LG/15/1

15th Meeting of the London Group on Environmental Accounting
Wiesbaden, 30 November – 4 December 2009

Issue paper on classification of physical flows

Prepared by UNSD in cooperation with the Waste subgroup of the London Group

Issue paper on classification of physical flows[1]

A. Introduction

1. This issue paper discusses the advantages and disadvantages of the current classification of physical flows in the SEEA-2003 and puts forward an alternative proposal for discussion. The paper therefore addresses issue nr. 2 from the issue list for the SEEA revision.

2. This paper is a revision of the issue paper on the classification of physical flows by Bram Edens, Alessandra Alfieri, Odd Andersen, and Ralf Becker of UNSD (LG14/1). It builds upon and reacts to previous issue papers. These include 'Classification of Physical Flows' (LG/12/7) and 'Classification of Physical Flows: Part II' (LG/13/1) by Statistics Netherlands, and Classifications of Material Flows for SEEA-MFA (LG/13/3) by Karl Schoer.

3. One of the important ideas put forward in the Dutch papers was to develop a correspondence between the EWC Stat and the CPC in order to allow waste and other discarded materials to be tracked and recorded in a more useful way. The paper by Karl Schoer contains a draft full set of classifications of physical flows that have been harmonized with MFA principles. One of its most important ideas was to classify flows of natural resources and ecosystem inputs according to the CPC. This paper includes Annexes that outlines these proposed classifications.

4. An earlier presentation containing our main ideas was given at the 13th Meeting of the London Group on Environmental Accounting, and an update of that presentation was discussed at the 14th London Group meeting.[2] That paper (LG 14/1) proposed a reorganization of the classification of flows that would distinguish flows from the environment to the economy (inflows), flows within the economy (consisting of products and waste), and flows from the economy to the environment (return flows). It recommended using CPC to classify all physical flows, with additions if necessary. The advantages of the proposal are that it would align the SEEA with the 2008 SNA and CPC 2.0 and allow for a complete integration of EW-MFA practices into the SEEA. Subsequently, the issue of the classification of physical flows related to waste was also discussed at the September 2009 meeting of the Expert Group on Classifications.[3] This paper represents a revision of the earlier work to account for comments received and for new information on the classification of waste under the European Waste Directive that has been provided by Eurostat.

5. A short description of the issue is presented in section B. Section C discusses the main issues that have arisen regarding the current classification of physical flows in the SEEA-2003. In section D an alternative proposal is put forward. Finally, the Annexes discuss an attempt to develop a correspondence between the CPC 2.0 and the EWC Stat, a list of the CPC classes involved in waste classification and the corresponding EWC Stat categories, and a possible classification of flows to and from the economy developed by Karl Schoer.

B. Description of the issue

[1] Paper prepared by UNSD in cooperation with the Waste subgroup of the London Group
[2] See Report of the 14th London Group Meeting and paper LG/1, which can both be found at: http://unstats.un.org/unsd/envaccounting/londongroup/meeting14.asp
[3] See report at: http://unstats.un.org/unsd/class/intercop/expertgroup/2009/ac190-2.asp

6. The SEEA-2003 distinguishes four types of physical flows: natural resources, ecosystem inputs, products, and residuals. These flows are organized into three classification systems:

- Flows of natural resources and ecosystem inputs are classified using the classifications developed for the SEEA asset classification;
- Physical product flows are classified according to the CPC;
- Residuals, which combine several classifications including solid waste, are classified according to the CPC or the EWC Stat, as appropriate.

7. The conceptual framework of SEEA-2003 that underlies these classifications is *roughly*[4] as follows: the environment supplies natural resources to the economy, which turns these resources, in combination with necessary ecosystem inputs such as oxygen, into products -- that is, desired outputs with market value; and residuals -- that is, undesired outputs without market value. These residuals may be reused directly without treatment, treated and recycled, disposed of as waste to controlled disposal sites, or discharged into the environment (as air emissions or as waste to uncontrolled landfills).

8. However, there appear to be several difficulties with this framework and the resulting classifications:

- The definition of "waste" and its relationship to the concept of residuals is ambiguous.
- The distinction between products, residuals and waste based on value is problematic, particularly in an account based on physical rather than monetary flows.
- The classifications are not aligned with the system boundaries[5] of the SEEA.
- More detailed and directly relevant classifications are needed for waste, residuals and ecosystem inputs.

C. Problems in the current classification of physical flows

9. The four major classification issues discussed above are addressed in this section. They include:

- The definition of waste and the scope of the waste accounts.
- The distinction between products and residuals (including waste).
- Alignment of the classifications with the system boundaries of the SEEA.
- The development of detailed classifications for waste and for ecosystem inputs.

Definition of waste and scope of waste accounts

10. The exact definition of the term "waste" and its relationship to the concept of residuals seems to differ in practice across national statistical offices. After consultation with Eurostat and members of the London Group subgroup on waste statistics, this paper proposes the following

[4] As demonstrated in the previous UNSD paper on classifications of physical flows (LG 14/1), conflicting definitions of many of these concepts (e.g. residuals) can be found in the SEEA-2003.
[5] The SEEA uses the production boundary of the SNA to distinguish between the economy and the environment.

definition of waste, which is based on the principles outlined in the European Waste Framework Directive.

11. **Waste includes all materials that are discarded and are not reused, regardless of their destination or monetary value.** Materials discarded directly to the environment are waste, even though such discards are generally illegal. In most cases materials with monetary value will be re-used if possible and will therefore not become waste, but the definition of waste does not depend on the value of the goods discarded.

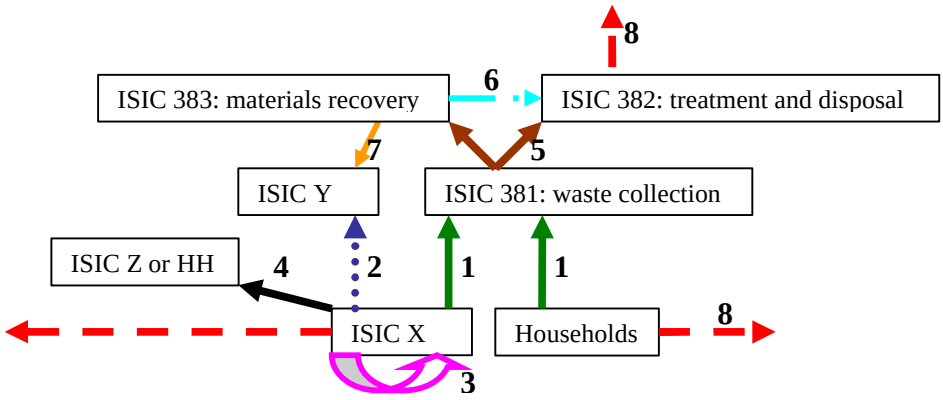
12. **Materials re-used without needing treatment are not waste**. Materials recycled or reused within the same establishment or enterprise are not recorded and are not considered waste. Discarded materials re-used without treatment by another enterprise are products.

13. **Materials that are discarded and subsequently treated and recycled are waste until they have undergone a recovery treatment.**

14. The only exception to the above rules is that solid **materials collected by a waste collection scheme (e.g., an enterprise within ISIC 38) are by definition waste,** whether or not they need treatment before re-use, and even if they are ultimately re-used. This exception is generally necessary in practical terms, because it is difficult to distinguish among items collected by the waste collection industry based on their specific needs for treatment or likelihood of reuse**.** In addition, the vast majority of the materials collected by waste collection schemes will in fact either be treated and recycled, or disposed of by being incinerated, exported, or deposited in a controlled landfill.

15. The proposed development of a gross flow account for waste follows upon this definition. In order to clarify the definitional issues involved, the figure below illustrates all of the flows between the environment and the economy that are related to discarded materials. As the discussion below illustrates, these materials may or may not be waste, depending on the need for treatment and on whether they are collected by a waste collection scheme.

Figure 1: Physical flows related to discarded materials



16. The diagram distinguishes several types of physical flows:

- The solid arrows 1 represent physical flows into ISIC 381 (waste collection)[6] covering both 'industrial waste' (originating from ISIC X) and 'municipal waste' (generally originating from households). These flows are by definition waste.

- The dotted arrow 2 (from ISIC X to ISIC Y) represents physical flows of discarded materials that can be re-used directly (without treatment) as intermediate consumption by other industries. For example, wood shavings discarded by the lumber industry may be reused without treatment as inputs into the paper industry. These flows are not waste.

- The arrow 3 (ISIC X to itself) represents materials that are directly recycled or reused at the place of generation (i.e. establishment), such as by incineration or reprocessing into component materials. For example, broken glass generated in the glass-making industry may be melted down and re-used within a glass-making establishment. Such flows are not waste under the proposed definition.

- The arrow 4 (from ISIC X to ISIC Z or to households) represents the production of products or by-products using materials that have been discarded under the production process used in ISIC X. For example, dirt excavated by the construction industry may be used for landscaping, either by households or by the landscaping industry. Such flows are also excluded from waste.

- The arrows 5 (from ISIC 381 to ISIC 382 and ISIC 383) represent flows of materials from waste collection (381) to waste treatment and disposal (ISIC 382) or to materials recovery (ISIC 383). For example, municipal waste collected by enterprises in ISIC 381 may be sorted into recyclable materials going to ISIC 383 and non-recyclables going to a controlled landfill. These flows are—again, by definition—waste.

- The arrow 6 (from ISIC 383 to ISIC 382) represents waste from the materials recovery industry. This flow is sometimes also labeled "secondary waste". This type of waste would include waste generated during the process of recycling. These flows are included in the definition of waste.

- The arrow 7 (from ISIC 383 to ISIC Y) represents materials that have been recovered. [7] These might include materials such as plastic or metal that have been recovered during the recycling process. Such materials are not waste once they have been treated.

- The arrows 8 represent flows from the economy to the environment. The flow from households or ISIC X to the environment could consist of a) flows of material to uncontrolled landfills or b) waste materials that are directly discharged into ambient

[6] Division: 38 - Waste collection, treatment and disposal activities; materials recovery:
381 - Waste collection 3811 - Collection of non-hazardous waste; 3812 - Collection of hazardous waste
382 - Waste treatment and disposal: 3821 - Treatment and disposal of non-hazardous waste; 3822 - Treatment and disposal of hazardous waste
383 - Materials recovery

[7] Recovery is defined as any waste management operation that diverts a waste material from the waste stream and which results in a certain product with a potential economic or ecological benefit. Recovery mainly refers to the following operations: material recovery, i.e. recycling; energy recovery, i.e. re-use a fuel; biological recovery, e.g. composting; re-use. Direct recycling or reuse within industrial plants at the place of generation is excluded.
Re-use shall mean any operation by which end of life products and equipment (e.g. electrical and electronic equipment) or its components are used for the same purpose for which they were conceived (OECD).

water or air (e.g. flow of waste water or of air emissions as materials are incinerated). The flow from ISIC 382 to the environment could consist of treated materials such as water that can be returned directly to the environment. Generally these flows are included in waste, but some exceptions may occur if the discarded materials have been adequately treated (in which case they are returns to the environment but not waste).

17. To summarize, under the definition of waste proposed above waste would consist of the following flows:

- All flows into ISIC 38 (arrows numbered 1). These discarded materials are by definition waste because they are collected by the waste collection industry.
- Flows of materials requiring treatment before re-use or disposal (arrows 5 and 6).
- Flows to the environment represented by arrows numbered 8 are borderline cases. If they consist of materials that need treatment and that have been returned to the environment without that treatment (generally illegally), then they are waste. If the flows have been treated and are legally returned to the environment as recovered materials (for example, wastewater that has been cleaned and returned to a reservoir, or mining overburden that has been processed and restored), then they are not waste.

18. The remaining flows are <u>not</u> waste under the European Waste Directive and under the proposed definition of waste. These flows include:

- All flows of materials that are re-used without treatment, whether within the same enterprise or industry, by another industry, or by households (arrows 2, 3 and 4).
- Flows of materials that have been treated and that now represent recycled products or intermediate inputs (arrow 7).

19. The application of this definition of waste is illustrated in the accompanying chart and table, which show a proposed format for a set of gross waste flow accounts. These examples show only gross flows of waste; an additional treatment for net flows may be needed. Further, the table applies only to waste flows and products created using recycled waste; integration of this information with other physical flow accounts must be done carefully to avoid double counting and to make correspondences across tables clear.

20. The proposed waste account traces both the supply and use of waste and other discarded materials. In the example, for the sake of illustration only two types of discards are shown: municipal waste generated by households and paper waste generated both by households and by enterprises in ISIC X. In both the chart and the supply panel of the table, it can be seen that a total of 290 tons of waste has been supplied within the economy over the accounting period (150 tons in the first instance, and 140 tons after processing), and 10 tons have been supplied to the environment from the economy. Of the waste within the economy, 100 tons is municipal waste. Waste paper is produced by industry X (perhaps government, for example), for a total of 40 tons, and by households, for 10 tons. This waste is then processed, resulting in a supply of 135 tons of reprocessed waste to controlled landfills, and 5 tons of recycled paper products.

21. The use panel of the table shows how the waste generated in the economy is used. In the first instance, 100 tons of municipal waste is collected by enterprises in ISIC 381 for reprocessing, and another 50 tons is collected by enterprises in the paper-recycling industry (which may or may not be part of ISIC 38 depending upon specific country

practices.) Of this waste, 135 tons are processed and deposited in controlled landfills, while 5 tons become paper products.

Figure 2: Waste Flow Accounts

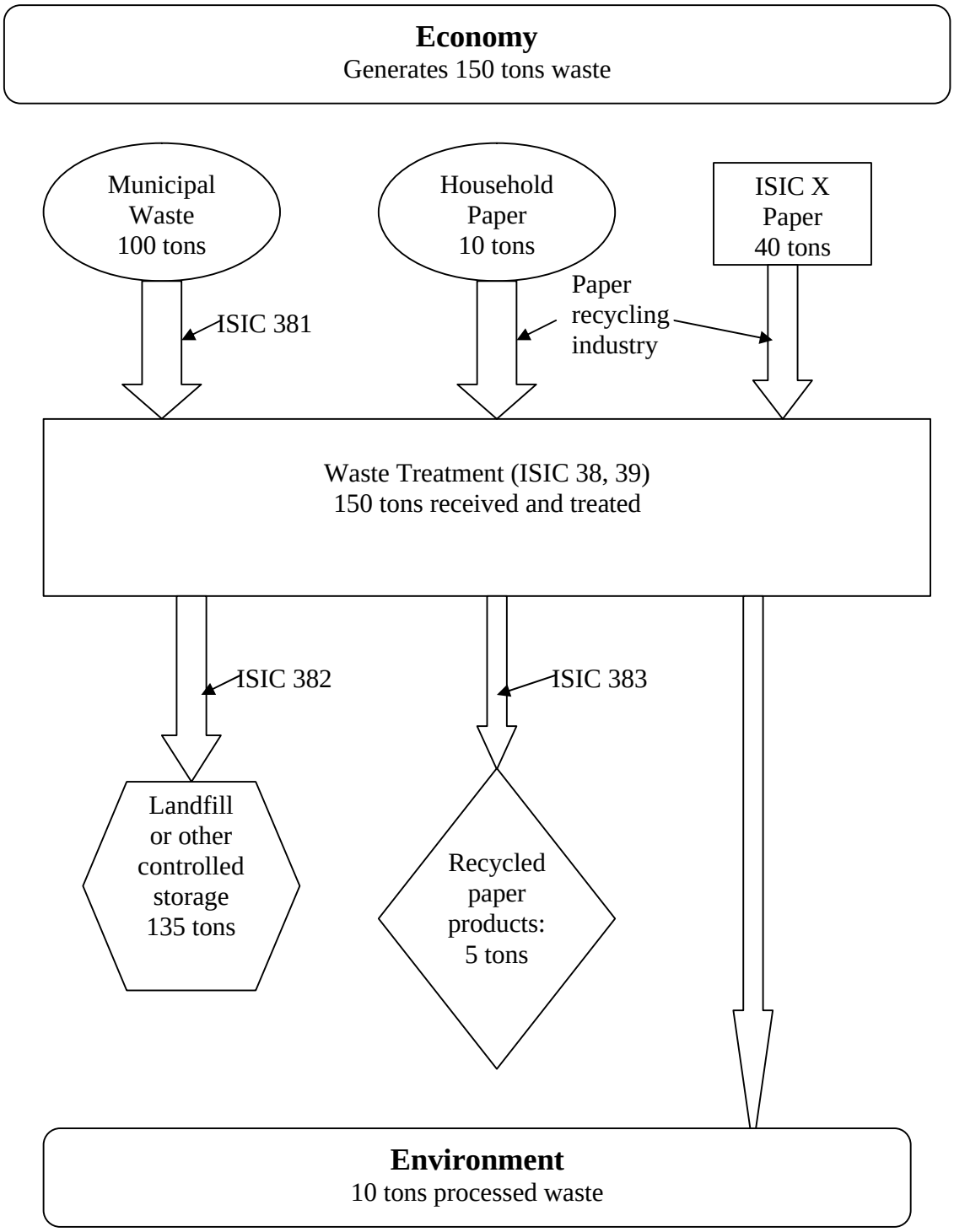


Table 1: Proposed Gross Flows Account for Waste and Products Made from Recycled Waste

Table 1.A: Physical use table for waste flows (all within the economy)

Tons

	Industries (by ISIC categories)							
	Paper Recycling	ISIC 381	ISIC382	ISIC 383	*Industry total*	*Gross Capital Formation*	House-holds	Total
Use of waste received from other economic units	**50**	**100**		**5**	**155**	**135**		**290**
of which:								
Municipal waste		*100*			*100*	*90*		**190**
Paper waste	*50*			*5*	*55*	*45*		**100**

Table 1.B: Physical supply table (economy and environment)

		Industries (by ISIC categories)					House-holds	Total
		ISIC X	ISIC 381	ISIC382	ISIC 383	*Industry total*		
Within the Economy	**Supply to other economic units**	**40**		**135**	**5**		**110**	**290**
	of which:							
	Municipal waste			*135*			*110*	*255*
	Waste paper	*40*						*40*
	Recycled paper products				*5*	*5*		*5*
To The Environ-ment	**Supply to the environ-ment**		**10**					**10**

The distinction between products, waste and residuals

22. While the fundamental concept of a product in the SEEA aligns with the SNA, the SEEA may need an expanded set of classifications for physical flows, because some physical flows involving materials without monetary value must be tracked in a physical flow account in order to preserve the principle of material balance. For example, as illustrated above, physical flows of discarded materials may in some cases be used as inputs in the production of products—sewage may be processed to produce fertilizer, mining overburden may be used for construction, and so forth. Even though these inputs may have no monetary value (or may even have a negative value, in the sense that they involve services such as waste removal that must be paid for), they must be tracked in the physical flow accounts if all physical flows and changes in stocks are to balance. Further, these flows are relevant to policy issues involving both waste management and environmental policies. Without a mechanism that allows physical flows to be tracked separately from monetary flows, it will be difficult to determine which waste materials remain within the economy and which are ultimately returned to the environment, a primary purpose of the SEEA.

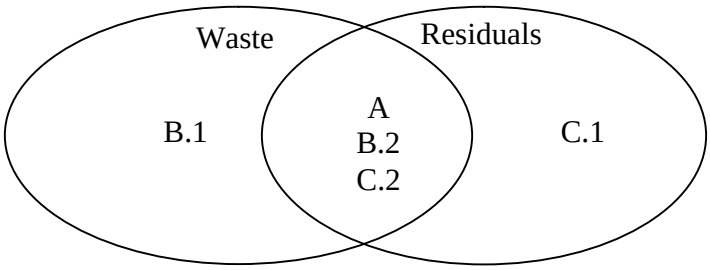
23. The majority of waste belongs to the category often classed as residuals by national statistical offices—that is, discarded materials with no monetary value. However, some residuals may not actually be waste under the definition given above—for example, discarded materials that have not been collected by a waste collection scheme, and that are re-used immediately without treatment. These may have no monetary value—for example, excavated dirt that is re-used for landscaping—but they are not waste because they are re-used without treatment.

24. Such examples are relatively rare, however. The more empirically important case where the proposed definition of waste differs from the definition of residuals concerns discarded items that do have monetary value but that must nevertheless be treated before re-use. Such materials might include wastewater that must be processed before it becomes drinkable, for example, or organic waste that must be composted before it becomes fertilizer. These materials are included in the definition of waste because they must be treated, even though they have at least nominal value and therefore may not be considered to be residuals. A definition of waste based on monetary value alone may misclassify such materials.

25. UNSD proposed to eliminate the category of residuals in the SEEA, because it seemed ambiguous in relation to waste. If residuals are discarded materials that have no monetary value, as defined above, they will overlap substantially with the waste category, but will not be exactly the same. Instead, it was proposed to substitute instead waste flows within the economy and returns to the environment, without reference to residuals.

26. Comments on this proposal indicated that NSOs feel that it is useful to keep the residuals category, however, at least in the monetary accounts. Therefore, UNSD is now proposing that the category of residuals can be retained for classification purposes in the monetary accounts, but that a stricter definition of waste should be used for the physical flow accounts and particularly for any waste accounts. Although in most cases residuals and waste will overlap, for policy and waste management purposes it may be necessary to account for untreated waste that has positive value (and therefore does not meet the definition of a residual.) Correspondence tables should be produced where possible to map the relationships between the classifications of residuals and waste.

Figure 3: Relationship between waste and residuals



Key:

A. Materials collected by ISIC 38 enterprises

B. Materials that need treatment before re-use (but not collected by a waste collection scheme)

    1. positive price materials
    2. zero or negative price materials

C. Materials that are returned to the environment

    1. after treatment (return flows)
    2. without treatment

27. Figure 3 illustrates the relationship between waste and residuals under the proposed definition of waste. As noted above, the two categories overlap significantly. Waste consists of all materials collected through ISIC 38 (A), plus all materials that need treatment before re-use (B.1 and B.2), and all materials returned to the environment without treatment (C.2). Properly treated return flows to the environment are residuals, but are excluded from waste under this definition, as are any other discarded materials that do not need further treatment. Similarly, residuals include categories A, B.1, and C.1 and C.2, but exclude B.2—materials needing treatment that have zero or negative prices. Maintaining these distinctions in the waste accounts will allow them to be aligned with the definition of waste underlying the European Waste Directive.

28. For policy and waste management purposes, it would be helpful in analyzing and managing waste flow information for residuals to be divided into flows that remain within the economy and those that are returned to the environment. Tracking flows to the environment will sometimes be difficult, because observation of those flows often cannot be made directly. In an account that is based on material balance, however, such flows can sometimes be inferred by comparing detailed supplies and uses of waste.

Classifications and system boundaries

29. The third difficulty with the SEEA-2003 conceptual framework is that the classifications of physical flows do not fully accord with the system boundaries of the SEEA-2003. A key goal of the

SEEA is to track flows to and from the environment in order to assess environmental impacts. The SEEA-2003 framework, however, is more strongly oriented toward the tracking of flows of environmental goods and services within the economy.

30. In SEEA-2003 there is a link between the asset classification and the classification of flows of natural resources and ecosystem inputs. Environmental assets are classified in SEEA-2003 into three main categories: natural resources, land and surface water, and ecosystems. In simplified terms, natural resources (as assets) provide natural resources (flows), ecosystems (as assets) provide ecosystem inputs (flows) and land and surface water (as assets) provide the space or habitat. The first two categories generate "resource flows," but the third is not directly connected to a physical or material flow (except in the case of land reclamation) – it is instead classified as a service flow (SEEA 1.23).

31. However, the classification of flows of natural resources and ecosystem inputs is problematic with regard to the natural growth and harvest of cultivated resources such as timber—it is not entirely clear where such flows cross the boundary from the environment into the economy under the SEEA-2003 framework. Cultivated resources produce flows of products, because those flows are the output of a production process. Strictly speaking, these cultivated resource flows should be excluded from the classification of environmental flows of natural resources and ecosystem inputs; only ecosystem inputs should be recorded as inputs from the environment.[8] However, in practice flows of ecosystem inputs are not captured in statistics and are difficult to measure (they are the result of modeling exercises). Instead of classifying this type of resource flow in relationship to environmental assets, therefore, they might be more usefully classified as products using CPC categories, with an appropriate breakdown into cultivated and non-cultivated resources. [9]

32. In addition, ecosystem inputs are defined ambiguously in SEEA-2003[10]. As a result, in some cases, such as water, it can be difficult to distinguish flows of natural resources from ecosystem inputs. There is also an issue of aligning ecosystem inputs with MFA practices, which use the term "balancing items" to describe such inputs. Finally, there is an issue of coverage: should so-called unused flows such as mining overburden be part of the classification of physical flows?

33. Boundary issues also apply on the output side. The classification of residuals covers both items that cross the boundary from the economy to the environment and materials that remain within the economy. This not only creates confusion, it may also lead to ambiguity in accounting for flows such as untreated leakage from otherwise-controlled landfills (see SEEA papa3.67). It is important for policy and waste management purposes to capture such flows between the economy and the environment.

D. Proposal on the development of classifications for physical flows

34. For all of the reasons outlined above, a reorganization of the classification of physical flows is proposed for the revised SEEA. This broad framework of the classification would be as shown in Figure 4 below:

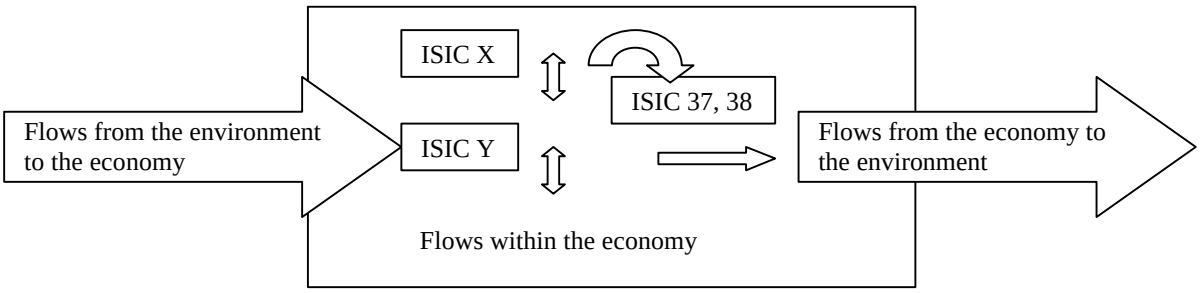
[8] The issue of the treatment of cultivated assets is dealt with at length in the outcome paper on the treatment of cultivated assets. It is proposed there to record the biomass growth as flow from the environment to the economy (as opposed to say the harvest). The CPC strictly speaking does not contain the growth of materials but the resulting products.

[9] This recommendation was also made in LG/13/3.

[10] Various definitions of ecosystem inputs can be found in the SEEA-2003: positive definitions such as "the water and air necessary for all life forms" (1.67); or negative definitions such as "Ecosystem inputs are restricted to the substances absorbed from the ecosystem for purposes of production and consumption such as the gases needed for combustion and production processes as well as oxygen, carbon dioxide, water and nutrients. Unlike natural resources, ecosystem inputs are not easily identifiable in any of the products to which they contribute" (3.42).

- Flows from the environment to the economy, or "inflows" consisting of:
    - flows of natural resources (classified according to the CPC)
    - balancing items (e.g. oxygen for combustion processes and respiration, nitrogen for Haber-Bosch process, carbon dioxide for respiration of cultivated crops, plants, and trees, soil minerals, but also materials that end up in the waste collection system such as green waste and contaminated soils);
- Flows within the economy (products and waste) classified according to CPC (with additional classifications as needed);
- Flows from the economy to the environment or "return flows" consisting of:
    - emissions to air
    - emissions to water
    - solid waste to uncontrolled landfill
    - dissipative use
    - balancing items.

Figure 4: Framework for classification of physical flows



35. Details of the proposal include:

- Waste will be defined in accordance with the EU regulations as discussed in the earlier part of this paper: *Waste consists of all materials that are discarded and not re-used.*
    - Materials that are re-used without needing treatment are not waste. Materials needing treatment after discard are waste until that treatment and recycling takes place.
    - The destination (within the economy or to the environment) and monetary value of discarded materials do not affect whether or not they are classified as waste.
    - The one exception to this rule is that all materials collected by waste collection schemes (industries in ISIC 38) are by definition waste.
- The term *residual* will continue to be defined as *discarded materials with no monetary value.*Itas discussed above. It is recognized that while the categories of residuals and waste will overlap to a very substantial degree, some waste, such as wastewater, may have some monetary value, but will nonetheless need treatment before re-use. Including such waste in the physical flow accounts and particularly in the waste accounts may be important for policy and waste management purposes.

If the residuals category is retained, correspondence tables making clear the relationship of that category to the waste category should be provided.

- For both waste and residuals it is important to track whether materials remain within the economy or are returned to the environment.
- The term ecosystem input will be replaced with the term material balancing items, because as noted in the comments by the Dutch, ecosystem inputs cannot generally be observed directly, and must be inferred using the principle of material balance.

36. As summarized in figure 4, therefore, the conceptual framework of the revised SEEA would consist of flows from the environment to the economy (formerly consisting of flows of natural resources and ecosystem inputs), flows within the economy (consisting of products and waste – formerly products plus part of the residuals), and flows from the economy to the environment (formerly – the remainder of the residuals).

37. Advantages of this proposal are the following:

- Alignment with CPC 2.0 and 2008 SNA.
- Harmonization of terminology with the EWC (definition of waste).
- Integration of EW-MFA as one of the building blocks of SEEA by defining flows from the environment to the economy and return flows explicitly with reference to the boundary between the economy and the environment (comparable with EW-MFA concepts of inputs and outputs respectively).
- Avoiding the difficulty of having dissipative use of products, which can often only be inferred as balancing items, in a classification of residuals; they would simply be flows from the economy to the environment.
- This framework was also chosen as the basis of SEEAW.

38. A remaining problem in the classification of physical flows is that appropriate categories for the classification of waste are difficult to define. Both Eurostat and the UNSD have concluded that the CPC alone does not classify waste in a way that allows it to be tracked appropriately in all cases.

39. It has been proposed to harmonize the EWC-Stat with the CPC, at least in broad outline, and to use the EWC-Stat categories for classifying waste rather than CPC 39 (and perhaps the largest of the other CPC categories that include some waste that is not immediately re-used, such as glass waste). Details on what such a proposal might entail are given in Annex 1, and a list of the CPC classes involved is shown in Annex 2. Additionally, it has been proposed to use the classification of flows to and from the environment developed by Karl Shoer (referred to above and detailed in Annex 3), to classify those flows.

40. This proposal was presented to the recent meeting of the Expert Group on Classification.[11] They have agreed to such a classification on an interim basis, but have also requested additional documentation on the EWC and on the categories chosen for classifying flows to and from the environment. They have agreed to a more comprehensive evaluation of theses classifications within six months.

[11] Meeting of the Expert Group on International Economic and Social Classifications, UNHQ, New York, 1-4 Sep. 2009. The minutes of this meeting are available on the UNSD web site.

Questions to the London Group

1. *Do you agree with the proposed framework for the classification of flows in the revised SEEA? Specifically, do you agree with the alternative typology of flows to distinguish flows from the environment to the economy, flows within the economy, and flows from the economy to the environment?*
2. *Do you agree with the proposed definition of waste?*
3. *Are the proposed gross flow accounts for waste useful, and are they feasible?*
4. *Do you agree with the proposed definitions of residuals and of flows to and from the environment?*
5. *Do you agree with the proposal to extend the classification of waste, at least until completion of a review by the Expert Group on Classifications, with EWC Stat categories for the purpose of classifying waste?*
6. *Do you agree on the use of the categories developed by Karl Shoer to track flows to and from the environment, at least until these categories can be evaluated by the Expert Group on Classifications?*

Annex 1: Issues in the harmonization of EWC Stat, HS and CPC 2.0

1. This annex addresses the issue of developing a correspondence between the EWC Stat and the CPC. As indicated earlier, there are various reasons why a correspondence table of CPC and the EWC-Stat would be useful. This annex details efforts by UNSD to develop such a correspondence. Similar work has been done at Eurostat, and work is now underway to compare the results of these studies.

2. The initial plan was to construct a correspondence table between EWC-Stat and HS (and by extension CPC) using a bottom-up approach. The idea was to start with the individual items in the LoW and classify them according to HS. Since we already have the correspondence between LoW and EWC-Stat, this would allow us to automatically generate a correspondence table between EWC-Stat and HS that would be rather comprehensive since all the detail of the LoW had been taken into account. However, as most of the items on the LoW cannot be easily classified according to HS, this approach had to be abandoned.

3. Instead, a pilot study carried out by Germany was used as basis for the work.[12] The table produced by this study was imported into MS Access, along with HS 2007 – CPC 2.0 correspondence tables. All the CN codes were converted to HS by truncation, and, where additional differences were present, they were identified and corrected. A query was then run to link the EWC-Stat, the HS and the CPC codes together and present them in a common table. This table was sorted according to EWC-Stat codes. The following work then had to be done:

- Sometimes, the CN links from the German study were only done at a high level (i.e. 1 or 2 digit level) of the EWC-Stat. Efforts were made to bring these links down to at least the 3-digit level.

- The table generated from this automatic process contained significant holes, i.e. large parts of the EWC-Stat classification had no links with HS/CPC at all. Efforts were made to fill in these gaps where possible by identifying additional HS codes containing waste. For this work, the following assumptions and decisions were made.

    - The German study was taken as the basis of this work and it was assumed that it covered the majority of codes in CN/HS where waste could be found. Although the work identified even more HS classes containing waste, the bulk of the HS classes involved in the linking table still come from that study.

    - Only items specifically identified as waste, scrap or similar "unwanted" products in HS were considered. For instance, no efforts were made to link the EWC-Stat code for "used vehicles" with any vehicle class in HS (which would presumably only contain vehicles intended for further use). Similarly, although the LoW has items for various chemicals and these can be classified in HS, these links were not introduced since the HS does not treat these as waste. In some borderline cases, it was decided to include the links after all, for instance in the case of manure.

Results

4. A total of 90 CPC subclasses could be shown to contain overlap with EWC-Stat. These include all the 48 subclasses in Division 39 – "Wastes or Scraps", as well as another 42 subclasses from various

[12] The pilot study carried out by Germany and presented in 2004 presents a list of those CN codes that had been identified to contain (among other things) waste items. These codes are also associated with the EWC-Stat categories with similar contents. The present draft can be considered an extended "dual" of the German exercise. Rather than providing a systematic list of CN codes with associated EWC-Stat categories, it presents the full list of EWC-Stat categories at the 3-digit level and attempts to identify the corresponding HS codes (and CPC subclasses). In addition to the inversion of the correspondence list, it also includes additional HS codes whose CN equivalents were not identified in the German study.

parts of the classification, of which a significant part were outputs from the agriculture or food sectors. The complete table with all CPC subclasses linked to the EWC Stat is included in our previous paper, LG/1.

5. The lists found there are rough approximations of a correspondence table between the EWC-Stat on one side and the HS Nomenclature / CPC on the other side. They attempt to identify, for each 3-digit category in EWC-Stat, the HS codes (and by extension the CPC subclasses) with overlapping scopes.

6. There are several reasons why only a rough approximation is feasible at this time:

- Differences in concepts and scope make it very difficult to develop something anywhere near a complete correspondence table. Even if it could be done (which is unlikely), the usefulness of such an exercise might be limited as there would be a large number of multiple links in both directions, many of which would be of little practical significance.

- Even with the guidance document provided by Eurostat[13], in many cases there is just too little information available to clearly identify the boundaries between EWC-Stat categories. The links with the source or industry-oriented List of Waste (LoW) provides some additional information, but the items on this list are only occasionally classifiable according to HS.

- There is no straightforward or systematic way of identifying waste items in the HS. They are scattered all over the range of codes, and are often hidden as minor items inside codes mainly concerned with other merchandise. A naïve search through explanatory notes and indexes after words like 'waste' can be useful, but does not guarantee that all codes containing waste items are identified. The reason for this is that waste items are not always explicitly referred to using the word 'waste'. To complicate matters further, a significant number of items in the HS index are available in French only. The identifying process therefore becomes a combination of heuristic searches, guesswork, past experience, gut feeling and luck.

7. It has not been attempted to provide exhaustive coverage of the EWC-Stat classes. A link with a HS code simply means that some degree of overlap in contents has been detected, but says nothing about how big this overlap is. The scope of an EWC-Stat class is not necessarily fully covered by the suggested links with HS. Although there might be several suggested links to HS for a given EWC-Stat class, they are not guaranteed to cover more than a fraction of its full scope.

8. In a few cases, a really good overlap could be found, where the EWC-Stat class seems to be fully covered by a HS code and vice versa. This is duly indicated in the comment field of the correspondence table in LG/1.

Conclusion

9. Although it is in theory possible to develop a complete correspondence between relevant waste categories of CPC and the EWC, this proves difficult in practice. Waste is scattered throughout the CPC: either it is explicitly identified as waste within the waste or scraps division, or it is separately identified as waste but in the relevant product heading (for instance in case of glass waste, radioactive waste, some of the textile waste, the animal and vegetal waste), or it is not separately identified as waste at all (e.g. green waste, unused explosives, discarded equipment). It should also be noted that construction and demolition waste is included in the CPC under municipal waste.

10. CPC is not the appropriate classification for waste. Its underlying principles do not make it suitable for classifying waste. We suggest classifying waste according to the EWC Stat and to use the EWC Stat for compiling waste accounts.

[13] WASTE/WG/43a/5.3.1 (2004)

11. In case data classified according to the EWC Stat need to be assigned to CPC classes the approximate correspondence table could be used (with caution). However, care should be made with respect to double counting especially in classes that combine both the product and waste.

Literature

Communication from the Commission to the Council and the European parliament on the Interpretative Communication on waste and by-products, 2007

Pilot study on statistics on the import and export of waste in Germany, Umweltbundesamt, 2004

Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste (Waste Framework Directive)

Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (2000/532/EC)

Regulation (EC) No 2150/2002 of the European Parliament and of the Council of 25 November 2002 on waste statistics (Waste Statistics Regulation)

Statistics on generation of waste Annex to the Manual on Waste Statistics WASTE/WG/43a/5.3.1 (2004)

Classification of physical flows I, R. Delahaye, M. de Haan and S. Schenau, Statistics Netherlands, LG/12/7

Classification of physical flows II, Sjoerd Scenau, LG/13/1

Classifications of Material Flows for SEEA-MFA, Karl Schoer, LG/13/3

Physical Flow Accounts Finland 1999, Thule Institute, 2004

Annex 2: Complete list of CPC subclasses involved in the linking with EWC-Stat

CPC Ver. 2 subclasses linked to EWC-Stat	
subclass code	**Subclass name**
01620	Tea leaves
01913	Cereal straw, husks, unprepared, ground, pressed, or in the form of pellets
01990	Other raw vegetable materials, n.e.c.
04910	Coral and similar products, shells of molluscs, crustaceans or echinoderms and cuttle-bone
15110	Slate
15320	Pebbles, gravel, broken or crushed stone, macadam; granules, chippings and powder of stone
16390	Other minerals n.e.c.
21180	Flours, meals and pellets of meat or meat offal, inedible; greaves
21291	Flours, meals and pellets, inedible, of fish, crustaceans, molluscs or other aquatic invertebrates
21299	Products n.e.c. of fish, crustaceans, molluscs or other aquatic invertebrates; dead fish, crustaceans, molluscs or other aquatic invertebrates unfit for human consumption
21710	Oil-cake and other solid residues, of vegetable fats or oils
21732	Degras; residues resulting from the treatment of fatty substances or animal or vegetable waxes
23319	Preparations used in animal feeding n.e.c.
23912	Coffee substitutes containing coffee; extracts, essences and concentrates of coffee, and preparations with a basis thereof or with a basis of coffee; roasted chicory and other roasted coffee substitutes, and extracts, essences and concentrates thereof
23925	Cinnamon (canella), processed
23993	Eggs, not in shell, and egg yolks, fresh or preserved; egg albumin
25090	Other manufactured tobacco and manufactured tobacco substitutes; "homogenized" or "reconstituted" tobacco; tobacco extracts and essences
26170	Jute and other textile bast fibres (except flax, true hemp and ramie), processed but not spun; tow and waste of these fibres
26190	Other vegetable textile fibres, processed but not spun; tow and waste of these fibres
26860	Gauze (other than narrow fabrics)
27150	Sacks and bags, of a kind used for the packing of goods
27991	Wadding of textile materials and articles thereof; textile fibres not exceeding 5 mm in length (flock), textile dust and mill neps
28310	Tanned or dressed furskins
31921	Natural cork, debacked or roughly squared, or in blocks, plates, sheets or strip; crushed, granulated or ground cork; waste cork
32113	Mechanical wood pulp; semi-chemical wood pulp; pulps of fibrous cellulosic material other than wood
33500	Petroleum jelly; paraffin wax, micro- crystalline petroleum wax, slack wax, ozokerite, lignite wax, peat wax, other mineral waxes, and similar products; petroleum coke, petroleum bitumen and other residues of petroleum oils or of oils obtained from bitumi
33610	Natural uranium and its compounds; alloys, dispersions, ceramic products and mixtures containing natural uranium and its compounds
33630	Uranium depleted in U235 and its compounds; thorium and its compounds; alloys, dispersions, ceramic products and mixtures containing uranium depleted in U235, thorium or compounds of these products
33720	Spent (irradiated) fuel elements (cartridges) of nuclear reactors
34629	Other phosphatic fertilizers, n.e.c.

CPC Ver. 2 subclasses linked to EWC-Stat	
subclass code	**Subclass name**
34654	Excreta of animals useful for manure/fertilizer and fuel preparation
35110	Paints and varnishes and related products
35420	Glues and gelatine, peptones and their derivatives, and related products; caseinates and other casein derivatives; albuminates and other albumin derivatives
35490	Other chemical products n.e.c.
36270	Articles of vulcanized rubber n.e.c.; hard rubber; articles of hard rubber
37111	Glass in the mass, in balls (except microspheres), rods or tubes, unworked; waste and scrap of glass
38230	Industrial diamonds, worked; dust and powder of natural or synthetic precious or semi-precious stones
38971	Human hair, unworked, whether or not washed or scoured; waste of human hair
39110	Raw offal, inedible (including pigs' bristles, horse hair, animal guts, bird skins, feathers, bones and ivory)
39120	Bran and other residues from the working of cereals or legumes; vegetable materials and vegetable waste, vegetable residues and by-products, whether or not in the form of pellets, of a kind used in animal feeding n.e.c.
39130	Residues of starch manufacture and similar residues
39140	Beet-pulp, bagasse and other waste of sugar manufacture
39150	Cocoa shells, husks, skins and other cocoa waste; coffee husks and skins
39160	Brewing or distilling dregs and waste
39170	Wine lees; argol
39180	Tobacco refuse
39211	Silk waste
39212	Waste of wool or of fine or coarse animal hair
39213	Garnetted stock of wool or of fine or coarse animal hair
39214	Cotton waste, except garnetted stock
39215	Other cotton waste; garnetted stock
39216	Waste of man-made fibres
39217	Worn clothing and other worn textile articles
39218	Rags, scrap twine, cordage, rope and cables and worn out articles of twine, cordage, rope or cables, of textile materials
39220	Waste of leather, leather dust, powder and flour
39230	Residual lyes from the manufacture of wood pulp, including lignin sulphonates, but excluding tall oil
39240	Waste and scrap of paper or paperboard
39250	Waste, parings and scrap of rubber (except hard rubber) and powders and granules obtained therefrom
39260	Used pneumatic tyres of rubber
39270	Waste, parings and scrap of plastics
39280	Sawdust and wood waste and scrap
39290	Other non-metal waste or scrap
39310	Slag, dross, scalings and other waste from the manufacture of iron or steel
39320	Ash and residue (except from the manufacture of iron or steel), containing metals or metallic compounds, except precious metals
39331	Waste and scrap of gold or of metal clad with gold
39332	Waste and scrap of precious metal (except gold) or of metal clad with precious metal (except gold)
39333	Ash containing precious metal or precious metal compounds

CPC Ver. 2 subclasses linked to EWC-Stat	
subclass code	**Subclass name**
39340	Ferrous waste and scrap
39350	Remelting scrap ingots of iron or steel
39361	Waste and scrap of copper
39362	Waste and scrap of nickel
39363	Waste and scrap of aluminium
39364	Waste and scrap of lead
39365	Waste and scrap of zinc
39366	Waste and scrap of tin
39367	Waste and scrap of tungsten, molybdenum, tantalum, magnesium, cobalt, cadmium, titanium, zirconium, beryllium and thallium
39368	Waste and scrap of antimony and chromium
39370	Vessels and other floating structures for breaking up
39380	Waste and scrap of primary cells, primary batteries and electric accumulators; spent primary cells, primary batteries and electric accumulators
39910	Municipal waste
39920	Sewage sludge
39931	Pharmaceutical waste
39939	Other clinical waste
39940	Waste organic solvents
39950	Wastes from chemical or allied industries
39990	Other wastes n.e.c.
41544	Zinc dust, powders and flakes
41601	Tungsten, molybdenum, tantalum, magnesium, cobalt, cadmium, titanium, zirconium, beryllium, gallium, hafnium, indium, niobium, rhenium and thallium, germanium and vanadium, unwrought, and powders thereof, except powders of magnesium; waste and scrap of ga
41603	Bismuth, antimony, manganese, chromium and articles thereof; including waste and scrap of bismuth or manganese
41604	Cermets and articles thereof

Annex 3: Classifications of physical flows according to Shoer proposal[14]

Flows from the environment to the economy

MFA code	CPC 2.0	Description
A	0 + 1	**Natural resources**
A.0	0	**Biological resources from agriculture, forestry and fishery**
A.0.1	01	**Resources from agriculture, horticulture and market gardening**
A.0.1.1	011	Cereals
A.0.1.2	012	Vegetables
A.01.3	013	Fruits and nuts
A.0.1.4	014	Oilseeds and oleaginous fruits
A.0.1.5	015	Edible roots and tubers with high starch or inilin content
A.0.1.6	016	Stimulant, spice and aromatic crops
A.0.1.7	017	Pulses (dried leguminous vegetables)
A.0.1.8	018	Sugar crops
A.0.1.9	019	Forage resources, fibres, living plants, cut flowers and flower buds, unmanufactured tobacco, natural rubber, (including crop residues used for animal feed)
A.0.1.10	n.a.	Grazed biomass
A.0.2	02	**Live animals and animal resources (excluding meat)**
A.0.2.1	021	Live animals
A.0.2.2	022-025	Raw milk,eggs and other animal resources (excluding meat)
A.0.3	03	**Forestry resources**
A.0.3.1	031	Wood in the rough
A.0.3.11	0311, 0312	Logs of coniferous wood; Logs of non-coniferous wood
A.0.3.11.a		Logs of coniferous wood; Logs of non-coniferous wood, cultivated[15]
A.0.3.11.b		Logs of coniferous wood; Logs of non-coniferous wood, non-Cultivated
A.0.3.13	0313	Fuel wood, in logs, in billets, in twigs, in faggots or in similar forms
A.0.3.13.a		Fuel wood, in logs, in billets, in twigs, in faggots or in similar forms, cultivated
A.0.3.13.b		Fuel wood, in logs, in billets, in twigs, in faggots or in similar forms, non-cultivated
A.0.3.2	032	Non-wood forest resources
A.0.4	04	**Fish and other fishing resources**
A.0.4.1	041	Fishes, live, fresh or chilled
A.0.4.1.a		Fishes, live, fresh or chilled, cultivated
A.0.4.1.b		Fishes, live, fresh or chilled, non-cultivated
A.0.4.2	042	Crustaceans, not frozen; oysters; other molluscs and aquatic invertebrates, live, fresh or chilled
A.0.4.2.a		Crustaceans, not frozen; oysters; other molluscs and aquatic invertebrates, live, fresh or chilled, cultivated
A.0.4.2.b		Crustaceans, not frozen; oysters; other molluscs and aquatic invertebrates, live, fresh or chilled, non-cultivated

[14] These classification are copied from the paper 'Classifications of Material Flows for SEEA-MFA' LG/13/3 by Karl Schoer.

[15] For all cultivated items the used biomass growth should be recorded rather than the harvest.

A.0.4.9	049	Other aquatic plants and animals
A.0.4.9.a		Other aquatic plants and animals, cultivated
A.0.4.9.b		Other aquatic plants and animals, non-cultivated
A.1	1 (excl.17)	**Ores and minerals, water**
A.1.1	11 (excl. 1102, 1104)	**Coal and lignite, peat (excl. agglomerated coal and lignite)**
A.1.10	110 (excl. 1102, 1104)	Coal and lignite, peat (excl. agglomerated coal and lignite)
A.1.10.1	1101	Coal, not agglomerated
A.1.10.3	1103	Lignite, not agglomerated
A.1.10.5	1105	Peat
A.1.2	12	**Crude petroleum and natural gas**
A.1.20	120	Crude petroleum and natural gas
A.1.20.1	1201	Petroleum oils, and oils obtained from bituminous minerals, crude
A.1.20.2	1202	Natural gas, liquefied or in the gaseous state
A.1.20.3	1203	Bitumeous or oil shale and tar sands
A.1.3	13ex	**Uranuim and thorium ores (excl. concentrates)**
A.1.4	14 ex	**Metal ores (excl. concentrates)**
A.1.4.1	141 ex	Iron ores, other than roasted iron pyrites (excl. concentrates)
A.1.4.2	142 ex	Non-ferrous metal ores (other than uranium or thorium ores), excl. concentrates
A.1.4.2.1	1421 ex	Copper ores (excl. concentrates)
A.1.4.2.2	1422 ex	Nickel ores (excl. concentrates)
A.1.4.2.3	1423 ex	Aluminium ores (excl. concentrates)
A.1.4.2.4	1424 ex	Precious metal ores (excl. concentrates)
A.1.4.2.9	1429 ex	Other non-ferreous metal ores (other than uranium or thorium ores), excl. concentrates
A.1.5	15	**Stone, sand and clay**
A.1.5.1	151	Monumental or building stone
A.1.5.2	152	Gypsium; andrythe; limestone flux; limestone and other calareous stomne, of kind used for the manufacture of lime or cement
A.1.5.3	153	Sands, pebbles, gravel, broken or crushed stone, natural bitumen and asphalt
A.1.5.4	154	Clays
A.1.6	16	**Other minerals**
A.1.6.1	161	Chemical and fertilizer minerals
A.1.6.2	162	Salt and pure soduim chloride; sea water
A.1.6.3	163	Precious and semi precious stones; pumice stone; emery; natural abrasives; other minerals
A.1.8	18	**Water abstraction**
B	n.a.	**Balancing items input side**
B.1	n.a.	Oxygen for combustion processes
B.2	n.a.	Oxygen for respiration of cultivated animals and aquatic resources
B.3	n.a.	Oxygen for human respiration
B.4	n.a.	Nitrogen for Haber-Bosch process
B.5	n.a.	Carbon dioxide for respiration of cultivated crops, plants, and trees
B.6	n.a.	Soil minerals
B.7	n.a.	Unused biomass from parks and gardening for waste collection
B.9	n.a.	Contaminated soils and polluted dredging spoils

Flows from the economy to the environment

MFA Code	Description
A	**Emissions to air**
A.1	**Carbon dioxide (CO_2)**
A.1.1	Carbon dioxide (CO_2) other than from biomass combustion and respiration of humans and livestock
A.1.2	Carbon dioxide (CO_2) from biomass combustion
A.1.3	Carbon dioxide (CO_2) from respiration of humans (balancing item output side)
A.1.4	Carbon dioxide (CO_2) from respiration of livestock (balancing item output side)
A.2	**Methane (CH4)**
A.3	**Dinitrogen oxide (N_2O)**
A.3.1	Dinitrogen oxide (N_2O) other than from dissipative use as a product
A.3.2	Dinitrogen oxide (N_2O) from dissipative use as a product
A.4	**Nitrous oxides (NOx)**
A.5	**Hydroflourcarbons (HFCs)**
A.6	**Perflourocarbons (PFCs)**
A.7	**Sulfur hexaflouride**
A.8	**Carbon monoxide (CO)**
A.9	**Non-methane volatile organic compounds (NMVOC)**
A.9.1	Non-methane volatile organic compounds (NMVOC) other than from dissipative use as a product
A.9.2	Non-methane volatile organic compounds (NMVOC) from dissipative use as a product
A.10	**Sulfur dioxide (SO_2)**
A.11	**Ammonia (NH3)**
A.12	**Heavy metals**
A.13	**Persistent organic pollutantsPOPs**
A.14	**Particles (e.g PM10, Dust)**
B	**Solid waste to uncontrolled landfill**
C	**Emissions to water**
C.1	**Nitrogen compounds (N), excl. emissions from agriculture (dissipative use)**
C.2	**Phosphorus compunds (P), excl. emissions from agriculture (dissipative use).**
C.3	**Heavy metals**
C.4	**Other substances and (organic) materials**
D	**Dissipative use of products n.e.c.**
D.1	**Organic fertilizer (manure)**
D.2	**Mineral fertilizer**
D.3	**Sewage sludge**
D.4	**Compost**
D.5	**Pesticides**
D.6	**Seeds**
D.7	**Other products for dissipative use (e.g. materials spread on roads, solvents)**
E	**Dissipative losses (e.g abrasion from tires, friction products, buildings and infrastructure)**
F	**Return flows of water**
G	**Balancing items output side: water vapor and other water losses**
G.1	Evaporation of water from production processes other than from combustion of fuels or from other excorporated water
G.2	Losses in distribution of water not because of leakages
G.3	Evaporation of excorporated water from fuel combustion
G.4	Other evaporation of excorporated water