Practical guidance for the development of inventories of waste oils

Note

This guidance has been developed by the Secretariat of the Basel, Rotterdam and Stockholm Conventions at the request of the Conference of the Parties (COP) to the Basel Convention. At its 13th meeting in April 2017, the COP took note of the guidance and invited Parties and others to make use of it and inform the Secretariat on their experience in doing so.

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].

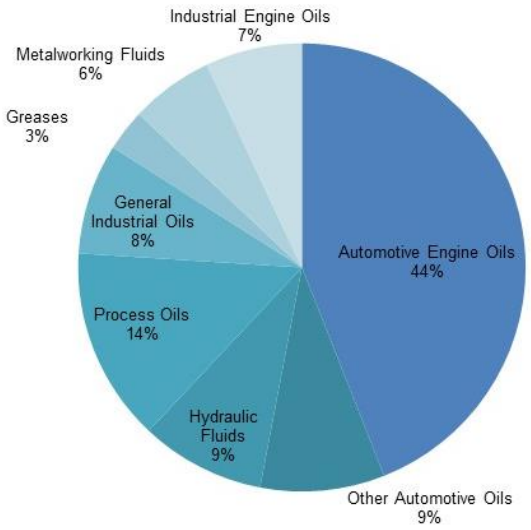

Figure 1. Distribution of the global oil market in 2013 [3]

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.

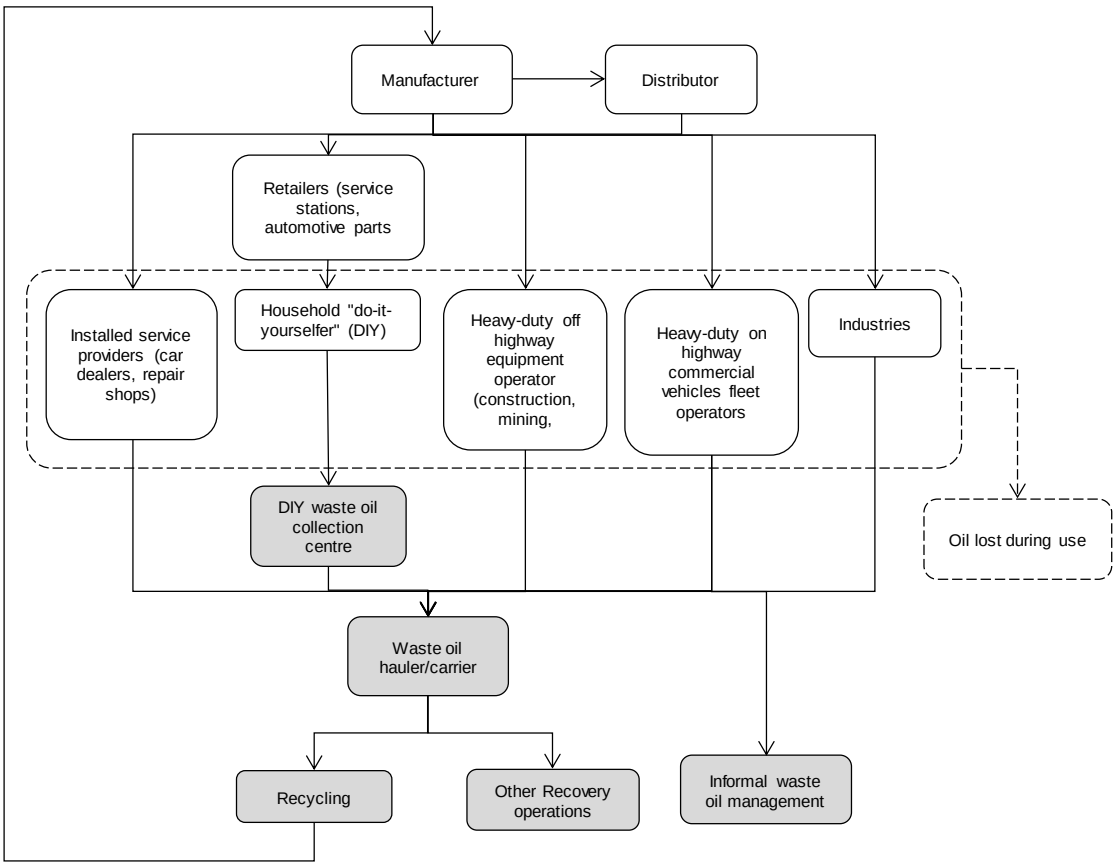

Figure 2. Example of a system showing the generation and management of waste oils and flows among the main actors of the system.

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 = $(2\times0.2) + (1\times0.8) = 1.2$

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 = $0.0054 \times (1-0.138) / (1 - 0.02) =$ 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

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[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 <u>per month</u>**	**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)				