/isic-4.asp

inventory. When such facilities do not yet exist, information obtained on waste oil collection and alternative disposal practices will help in devising an appropriate strategy for the ESM of this waste stream.

7 Obtaining data on the transboundary movements

40. Parties to the Basel Convention have the obligation to designate one or more authorities (competent authorities) for approving the transboundary movements of hazardous and other wastes. Competent authorities should therefore maintain a record of annual imports and exports of waste oil. Parties should provide this information in table 4 (export) and table 5 (import) of their national report.

8 Updating the inventory

41. As highlighted above, a national database of oil users and other key stakeholders involved in the life-cycle of oils should be established to record the data collected and computed in developing the inventory of waste oil. Because oil use is dynamic (e.g., the number of registered automotive vehicles increase annually in many countries), it is recommended to establish a procedure for collecting data from the stakeholders in the database on a regular basis in order to update the inventory.

42. Through its iterations, the inventory should become more detailed and result in more accurate outputs. Broadening the scope of the inventory to include more sources of data or broader geographic areas will produce results that increasingly reflect the national situation.

9 Assessment of results and conclusions

43. It is important to assess the results of the inventory to identify measures that can make it more complete. Key elements to be assessed include the reliability of the data collected and the accuracy of the results. The assessment may also identify potential gaps in the control system for the implementation of the Basel Convention.

44. On approach to assessing the accuracy of the waste oil inventory is to compare the amount of waste oil generated to information on the disposal of waste oil in the country. Data on waste oil collection and disposal can be obtained using existing administrative data such as waste tracking documents or if the number of the companies involved in waste oil management is limited, a survey or census can be considered. Discrepancies between the amount of waste oil generated and the amount disposed/recycled domestically and/or exported could be due to a number of reasons that are worth investigating. They could indicate inaccuracies in the data collected, poor record keeping, differences in classification, missing data, etc. Importantly, in many countries, of the amount of waste oil generated, only a portion is collected and therefore available to waste oil haulers and waste disposal facilities. The collection efficiency depends on a number of factors such as how well collection is organized, awareness of the need to collect waste oils for safe disposal and the existence of alternative uses for waste oils. In many countries, waste oils are simply dumped in the environment, especially by small generators. Discrepancies could also point to deficiencies in the management system of waste oils and the control of their transboundary movement.

10 References

[1] ICC (Committee for Administering the Mechanism for Promoting Implementation and Compliance of the Basel Convention). 2014. Methodological guide for the development of Inventories of hazardous wastes and other wastes under the Basel Convention. Available at: http://www.basel.int/portals/4/download.aspx?d=UNEP-CHW.12-9-Add.1.English.pdf

[2] UNEP. 2017. Revised factsheets on specific wastestreams. UNEP/CHW.13/INF/7

[3] Gill, G. A World Going Flat? Lubes'n'Greases. January 2015, pp21-25. Available at http://viewer.zmags.com/publication/cc879139

[4] UNEP-DTIE-IETC (2012) Compendium of Recycling and Destruction Technologies for Waste Oils. Available at https://wedocs.unep.org/rest/bitstreams/14555/retrieve [Accessed on 5 January 2017]

[5] Africa Institute (2103) Regional Policy Guidelines: Economic Instruments for the Environmentally Sound Management of Waste Oil. Available at http://africainstitute.info/download/regional-policy-guidelines-for-waste-oil/

[6] ACIL Tasman (2008) Used Oil Management Options Study, Part A: Report on the Western Australian Used Oil Market, Prepared for the Western Australia Waste Authority. Available at

http://www.wasteauthority.wa.gov.au/media/files/documents/used_oil_report_final_solutions_for_WA_market.pdf

[7] Kline & Company (2012) Lubricant Consumption and Used Oil Generation in California: A Segmented Market Analysis Part II: Collectable Used Oil Availability in California, 2000-2011, Report to the California Department of Resources Recycling and Recovery (CalRecycle). Available at http://www.calrecycle.ca.gov/publications/Documents/1512%5C20141512.pdf

[8] Geyer, R., Kuczenski, B., Henderson, A. and Zink, T. (2013) Life Cycle Assessment of Used Oil Management in California Pursuant to Senate Bill 546 (Lowenthal), Report to the California Department of Resources Recycling and Recovery (CalRecycle). Available at http://www.calrecycle.ca.gov/Publications/Documents/1465/20131465.pdf

[9] Bamiro, O. A. and Osibanjo, O. (2004) Pilot Study of Used Oils in Nigeria. Basel Convention Coordinating Centre for the African Region in Nigeria.

[10] Monier, V. and Labouze, E. (2001) Critical Review of Existing Studies and Life Cycle Analysis on the Regeneration and Incineration of Waste Oils, Report to the European Commission DG Environment. Available at http://ec.europa.eu/environment/waste/studies/waste_oil.htm

[11]] UNEP. 2017. Manual for completing the format for national reporting under the Basel Convention. Available at http://www.basel.int/Countries/NationalReporting/Guidance/tabid/1498/Default.aspx

Annex 1

Examples of waste oil generation factors

Sector	Application	Grade	1974 (1)	1995 (2)	2002 (3)	2004 (4)	2005 (5)	2006 (6)	2006 (7)	2009 (8)	2010 (9)
Consummer automotive	Passenger car motor oil	Multigrade	67%			75%	92%	85%	95%	94%	86%
		Monograde							90%		83%
	Off-Road	2-Stroke								0%	0%
		4-Stroke								93%	75%
	Automotive transmission fluid						80%	96%	50%	88%	88%
	Gear Oils							95%	30%	88%	83%
	Light-duty Greases		0%			10%					0%
Commercial automotive	Heavy-duty motor oil	Multigrade	59%			75%	83%	85%	83%	81%	80%
		Monograde									77%
	Hydraulic and transmission fluid	Hydraulic	10%			80%	95%	80%		89%	88%
		Tractor	75%				80%				80%
		Other									85%
	Gear Oils						80%	30%		84%	83%
	Heavy-duty Greases		0%			10%					0%
Industrial	Process oils	Electrical	27%			95%				98%	87%
		White Oils	10%			0%				0%	9%
		Rubber	10%			0%				0%	0%
		Aromatic				0%				0%	0%
		Paraffinic				0%				0%	0%
		Naphthenic				0%				0%	0%
		Synthetic				0%				0%	0%
	Industrial engine oils	Marine	50%			10%	40%			34%	0%
		Railroad	20%				37%			93%	41%
		Natural Gas	20%				20%			93%	85%
		Other								93%	70%
	Metalworking Fluids	Removal	100%			20%				34%	90%
		Forming	60%			20%				0%	80%
		Treating	60%			20%				0%	0%
		Other/Total	10%			20%				0%	0%
	Hydraulic Fluids	Non-synthetic	76%			80%	70-80%	10%		90%	75%
		Synthetic									90%
	Other industrial oils	Gear Oils	59%			80%		20%			
		Turbine Oils	59%			50%		80%			
		Compressor Oils	60%			50%		30%			
		Refrigeration Oils	32%					20%			
		All/Other	73%				80%				
	Industrial greases		0%			10%				0%	0%

(1) "Waste Oil Recycling and Disposal". Recon Systems/Weinstein, N. 1974

(2) "Assessment of Opportunities to Increase the Recovery and Recycling Rates of Waste Oils". Argonne National Laboratory. 1995

(3) EuropaLab. 2002, cited by Kline in Lubricant Consumption and Used Oil Generation in California: A Segmented Market Analysis Part II: Collectable Used Oil Availability in California, 2000-2011

(4) Netcen. 2004, cited by Kline in Lubricant Consumption and Used Oil Generation in California: A Segmented Market Analysis Part II: Collectable Used Oil Availability in California, 2000-2011.

(5) "Consumed in Use Study". Spence, R. 2005

(6) "Compendium of Recycling and Destruction Technologies for Waste Oils". U.N. Environment Programme. 2006.

(7) RGS. 2006, cited by Kline in Lubricant Consumption and Used Oil Generation in California: A Segmented Market Analysis Part II: Collectable Used Oil Availability in California, 2000-2011

(8) Kilne, 2009, cited by Kline in Lubricant Consumption and Used Oil Generation in California: A Segmented Market Analysis Part II: Collectable Used Oil Availability in California, 2000-2011

(9) Lubricant Consumption and Used Oil Generation in California: A Segmented Market Analysis Part I. Kline. 2010

Annex 2

Example of a questionnaire for requesting data on oil sales

Dear Sir/Madam,

This questionnaire is for collecting data on the sale of oils to determine the amount of waste that results from their use. The information you provide will only be used for the purpose of developing an inventory of waste oil. Thank you for your cooperation.

SECTION A: Respondent information

Name	
Role/title	
Organization	
Address	
Telephone	
E-mail	
Date of completion	

Section B: Information on the management of used oils

For each type of oils sold by your company, please provide answers to the following questions in the table below:

a) What is the unit of sales of this type of engine oils (e.g. Gallons, Jerry cans, Drums, etc.)? Specify the volume of this unit in liters in a bracket.
b) How many such units of this type of engine oils do you sell on average per month?
c) Who are the major customers?

Sector	**Types**	**a) Sales unit (volume in litres)**	**b) Quantities sold per month**	**c) Major customers**
Automotive	Transmission fluids			
	Gear oils			
	Hydraulic fluids			
	Other (Please specify)			
Industrial	Process oils			
	Metalworking fluids			
	Heat transfer oils			
	Other (Please specify)			
Other (Please specify)				