Product Environmental Footprint Category Rules (PEFCR)

Household Heavy Duty Liquid Laundry Detergents (HDLLD) for machine wash

September 2019
Version 1.2
Time validity: 31st December 2021

Errata

Upload date	Changes made
07/03/2019	**Publication of the PEFCR** (v1.0)
20/08/2019	**Publication of the PEFCR** (v1.1)
	Datasets substitution (Table VI-16: End of Life- Packaging) 034b2afb-2aa4-4d64-99b5-f39f700f3d44 Waste incineration of **untreated** wood waste-to-energy plant with dry flue gas treatment, including transport and pre-treatment production mix, at consumer wood waste. **with** 034b2afb-2aa4-4d64-99b5-f39f700f3d44 Waste incineration of **processed** wood; waste-to-energy plant with dry flue gas treatment, including transport and pre-treatment; production mix, at consumer; wood waste. 8fd8211a-135d-4921-aaeb-e2e5100bac2e Landfill of **untreated** wood landfill including leachate treatment and with transport without collection and pre-treatment production mix (region specific sites), at landfill site **with** 0907b969-c8a5-4317-84b3-04ad0a04447e Landfill of **processed** wood; landfill including leachate treatment and with transport without collection and pre-treatment; production mix (region specific sites), at landfill site
	Dataset substitution (Table VI-9: Manufacturing) *99ca61fe-4fc2-4e04-b4cf-ed0acd2e2e94* Steel electrogalvanized coil; steel sheet electrogalvanization; single route, at plant; 1.5 mm sheet thickness, 0.02 mm zinc thickness. **with** 50209559-8f2d-4287-b81a-74ab900edc54 Steel electrogalvanized coil; steel sheet electrogalvanization; single route, at plant; 1.5 mm sheet thickness, 0.02 mm zinc thickness.
	Correction of LCIA results for the reference product (IV. Most relevant impact categories, life cycle stages, processes, VII.1 Benchmark values, Annex X.4. Representative product)
	Truck production is excluded as it is below the 1% cut off criteria (III.4 System boundaries and VI.4 Distribution)
	The end of life of the label is excluded as it is below the 1% cut off criteria ((III.4 System boundaries)
	The water emissions of the Treatment of detergent wastewater, large plant dataset should be manually corrected to be aligned with the assumption in term of geographical distribution of water flows in water consumption dataset at Use Stage. (VI.6.1. Wastewater treatment, Annex X.5 for further explanations)
	Typo for amount of equipment for Manufacturing infrastructure: 5E-03 kg*weight in kg of one dose. (Table VI-9 in VI.3 Manufacturing)
	Typo for amount of capital goods for Storage infrastructure: 4.31E-02 m³ for retail space building and 1.23E-02 kg for parking. (Table VI-11 in VI.4 Distribution stage)
	Datasets substitution (Table VI-16 in VI.6.2 Municipal Solid Waste management)

Upload date	Changes made		
	95051bb3-46cc-40c1-8b6d-6d58ac334bb9 & 4b75bb92-fa95-4abd-9c30-4ea81f9c1235 Corrugated box, uncoated Kraft Pulping Process, pulp pressing and drying production mix, at plant 280 g/m2 & End of life of beverage cartons collection, transport, cleaning production mix, at plant 1kg of cardboard waste disposed	**with**	a0c91472-04d8-4293-acf5-0ec97a514bfd Testliner (2015); technology mix, thermal energy sold/used externally; production mix, at plant; 1.09 kg waste paper input per kg Testliner
	Further to Critical Review (June/July 2019) **Correction of most relevant Life cycle stages and processes + LCIA results for the reference product** (IV. Most relevant impact categories, life cycle stages, processes, figure IV.1, VII.1 Benchmark values, Annex X.4. Representative product) **Several precisions added through the report related to modifications performed since last critical review** Limitation added in VI.6.1. Wastewater treatment due to the alignment procedure (footnote 69) Precision of assumptions used to evaluate the detergent contribution in total organic load in wastewater treatment (footnote 2626) Assumption for transport of ingredient for the RP : Percentage of average concentration of ingredients for Representative Product and reminder that deionised water added to ingredients on manufacturing site is not transported (annex X.4) **New critical review report added** (II.3, II.4 and annex X3)		
16/09/2019	**Publication of the PEFCR** (v1.2) **Correction of 'TOTAL' for 'Total Life Cycle stages' in Table VII 3: Weighted benchmark values for the A.I.S.E HDLLD RP** (3.86E-5)		

Between 2013 and 2018, A.I.S.E. has coordinated the efforts of the multi-stakeholder A.I.S.E. PEF Technical Secretariat (A.I.S.E. PEF TS) to develop this PEFCR for Heavy Duty Liquid Laundry Detergents, in close collaboration with the 'Review Panel', the European Commission, its Joint Research Center (JRC) and the EU OEF/PEF Technical Helpdesk.

Highly committed to progress the sustainability of the cleaning and maintenance products industry in Europe, A.I.S.E. has historically developed a series of forward looking, voluntary sustainability initiatives. Given this long track record A.I.S.E. welcomed the opportunity to participate in the EU PEF pilot project, which built upon existing initiatives at European and national level, such as the 'A.I.S.E. Charter for Sustainable Cleaning'[1], The French Grenelle pilot case for laundry detergents on environmental information[2], and the Cleanright.eu website[3].

From Dec 2013 to August 2018, the A.I.S.E. PEF Technical Secretariat has followed the official test phases (1. Development of draft and final PEFCR, 2. Verification and testing (6 supporting studies), 3. Testing of Communication Vehicles, and 4. Remodelling of Reference Products).

The final version of the PEFCR for Heavy Duty Liquid Laundry Detergents is the outcome of this extensive PEF pilot process. It should be noted that the PEF method and associated databases were still being refined and improved at the moment when this PEFCR was submitted and that the method and databases will continue to be optimised during the EF 'Transition Phase' (2018-2020). In order to assist interested applications of the PEFCR, A.I.S.E. publishes this PEFCR in combination with additional commentary and guidance to offer assistance for the interpretation and sound deployment of the PEF results.

[1] http://www.sustainable-cleaning.com/en.companyarea_documentation.org and http://www.sustainable-cleaning.com/content_attachments/documents/ASPs_LLD1stReview_1April2016.pdf

[2] www.afise.fr

[3] http://uk.cleanright.eu/

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Acronyms and Units

Abbreviations

A.I.S.E.	International Association for Soaps, Detergents and Maintenance Products
ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
AF	Allocation Factor
AR	Allocation Ratio
ASP	Advanced Sustainability Profile
B2B	Business to Business
B2C	Business to Consumer
BoM	Bill of Materials
CAS	Chemical Abstracts Service
CDV	Critical Dilution Volume
CECED	European Committee of Domestic Equipment Manufacturers
CF	Characterisation Factor
CFC	Chlorofluorocarbon
CFF	Circular Footprint Formula
CFF-M	Circular Footprint Formula – Modular form
CH	Switzerland
CPA	Classification of Products by Activity
CTU	Comparative Toxic Unit
DC	Distribution Center
DNM	Data Needs Matrix
DQA	Data Quality Assessment
DQR	Data Quality Rating
EC	European Commission
ECHA	European Chemicals Agency
EEB	European Environmental Bureau
EF	Environmental Footprint
EFTA	European Free Trade Association
EI	Environmental Impact
ELCD	European reference Life Cycle Database
ERASM	Environment & Health Risk Assessment and Management
EoL	End-of-Life
EPD	Environmental Product Declaration
ESC	Environmental Safety Check
EU	European Union
EU COM	European Commission
FAO	Food and Agriculture Organization of the United Nations
FU	Functional Unit
GE	Gross Energy intake
GHG	Greenhouse Gas
GLO	Global (worldwide) market situation (ecoinvent abbreviation to define the geographical scope)
G_R	Geographical Representativeness
GWP	Global Warming Potential
HC50	Hazardous Concentration for 50% of the species

HD	Helpdesk
HDLLD	Heavy Duty Liquid Laundry Detergents
HERA	Human and Environmental Risk Assessment
HDPE	High Density Polyethylene
IEA	International Energy Agency
IFRA	International Fragrance Association
ILCD	International Reference Life Cycle Data System
IPCC	Intergovernmental Panel on Climate Change
IPTS	Institute for Prospective Technological Studies
ISO	International Organization for Standardization
JRC	Joint Research Centre
LAS	Linear alkylbenzene sulfonate
LCA	Life Cycle Assessment
LCDN	Life Cycle Data Network
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LDPE	Low Density Polyethylene
LT	Lifetime
NACE	Nomenclature Générale des Activités Economiques dans les Communautés Européennes
NDA	Non-Disclosure Agreement
NEF	Nordic Environmental Footprint
NF	Normalisation Factor
NGO	Non-Governmental Organisation
NMVOC	Non-Methane Volatile Organic Compounds
OECD	Organisation for Economic Co-operation and Development
OEFSR	Organisation Environmental Footprint Sector Rules
P	Precision
PCR	Product Category Rules
PEC	Predicted Environmental Concentration
PEF	Product Environmental Footprint
PEFCR	Product Environmental Footprint Category Rules
PESR	Projected Environmental Safety Ratio
PM 2.5	Fine particulate matter (diameter of 2.5 micrometres or less)
PNEC	Predicted No Effect Concentration
QSAR	Quantitative Structure–Activity Relationship
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RER	European market situation (ecoinvent abbreviation to define the geographical scope)
RF	Reference Flow
RIFM	Research Institute for Fragrance Materials
RP	Representative Product
SB	System Boundary
SC	Steering Committee
SCP/SIP	Sustainable consumption and production (SCP) / Sustainable industrial policy (SIP)
SETAC	Society of Environmental Toxicology and Chemistry
SLES	Sodium lauryl ether sulfate
SMGP	Single market for green products
SMRS	Sustainability Measurement & Reporting System
SPF BE	Federal Public Service - Health, Food chain safety and Environment - Belgium
SSD	Species Sensitivity Distribution

SOM	Soil Organic Matter
TAB	Technical Advisory Board
Te_R	Technological Representativeness
Ti_R	Time Representativeness
TS	Technical Secretariat
TU Berlin	Technical University Berlin
UNEP	United Nations Environment Program
US EPA	United States Environmental Protection Agency
UUID	Universally Unique Identifier
WBCSD	World Business Council for Sustainable Development
WMO	World Meteorological Organization
WRI	World Resources Institute
WTA	withdrawal-to-availability
WWTP	Wastewater treatment plant

Units:

CTU	Comparative Toxic Unit
g	Gram
kg	Kilogram
km	Kilometre
kWh	Kilowatt hour
m^2	Square metre
m^3	Cubic metre
MJ	Mega Joule
ml	millilitre
pkm	Person kilometre
t	Tonne
tkm	Tonne kilometre
vkm	Vehicle kilometre
°C	Temperature in Celsius

Definitions

Activity data - This term refers to information which is associated with processes while modelling Life Cycle Inventories (LCI). In the PEF Guide it is also called "non-elementary flows". The aggregated LCI results of the process chains that represent the activities of a process, are each multiplied by the corresponding activity data[4] and then combined to derive the environmental footprint associated with that process (See Figure 1). Examples of activity data include quantity of kilowatt-hours of electricity used, quantity of fuel used, output of a process (e.g. waste), number of hours equipment is operated, distance travelled, floor area of a building, etc. In the context of PEF the amounts of ingredients/raw materials from the bill of ingredients/bill of materials (BOM) shall always be considered as activity data.

Aggregated dataset - This term is defined as a life cycle inventory of multiple unit processes (e.g. material or energy production) or life cycle stages (cradle-to-gate), but for which the inputs and outputs are provided only at the aggregated level. Aggregated datasets are also called "LCI results", "cumulative inventory" or "system processes" datasets. The aggregated dataset can have been aggregated horizontally and/or vertically. Depending on the specific situation and modelling choices a "unit process" dataset can also be aggregated. See Figure I-1[5].

Application specific - It refers to the generic aspect of the specific application in which a material is used. For example, the average recycling rate of PET in bottles.

Benchmark – A standard or point of reference against which any comparison can be made. In the context of PEF, the term 'benchmark' refers to the *average* environmental performance of the representative product sold in the EU market. A benchmark may eventually be used, if appropriate, in the context of communicating environmental performance of a product belonging to the same category.

Bill of materials – A bill of materials or product structure (sometimes bill of material, BOM or associated list) is a list of the raw materials, sub-assemblies, intermediate assemblies, sub-components, parts and the quantities of each needed to manufacture an end product. This term is specifically used for packaging in this PEFCR whereas another term, "Bill of Ingredients", is used for detergent – see definition(s) below.

Bill of Ingredients 'as bought from the suppliers' - this term describes the list and quantity of all raw materials (including ingredients, other chemical constituents, solvents and water) as purchased from commercial suppliers and necessary to produce one dose of the detergent under study. It differs from the Bill of ingredients 'in 100% active substances" ('unreacted formulation') as it includes the quantities of water used in the commercial raw materials. This bill will be used for the transport of ingredients to the manufacturing plant.

Bill of ingredients 'in 100% active substances' ('unreacted formulation') - The ingredients are the chemicals in the commercial raw materials before they are mixed during the HDLLD manufacturing process. The ingredients and their quantity used for one dose constitute the Bill of Ingredients. Most liquid detergent ingredients are delivered by the suppliers as aqueous raw material solutions. The concentration of the active ingredient

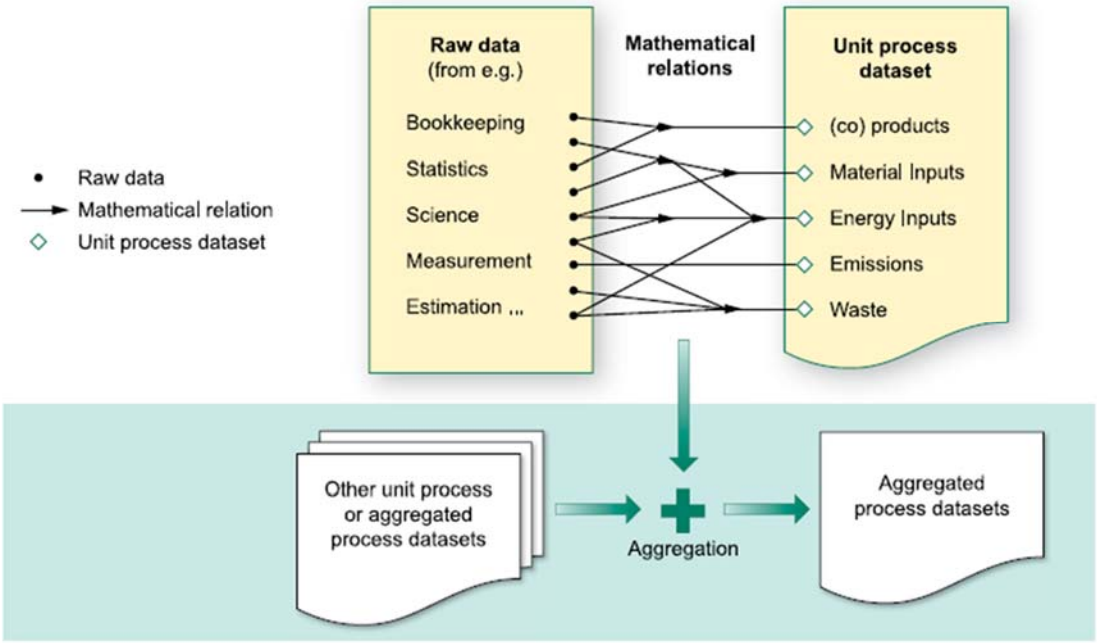
[4] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 2004).

[5] Source: UNEP/SETAC "Global Guidance Principles for LCA Databases"

may vary according to the suppliers. Therefore, to ensure a consistent Bill of Ingredients, one needs to express the amount of ingredients as 100% active (i.e. without water) and list each components of all raw materials). This Bill will be called Bill of Ingredients 'in 100% active content' ('unreacted formulation').

Bill of ingredients 'in 100% active substances' ('reacted formulation') - During the detergent manufacturing process, some ingredients may react chemically, such as during the neutralisation of acid surfactant mixtures with alkaline materials. If this occurs, there is difference between the Bill of Ingredients 'in 100% active content' ('unreacted formulation') and the so-called 'reacted formulation' that refers to the composition of the marketed HDLLD product. The Bill of ingredients 'in 100% active substances' ('reacted formulation') is used by the consumer and ultimately discharged after use in the consumer home to the sewerage system.

Figure I-1: Definition of a unit process dataset and an aggregated process dataset



Business to Business (B2B) – Describes transactions between businesses, such as between a manufacturer and a wholesaler, or between a wholesaler and a retailer.

Business to Consumers (B2C) – Describes transactions between business and consumers, such as between retailers and consumers. According to ISO 14025:2006, a consumer is defined as "an individual member of the general public purchasing or using goods, property or services for private purposes".

Commissioner of the EF study - Organisation (or group of organisations) that finances the EF study in accordance with the PEF Guide, PEFR Guidance and the relevant PEFCR, if available (definition adapted from ISO 14071/2014, point 3.4).

Company-specific data – It refers to directly measured or collected data from one or multiple facilities (site-specific data) that are representative for the activities of the company. It is synonymous to "primary data". To determine the level of representativeness a sampling procedure can be applied.

Comparative assertion – An environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function (adapted from ISO 14025:2006).

Comparison – A comparison, not including a comparative assertion, (graphic or otherwise) of two or more products based on the results of a PEF study and supporting PEFCRs or the comparison of one or more products against the benchmark, based on the results of a PEF study and supporting PEFCRs.

Data Quality Rating (DQR) - Semi-quantitative assessment of the quality criteria of a dataset based on Technological representativeness, Geographical representativeness, Time-related representativeness, and Precision. The data quality shall be considered as the quality of the dataset as documented.

Direct elementary flows (also named elementary flows) – All output emissions and input resource use that arise directly in the context of a process. Examples are emissions from a chemical process, or fugitive emissions from a boiler directly onsite. See Figure 2.

Disaggregation – The process that breaks down an aggregated dataset into smaller unit process datasets (horizontal or vertical). The disaggregation can help making data more specific. The process of disaggregation should never compromise or threat to compromise the quality and consistency of the original aggregated dataset

EF communication vehicles – It includes all the possible ways that can be used to communicate the results of the EF study to the stakeholders. The list of EF communication vehicles includes, but it is not limited to, label, environmental product declarations, green claims, website, infographics, etc.

EF report – Document that summarises the results of the EF study. For the EF report the template provided as annex to the PECFR Guidance shall be used. In case the commissioner of the EF study decides to communicate the results of the EF study (independently from the communication vehicle used), the EF report shall be made available for free through the commissioner's website. The EF report shall not contain any information that is considered as confidential by the commissioner, however the confidential information shall be provided to the verifier(s).

EF study – Term used to identify the totality of actions needed to calculate the EF results. It includes the modelling, the data collection, and the analysis of the results.

Electricity tracking[6] – Electricity tracking is the process of assigning electricity generation attributes to electricity consumption.

Elementary flow – Material or energy entering the system being studied that has been drawn from the environment without previous human transformation, or material or energy leaving the system being studied that is released into the environment without subsequent human transformation.

Environmental aspect – Element of an organisation's activities or products or services that interacts or can interact with the environment (ISO 14001:2015)

External Communication – Communication to any interested party other than the commissioner or the practitioner of the study.

[6] https://ec.europa.eu/energy/intelligent/projects/en/projects/e-track-ii

Foreground elementary flows – Direct elementary flows (emissions and resources) for which access to primary data (or company-specific information) is available.

Independent external expert – Competent person, not employed in a full-time or part-time role by the commissioner of the EF study or the practitioner of the EF study, and not involved in defining the scope or conducting the EF study (adapted from ISO 14071/2014, point 3.2).

Input flows – Product, material or energy flow that enters a unit process. Products and materials include raw materials, intermediate products and co-products (ISO 14040:2006).

Intermediate product – An intermediate product is a product that requires further processing before it is saleable to the final consumer.

Lead verifier – Verifier taking part in a verification team with additional responsibilities compared to the other verifiers in the team.

Life Cycle Inventory (LCI) – The combined set of exchanges of elementary, waste and product flows in an LCI dataset.

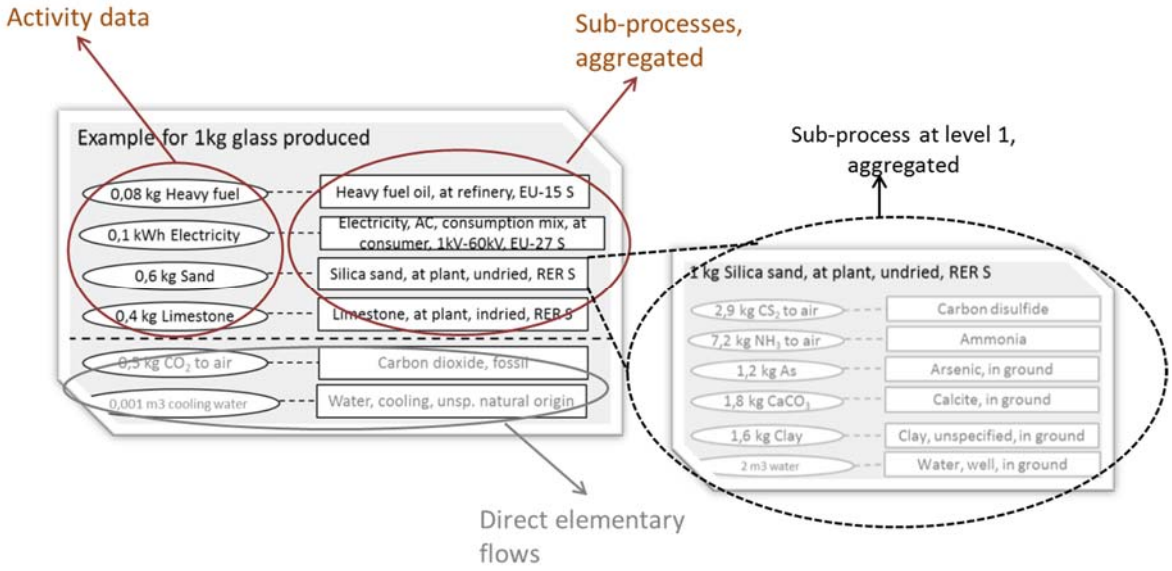
Life Cycle Inventory (LCI) dataset - A document or file with life cycle information of a specified product or other reference (e.g., site, process), covering descriptive metadata and quantitative life cycle inventory. A LCI dataset could be a unit process dataset, partially aggregated or an aggregated dataset.

Material-specific – It refers to a generic aspect of a material. For example, the recycling rate of PET.

Output flows – product, material or energy flow that leaves a unit process. Products and materials include raw materials, intermediate products, co-products and releases (ISO 14040:2006).

Partially disaggregated dataset - A dataset with a LCI that contains elementary flows and activity data, and that only in combination with its complementing underlying datasets yield a complete aggregated LCI data set. We refer to a partially disaggregated dataset at level 1 in case the LCI contains elementary flows and activity data, while all complementing underlaying dataset are in their aggregated form (see an example in Figure I-2: An example of a partially aggregated dataset, at level 1Figure I-2).

Figure I-2: An example of a partially aggregated dataset, at level 1



The activity data and direct elementary flows are to the left, and the complementing sub-processes in their aggregated form are to the right. The grey text indicates elementary flows.

PEFCR Supporting study – The PEF study done on the basis of a draft PEFCR. It is used to confirm the decisions taken in the draft PEFCR before the final PEFCR is released.

PEF Profile – The quantified results of a PEF study. It includes the quantification of the impacts for the various impact categories and the additional environmental information considered necessary to be reported.

PEF screening – A preliminary study carried out on the representative product(s) and intended to identify the most relevant life cycle stages, processes, elementary flows, impact categories and data quality needs to derive the preliminary indication about the definition of the benchmark for the product category/sub-categories in scope, and any other major requirement to be part of the final PEFCR.

Population – Any finite or infinite aggregation of individuals, not necessarily animate, subject to a statistical study.

Practitioner of the EF study – Individual, organisation or group of organisations that performs the EF study in accordance with the EF Guide, EF Guidance and the relevant PEFCR if available. The practitioner of the EF study can belong to the same organisation as the commissioner of the EF study (adapted from ISO 14071/2014, point 3.6).

Primary data[7] - This term refers to data from specific processes within the supply-chain of the company applying the PEFCR. Such data may take the form of activity data, or foreground elementary flows (life cycle inventory). Primary data are site-specific, company-specific (if multiple sites for a same product) or supply-chain-specific. Primary data may be obtained through meter readings, purchase records, utility bills, engineering models, direct monitoring, material/product balances, stoichiometry, or other methods for

[7] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 2004).

obtaining data from specific processes in the value chain of the company applying the PEFCR. In this Guidance, primary data is synonym of "company-specific data" or "supply-chain specific data".

Product category – Group of products (or services) that can fulfil equivalent functions (ISO 14025:2006).

Primary packaging (or **consumer packaging**) – This term refers to the material that contains, preserves and protects the product, and it provides information to the end user. It is the smallest unit of distribution and can also include dosing devices.

Product Category Rules (PCR) – Set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories (ISO 14025:2006).

Product Environmental Footprint Category Rules (PEFCRs) – Product category-specific, life-cycle-based rules that complement general methodological guidance for PEF studies by providing further specification at the level of a specific product category. PEFCRs help to shift the focus of the PEF study towards those aspects and parameters that matter the most, and hence contribute to increased relevance, reproducibility and consistency of the results by reducing costs versus a study based on the comprehensive requirements of the PEF guide.

Reacted Formulation – see "Bill of ingredients 'in 100% active substances'"

Representative product (model) - The "representative product" may or may not be a real product that one can buy on the EU market. Especially when the market is made up of different technologies, the "representative product" can be a virtual (non-existing) product built, for example, from the average EU sales-weighted characteristics of all technologies around. A PEFCR may include more than one representative product if appropriate.

Secondary data[8] – It refers to data not from specific process within the supply-chain of the company applying the PEFCR. This refers to data that is not directly collected, measured, or estimated by the company, but sourced from a third-party life-cycle-inventory database or other sources. Secondary data includes industry-average data (e.g., from published production data, government statistics, and industry associations), literature studies, engineering studies and patents, and can also be based on financial data, and contain proxy data, and other generic data. Primary data that go through a horizontal aggregation step are considered as secondary data.

Secondary packaging – This term refers to any packaging that includes primary packed products and is often used to group primary packs together to protect them during storage, transport and distribution.

Site-specific data – It refers to directly measured or collected data from one facility (production site). It is synonymous to "primary data".

Sub-processes – Those processes used to represent the activities of the level 1 processes (=building blocks). Sub-processes can be presented in their (partially) aggregated form (see Figure 2).

[8] Based on GHG protocol scope 3 definition from the Corporate Accounting and Reporting Standard (World resources institute, 2004)

Supply-chain – It refers to all of the upstream and downstream activities associated with the operations of the company applying the PEFCR, including the use of sold products by consumers and the end-of-life treatment of sold products after consumer use.

Supply-chain specific – It refers to a specific aspect of the specific supply-chain of a company. For example, the recycled content value of an aluminium can produced by a specific company.

Tertiary packaging (or **transport packaging**) – This term refers to any outer packaging, including pallet, stretch wrap, etc. Tertiary packaging is used for warehouse storage, transport shipping.

Type III environmental declaration – An environmental declaration providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information (ISO 14025:2006). The predetermined parameters are based on the ISO 14040 series of standards, which is made up of ISO 14040 and ISO 14044.

Unit process dataset - Smallest element considered in the life cycle inventory analysis for which input and output data are quantified (ISO 14040:2006). In LCA practice, both physically not further separable processes (such as unit operations in production plants, then called "unit process single operation") and also whole production sites are covered under "unit process", then called "unit process, black box" (ILCD Handbook).

Unreacted formulation – see "Bill of Ingredients 'as bought from the suppliers'"

Validation statement – Conclusive document aggregating the conclusions from the *verifiers* or the verification team regarding the EF study. This document is mandatory and shall be electronically or physically signed by the *verifier or in case of a* verification panel, by the lead verifier. The minimum content of the validation statement is provided in this document.

Verification report – Documentation of the verification process and findings, including detailed comments from the *Verifier(s)*, as well as the corresponding responses. This document is mandatory, but it can be confidential. However, it shall be signed, electronically or physically, by the *verifier or in case of a* verification panel, by the lead verifier.

Verification team – Team of verifiers that will perform the verification of the EF study, of the EF report and the EF communication vehicles.

Verifier – Independent external expert performing a verification of the EF study and eventually taking part in a verification team.

Washing – This term means the cleaning of laundry, fabrics, dishes and other hard surfaces. As indicated in the Detergents Regulation No 648/2004, 'Cleaning' has the meaning defined by EN ISO 862 Surface active agents (a process in which dirt (stains) are removed from their substratum and put into solution or into dispersion).

I. Introduction

The 'Product Environmental Footprint (PEF) Guide'[9] provides detailed and comprehensive technical guidance on how to conduct a PEF study. PEF studies may be used for a variety of purposes, including in-house management and participation in voluntary or mandatory programmes.

For all requirements not specified in this PEFCR the applicant shall refer to documents this PEFCR is in conformance with (see chapter II.7).

The compliance with the present PEFCR is optional for PEF in-house applications, whilst it is mandatory whenever the results of a PEF study or any of its content is intended to be communicated.

Terminology: shall, should and may

This PEFCR uses precise terminology to indicate the requirements, the recommendations and options that could be chosen when a PEF study is conducted.

- The term "shall" is used to indicate what is required in order for a PEF study to be in conformance with this PEFCR.
- The term "should" is used to indicate a recommendation rather than a requirement. Any deviation from a "should" requirement has to be justified when developing the PEF study and made transparent.
- The term "may" is used to indicate an option that is permissible. Whenever options are available, the PEF study shall include adequate argumentation to justify the chosen option.

[9] PEF Guide, Annex to Commission 2013/179/EU on the use of common methods to measure and communicate the life cycle environmental performance of products and organizations (April 2013) and available at http://ec.europa.eu/environment/eussd/smgp/index.htm

II. General information about the PEFCR

II.1. Technical Secretariat

The Technical Secretariat (TS) consists of the members of the A.I.S.E. PEF pilot project that was carried out between October 2013 and August 2018. The following table provides the organizations in the TS at the time of final vote.

Table II-1: Members of the Technical Secretariat

Name of the organization	Type of organisation	Participation since
A.I.S.E. (International Association for Soaps, Detergents and Maintenance Products)	Industry Association	October 2013
AFISE (Association Française des Industries de la Détergence, de l'Entretien et des Produits d'Hygiène Industrielle)	Industry Association	October 2013
CESIO (European Committee of Organic Surfactants and their Intermediates)	Industry Association	October 2013
DETIC (Association Belgo-Luxembourgeoise des producteurs et des distributeurs de savons, cosmétiques, détergents, produits d'entretien, d'hygiène et de toilette, colles, produits et matériel connexes)	Industry Association	October 2013
Dalli Group	Detergent Industry Manufacturing Company	October 2013
Ecover Co-ordination Center NV	Detergent Industry Manufacturing Company (SME)	October 2013
GS1 (Global Standards 1)	Non-profit organisation	October 2013
Henkel AG & Co. KGaA	Detergent Industry Manufacturing Company	October 2013
McBride plc	Detergent Industry Manufacturing Company	October 2013

Name of the organization	Type of organisation	Participation since
Procter & Gamble Services Company NV	Detergent Industry Manufacturing Company	October 2013
SGS	Inspection, verification, testing and certification company	October 2013
Solinnen	Consultant	October 2013
FOEN (Swiss Federal Office for the Environment)	Governmental organisation	October 2013
TSC (The Sustainability Consortium)	Non-profit organisation	October 2013
TU Berlin (Chair of Sustainable Engineering)	Academia	October 2013
Unilever	Detergent Industry Manufacturing Company	October 2013
Vandeputte S.A./NV Savonnerie - Zeepfabriek	Detergent Industry Manufacturing Company (SME)	October 2013

It is estimated that more than 100 manufacturers are operating in the total EU Household Liquid Laundry Detergents sector. The seven companies represented in the A.I.S.E. PEF TS (Dalli, Ecover, Henkel, McBride, Procter & Gamble, Unilever and Vandeputte) have a share of over 72% of this market[10]. Also, an important share of the market is covered by retailers' own brands (about 12% in the EU market in 2015). Dalli, McBride and Vandeputte are operating in the manufacturing of products for private label retailers, and should their share of the private label sales be added to the above percentage, it can be anticipated that the coverage of the TS members is even higher than 72%.

Trade representativeness of A.I.S.E.

A.I.S.E., the international Association for Soaps, Detergents and Maintenance Products is the official representative body of this industry in Europe. Its membership includes 18 corporate members and 29 national associations in Europe and beyond, covering about 900 companies ranging from small and medium-sized enterprises to large and multinational companies, active both in the consumer goods market and the Professional

[10] Data 2015 – Source Euromonitor International

Cleaning & Health (PC&H) domains. It is estimated that A.I.S.E. together with its members represents more than 90% of the market of this industry.

II.2. Consultation and stakeholders

The procedure for the development of a PEFCR considers a number of steps that have been followed by this Technical Secretariat, namely:

- Definition of PEF product category and scope of the PEFCR
- Definition of the product "model" based on representative product(s)
- PEF Screening
- Draft PEFCR
- PEFCR supporting studies
- Confirmation of the benchmark
- Remodelling of the Representative Product (benchmark) with EF-compliant database made available by the European Commission
- Final PEFCR

A first face to face consultation with stakeholders took place in March 2014 and focused on the definition of the PEF product category, the scope of the PEFCR and the definition of the representative product.

The TS invited a wide range of stakeholders: 60 representatives from 46 stakeholder organisations (18 companies (multinationals, large and SMEs), 14 sectorial or industry organisations, 14 experts and advisors (from governmental bodies, academia, LCA consultants, etc.)). Thus, 29 organisations not represented in the Technical Secretariat attended this consultation meeting and provided comments. Manufacturing companies and retailers among these 29 organisations add another 4% to the market covered by the TS members.

A first version of the PEFCR was drafted after the completion of the PEF Screening step (including the critical review of the report and the model performed by the European Commission and a neutral independent Review Panel).

The first draft PEFCR was submitted to a virtual consultation in April 2015, then amended further according to the comments as received from the stakeholders as well as those comments as received from the EF Technical Advisory Board, and finally validated by the EF Steering Committee in July 2015.

The second draft of the PEFCR was used by six companies to perform a PEF supporting study on one of their products sold in Europe.

A third draft PEFCR, including amendments in response to comments as provided by the 6 companies who performed the PEF supporting studies, was submitted to a virtual public consultation between 3 June and 1 July 2016, and afterwards to the independent Review Panel in August 2016.

This final PEFCR has been prepared, taking into account any further received comment (stakeholders including the European Commission and Review Panel) as well as the result of the remodelling exercise of the Representative Product (benchmark).

All documents related to the work performed by the Technical Secretariat as well as the stakeholder consultations (documents submitted to consultation, minutes of physical consultation, stakeholders' comments and answers from the Technical Secretariat) are available at a dedicated Wikipage on the EF online platform via:

https://webgate.ec.europa.eu/fpfis/wikis/display/EUENVFP/Stakeholder+workspace%3A+PEFCR+pilot+Household+liquid+laundry+detergents.

The following table provides summary information on comments received during the consultations.

Table II-2: Summary information on the Public Consultations the PEFCR

Public Consultation	Period	Organisations that provided comments	Number of comments received
First consultation (face to face)	24 February to 25 March 2014	CECED EPD System JRC/IPTS MIELE & Cie KG	14
Second consultation (virtual)	8 April to 6 May 2015	ADEME Ecover GreenDelta QUANTIS MIELE & Cie KG NEF SPF BE Thinkstep	160
Third consultation (virtual)	3 June to 1 July 2016	ADEME CECED EEB EC IFRA Miele & Cie KG SPF BE TU Berlin	128

II.3. Review panel and review requirements of the PEFCR

The Technical Secretariat has set up an independent third-party panel composed of three members for the PEFCR review. The panel members do not have conflicts of interest on branded products and are not members of the Technical Secretariat.

Table II-3: Members of the Review Panel

Name of the member	Affiliation	Role
Prof. Roland Clift	He was a founding member of the UK Ecolabelling Board, a member of the "Groupe des Sages" set up in the 1990s to advise the European Commission on the application of LCA to product labelling. He was a member of the groups which initially drafted and subsequently revised PAS 2050.	Chairman of the panel

Name of the member	Affiliation	Role
	His self-assessed reviewer qualification score is 23 points.	
Mrs Hélène Lelièvre	She has 16 years of experience in LCA and Sustainability consulting. She has been working as an independent LCA expert consultant in environment (Enviroconseil) for 8 years and in particular performed 5 complete LCA studies on laundry detergents. Her self-assessed reviewer qualification score is 15 points.	Member of the panel
Mr Martin Windenberg	He works as a guest researcher at the Regional Centre of Expertise Vienna (RCE-Vienna) at the Institute for the Environment and Regional Development. He has been leading the Sustainability Project at GLOBAL 2000/Friends of the Earth Austria for more than 5 years, resulting in a holistic assessment method for sustainable agricultural production used in business co-operations. His self-assessed reviewer qualification score is 6 points.	Member of the panel

The critical review has been performed concurrently with the entire pilot process. The 3-person panel reviewed the screening study and the first version of the PEFCR (2015- Nov 2016). The final step of the critical review was conducted on the final version of the PEFCR in spring 2018 by Hélène Lelièvre. This procedure was agreed with the European Commission.

This final review was executed after the remodelling of the Reference Product (benchmark) with EF-compliant data as requested by the EC and carried out by an EC mandated consultant. However, after this final review the EC provided additional comments, highlighting also the use of a wrong dataset for wastewater treatment by the mandated consultant. Those comments were implemented and results were corrected accordingly in the final version of the PEFCR (v1.0) published in February 2019, without been subject to another round of review before the publication.

In addition, in spring 2019, further to a deeper analysis of the remodelling by the EC, additional amendments were necessary in the remodelling and required significant changes in the PEFCR. In this specific context of multiple significant amendments, it was agreed to have an additional review conducted by Helene Lelièvre in June/July 2019.

Through its different steps, the review verified that the following requirements are fulfilled:

- The PEFCR has been developed in accordance with the requirement provided in the PEFCR Guidance version 6.3, and where appropriate in accordance with the requirements provided in the most recent approved version of the PEF Guide, and supports creation of credible and consistent PEF profiles,

- The functional unit, allocation and calculation rules are adequate for the product category under consideration,
- Company-specific and secondary datasets used to develop this PEFCR are relevant, representative, and reliable,
- The selected LCIA indicators and additional environmental information are appropriate for the product category under consideration and the selection is done in accordance with the guidelines stated in the PEFCR Guidance version 6.3 and the most recent approved version of the PEF Guide,
- The benchmark is correctly defined,
- Both LCA-based data and the additional environmental information prescribed by the PEFCR give a description of the significant environmental aspects associated with the product.

II.4. Review statement

This final review from June/July 2019 focused as asked by A.I.S.E. and agreed by the European Commission on the following aspects:

- "(i) the benchmark calculation,
- (ii) the classes of performance (if relevant),
- (iii) the selection of most relevant processes and (iv) the selection of most relevant Impact categories."

The results of this final review are complimentary to the previous peer review works performed in 2015 and 2016 by the whole panel.

The selection of the most relevant impact categories is in compliance with the PEFCR guidance version 6.3 of December 2017.
The selection of the main life cycle stages and processes is in compliance with the PEFCR guidance version 6.3 of May 2018.

The use of a specific EC wwtp dataset has been better documented in the PEFCR and the assumptions used to calculate the 9.2% allocation factor of this specific dataset have been displayed (section VI-6.1. Wastewater treatment).

During the future revision of the HDLLD PEFCR, it is recommended to:

- Revise the assumption on the ratio g Chemical Organic Demand (COD) per g of non water ingredient[11] of the liquid laundry detergent. The current assumption of 1 g COD/g ingredient seems too low (the value is calculated to 2 g COD/g ingredient with an approach based on the OECD guidance 301 dealing with biodegradability and theoretical oxygen demand).
- Refine the instructions described in section "X-5 Instructions for aligning the treatment of detergent wastewater dataset to the water consumption dataset at the use phase (EU average scenario)" by distinguishing:
  - the direct impact of the tap water consumption
  - the direct impact of the wwtp.
- Describe the representative product using 3 series of data: formulation expressed at the raw materials level (it will have to be added in annex X.4), formulation at the constituent level, unreacted (that is expressed as 100% pure chemical, unreacted), necessary for the chemical ingredient production LCA model and formulation at the

[11] that is all ingredients except water (example: surfactants, builders, solvents....)

constituent level, reacted (that is expressed as 100% pure chemical, reacted), necessary for the wwtp LCA model.

As a reminder, the 2 following remarks (topics identified in the June 2018 3rd external review round) are maintained:

- The default transportation data on packaging parts used for the representative product seem overestimated (18 000 km by boat and 1000 km by road) and it is highly recommended during the revision of the PEFCR to collect primary data from participating companies to update the PEF results of the representative product. In addition, the default values proposed by the EC in the guidance version 6.3 for the transport from suppliers to factory (case of suppliers located in Europe) should be reviewed as it is assessed that the systematic use of a fluvial barge is not the classical industrial practice for this step (as a reminder, current default values from the PEFCR guidance v6.3 are 360 km by fluvial barge versus 230 km by truck and 280 km by train).
- The contribution of the storage of the HDLLD at retail has a larger contribution than the production of the laundry detergent for 3 indicators (climate change, fossil energy and acidification). It would be interesting to better understand this and refine the data of the LCA model if necessary.

The following key limitations of the current model and default datasets are identified:

- The dosage of the representative product (75 ml chosen) will have to be updated in the revision of the liquid laundry detergent PEFCR as it is probably currently out of date;
- The default datasets for the surfactants production, main ingredients of the liquid laundry detergent are out of date and more recent datasets derived from the recent ERASM LCI work should be envisaged in the coming years;
- The modeling of the wastewater treatment step is not specific to the product under study, which highly alters the LCA results from this step. Additional work by the EC on this part (common to many products) is highly recommended; This, in addition to the above remarks linked to the wastewater treatment step will allow to get a more accurate assessment;
- There are key limitations of the USEtox LCA results due to data gaps in the characterization factors for specific ingredients and previous remark. Ongoing work currently carried out by the EC with ECHA will hopefully allow to get comprehensive results.

The review round reports and detailed comments are available in Annex X.3.

II.5. Geographic validity

This PEFCR is valid for products in scope sold/consumed in the European Union + EFTA.

Each PEF study shall identify its geographical validity listing all the countries where the product object of the PEF study is consumed/sold with the relative market share. In case the information on the market for the specific product object of the study is not available, Europe +EFTA shall be considered as the default market, with an equal market share for each country.

II.6. Language

The PEFCR is written in English. The original in English supersedes translated versions in case of conflicts.

II.7. Conformance to other documents

This PEFCR has been prepared in conformance with the following documents (in prevailing order):

- PEFCR Guidance version 6.3,
- Product Environmental Footprint (PEF) Guide; Annex II to the Recommendation 2013/179/EU, 9 April 2013. Published in the official journal of the European Union Volume 56, 4 May 2013,
- Detergent Regulation (EC648/2004).

III. PEFCR scope

III.1. Product classification (NACE/CPA)

The CPA codes for the products included in this PEFCR are:

CPA 20.41 – Manufacture of soap and detergents, cleaning and polishing preparations.

20.41.32 – Detergent and washing preparations.

This PEFCR provides rules for the product category "Heavy Duty Liquid Laundry Detergents (HDLLD) for Machine Wash," including 100% liquid capsules.

Other products such as "Light Duty Liquid Laundry Detergents"[12], "General Purpose Powder Laundry Detergents" and "Powder Tablets" are not covered by this PEFCR, since the different product types vary in their function and composition (ingredient families). For example:

- Powder laundry detergents are not fully interchangeable with liquids, especially the bleach containing powders which are recommended for use with heavy soiled fabrics and at higher washing temperatures,
- Light duty laundry detergents have a different recommended dose and are used for different wash loads,
- Manual laundry detergents (laundry washing by hand) are not interchangeable with machine laundry detergents.

Table III-1 for example presents guidance[13] to combine the most appropriate type of laundry detergents and washing temperature in relation to hygiene requirements. The guidance demonstrates that liquid detergent and powder detergent are not fully interchangeable and do not fulfil the same consumer's needs.

[12] According to the Detergent Regulation (EC648/2004), a detergent shall be considered to be a heavy-duty detergent unless the claims of the manufacturer predominantly promotes fabric care.

[13] Source: 'I prefer 30°' consumer engagement campaign, A.I.S.E., expert study 2013, www.iprefer30.eu.

Table III-1: Laundry guidance on choice of detergent and washing temperature in relation to soiling and hygiene needs (A.I.S.E.)

Laundry items	Recommendation (detergent, washing temperature)
Heavily soiled laundry items: - Items of ill persons, clothing of their carers or items of vulnerable persons, - Professional clothing that may be contaminated, - Kitchen/food preparation textiles, - Items heavily soiled with faeces, vomit and blood, - High people-contact sports clothing.	General purpose powder detergent[14] at high (60° C) temperature.
Normally or lightly soiled and not malodorous normal laundry items with no intense intimate body contact such as: - All outer clothing items (jackets, sweaters, shirts, skirts, trousers, dresses, ...), - T-shirts, - Top underclothing, - Socks (unless in cases of fungal infection), - Trousers.	Liquids detergents at 30 °C
All other normal laundry items with or without intimate body contact.	General purpose powder detergent or a liquid laundry detergent but using higher temperatures than 30 °C.

III.2. Representative product

The representative product is a "model" of concentrated liquid detergent products dosed at 75ml/wash (i.e. one washing machine cycle) sold in the EU market in 2014.

It has been defined using data collected from the companies participating in the TS, which represent the majority of the EU and EFTA market. These collected data were normalised to the market share of each company (see Annex X.4 for a detailed description of the RP).

The representative product has been evaluated with the average EU scenario (compulsory scenario) as described in Table III-6 in section III.6.2. and all default data provided in this PECFR.

The screening study is available upon request to the TS coordinator, Sascha Nissen (sascha.nissen@aise.eu).

III.3. Functional unit and reference flow

The functional unit is:

"wash 4.5 kg of dry fabric with the recommended dosage for

[14] A general purpose powder detergent is a powder detergent that can be used for any textile/colour and which contains oxygen-based bleaching agents (see ingredient list on the package).

- **a 4.5 kg load;**
- **normally soiled fabric;**
- **with a medium water hardness;**

in a 6 kg capacity machine wash at 75% loading ".[15]

Table III-2 defines the key aspects used to define the FU.

Table III-2: Key aspects of the FU

What?	washing dry fabric
How much?	4.5 kg of dry fabric
How well?	wash "normally soiled" fabric in water with medium hardness until clean (i.e., reaching a cleaning performance acceptable to consumers)
How long?	one washing machine cycle

The reference flow is the amount of product needed to fulfil the defined function and shall be measured in ml (recommended dosage of the detergent). All quantitative input and output data collected (including the packaging) in the study shall be calculated in relation to this reference flow.

In this PEFCR the same approach of cleaning performance is being used as in the 'A.I.S.E. Charter for Sustainable Cleaning'[16]: The product shall be fit for purpose, and reach a performance acceptable to consumers, consistent with claims made and supplemented by independently verifiable performance data held by companies in support of their claims.

III.4. System boundaries

The following life cycle stages and processes shall be included in the system boundary:

[15] The aspects "4.5 kg of dry fabric", "normally soiled fabric" and "medium water hardness" used for the product function definition are based on the Detergent Regulation (EC648/2004). See also Table III-1 for the description of heavily, normally and lightly soiled laundry items.

[16] Cf. References in section IX for link to the 'A.I.S.E. Charter for Sustainable Cleaning'.

Table III-3: Life cycle stages

Life cycle stage (minimum default stages cf. PEFCR guidance v6.3)	**Life cycle stage** (stages considered in this PEFCR)	**Short description of the processes included**
Raw material acquisition and pre-processing	Ingredients sourcing and manufacturing	Sourcing and manufacturing of ingredients that are mixed during the HDLLD manufacturing (builders, sequestrants, surfactants, enzymes, fragrances, alkalinity sources, solvents and others)
	Packaging raw material sourcing and manufacturing	Sourcing and manufacturing of packaging raw material necessary for the detergent packaging (e.g. plastics). The three levels of packaging are considered, primary, secondary and tertiary.
	Transport of ingredients	Transport to the detergent manufacturing plant
	Transport of packaging materials	Transport to the detergent manufacturing plant
Production of the laundry detergent	Detergent manufacturing (HDLLD manufacture)	This stage consists mainly in mixing the ingredients and packing of product. There is no production of co-products or by-products.
Product distribution and storage	Transport and Distribution to retail	Transport and storage
	Transport and distribution to consumer's homes	Transport to consumer's homes
Use stage	Product use	Fabric washing
End-of-life	End-of-life	Wastewater treatment (end-of-life of the detergent) and municipal solid waste treatment (end-of-life of packaging)

According to this PEFCR, the following processes at the HDLLD production stage may be excluded based on the cut-off rule (a 1% cut-off for all impact categories based on environmental significance):

- Losses to the environment from detergent production[17],
- Air emissions and losses of packaging,

At other stages through the life cycle, the following processes are also excluded based on the same cut-off rule:

- Truck production for all transport by road,
- Losses of product during distribution and retail,
- Label end-of-life.

At the use stage, the washing machine manufacturing[18] and the manufacturing of fabrics to be washed, which are detergent independent processes[19], shall be excluded from the system boundaries.

Each PEF study done in accordance with this PEFCR shall provide in the PEF study a diagram indicating the organizational boundary, to highlight those activities under the control of the organization and those falling into Situation 1, 2 or 3 of the data need matrix (cf. Table V-4).

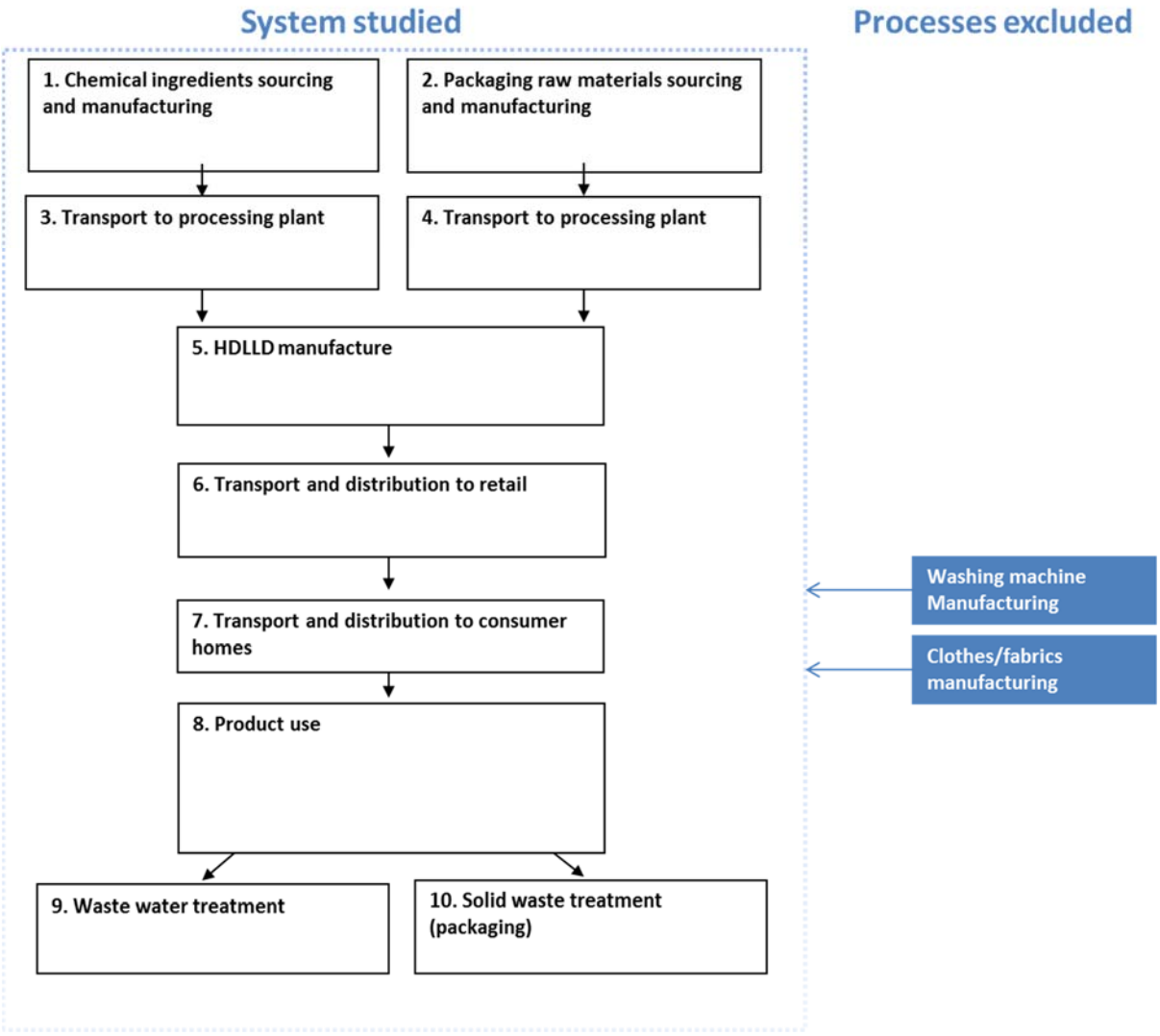
Figure III-1 presents the system boundary diagram.

[17] According to A.I.S.E. experts, the environmental losses during detergent production are less than 0.4% of the release after consumer use.

[18] The most representative technology used in EU (front load washing machine) was considered at use stage to define the electricity and water consumption (see section VI.5).

[19] A detergent independent process is a process that has no relationship with the way the detergent is designed or distributed.

Figure III-1: System boundary diagram



III.5. Impact assessment

Each PEF study carried out in compliance with this PEFCR shall calculate the PEF-profile including all PEF impact categories listed in Table III-4 as well as the indicator listed in Table III-5.

Table III-4: List of the impact categories to be used to calculate the PEF profile (PEF guidance v6.3 requirements)

Impact category	Indicator	Unit	Recommended default LCIA method
Climate change[20]	Radiative forcing as Global Warming Potential (GWP100)	kg $CO_{2\ eq}$	Baseline model of 100 years of the IPCC (based on IPCC 2013)
Climate change-biogenic			

[20] Climate change includes Climate change biogenic as well as Climate change land use and land transformation. The sub-indicators 'Climate change - biogenic' shall be reported separately because its contribution to the total climate change impact, based on the benchmark results, is more than 5%.

Impact category	Indicator	Unit	Recommended default LCIA method
Ozone depletion	Ozone Depletion Potential (ODP)	kg CFC-11eq	Steady-state ODPs 1999 as in WMO assessment
Human toxicity, cancer*	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model (Rosenbaum et al, 2008)
Human toxicity, non- cancer*	Comparative Toxic Unit for humans (CTU_h)	CTUh	USEtox model (Rosenbaum et al, 2008)
Particulate matter	Impact on human health	disease incidence	UNEP recommended model (Fantke et al 2016)
Ionising radiation, human health	Human exposure efficiency relative to U^{235}	kBq U^{235}eq	Human health effect model as developed by Dreicer et al. 1995 (Frischknecht et al, 2000)
Photochemical ozone formation, human health	Tropospheric ozone concentration increase	kg NMVOC eq	LOTOS-EUROS model (Van Zelm et al, 2008) as implemented in ReCiPe
Acidification	Accumulated Exceedance (AE)	mol H+ eq	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)
Eutrophication, terrestrial	Accumulated Exceedance (AE)	mol N eq	Accumulated Exceedance (Seppälä et al. 2006, Posch et al, 2008)
Eutrophication, freshwater	Fraction of nutrients reaching freshwater end compartment (P)	kg Peq	EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe
Eutrophication, marine	Fraction of nutrients reaching marine end compartment (N)	kg N eq	EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe
Ecotoxicity freshwater*	Comparative Toxic Unit for ecosystems (CTU_e)	CTUe	USEtox model, (Rosenbaum et al, 2008)
Land use	• Soil quality index[21] • Biotic production • Erosion resistance • Mechanical filtration • Groundwater replenishment	• Dimensionless (pt) • kg biotic production[22] • kg soil • m^3 water • m3 groundwater	• Soil quality index based on LANCA (EC-JRC)[23] • LANCA (Beck et al. 2010) • LANCA (Beck et al. 2010) • LANCA (Beck et al. 2010) • LANCA (Beck et al. 2010)
Water use**	User deprivation potential (deprivation-weighted water consumption)	m^3 world eq.	Available Water Remaining (AWARE) Boulay et al., 2016
Resource use, minerals and metals	Abiotic resource depletion (ADP ultimate reserves)	kg Sb-eq	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002.
Resource use, fossils	Abiotic resource depletion – fossil fuels (ADP-fossil)	MJ	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002

[21] This index is the result of the aggregation, performed by JRC, of the 4 indicators provided by LANCA model as indicators for land use

[22] This refers to occupation. In case of transformation the LANCA indicators are without the year (a)

[23] Forthcoming document on the update of the recommended Impact Assessment methods and factors for the EF

*Long-term emissions (occurring beyond 100 years) shall be excluded from the toxic impact categories. Toxicity emissions to this sub-compartment have a characterisation factor set to 0 in the EF LCIA (to ensure consistency). If included by the applicant in the LCI modelling, the sub-compartment 'unspecified (long-term)' shall be used.

**The results for water use might be overestimated and shall therefore be interpreted with caution. Some of the EF datasets tendered during the pilot phase and used in this PEFCR/OEFSR include inconsistencies in the regionalization and elementary flow implementations. This problem has nothing to do with the impact assessment method or the implementability of EF methods, but occurred during the technical development of some of the datasets. The PEFCR/OEFSR remains valid and usable. The affected EF datasets will be corrected by mid-2019. At that time it will be possible to review this PEFCR/OEFSR accordingly, if seen necessary.

The full list of normalization factors and weighting factors are available in Annex X.1- List of EF normalisation factors and weighting factors.

The full list of characterization factors (EC-JRC, 2017a) is available at this link http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtm

Table III-5: Additional indicator to be used (A.I.S.E. specific requirements)

Risk	Indicator	Unit	Assessment method and source
Ecotoxicity freshwater	Environmental Safety Check (ESC)	PESR	ESC – A.I.S.E. Charter for Sustainable Cleaning 2016[24]

The A.I.S.E. PEF TS developed a consensus that ecotoxicity is an important consideration, characterising the environmental profile of laundry detergents.

Therefore, and in the absence of an aligned, robust USETOX methodology (see chapter III.6. Limitations), the PEFCR requires the use of the alternative 'Environmental Safety Check ESC' method as referenced in 'chapter VII.4. Additional environmental information'.

The ESC results are a stand-alone information and will not influence the benchmark results, nor lead to changes in the identification of most relevant life cycle stages, processes, and elementary flows.[25]

III.6. Limitations

Even if a PEF study is carried out in accordance with this PEFCR, it will have some limitations on its results as listed in section III.6.1. also in order to make any comparison of products or any comparative assertion about a product against the benchmark, the applicant shall comply with specific requirements listed in section III.6.2.

[24] Pickup et al. (2016): 'A risk-based, product-level approach for assuring aquatic environmental safety of cleaning products in the context of sustainability: The Environmental Safety Check (ESC) scheme of the A.I.S.E. Charter for Sustainable Cleaning. (http://onlinelibrary.wiley.com/doi/10.1002/ieam.1764/abstract;jsessionid=9667971C666660DBB3F6823B98A7D08C.f04t04). The paper, beyond allowing a wider scientific recognition of the principles behind the functioning of the tool, also addresses the advantages of a risk-based approach in driving the continuous improvement of the sustainability of down-the-drain products.

[25] Note: Fragrances (Perfumes) are exempt from the ESC calculation, provided that they are compliant with IFRA Standards. Companies must obtain confirmation from suppliers that the fragrance compound complies with all IFRA standards relating to potential environmental risks in respect of all its constituents (see details in chapter 'VII.5. Other impact results')."

III.6.1. Limitations linked to current state of development of the PEF methodology and databases

Limitations as regards impact category

The PEFCR Guidance v6.3 (Dec 2017) requires that USEtox temporarily be excluded from the procedure to identify the most relevant impact categories as well as benchmarking and communication, due to its lack of robustness ('*Robustness III/Interim*'). The USEtox methodology as well as the presently available characterization factors have been tested by the A.I.S.E. PEF TS and they do not allow to adequately assess the ecotoxicity freshwater impact for a HDLLD. Indeed, the available characterization factors cover a limited set of ingredients used to manufacture HDLLD, and the missing CFs calculated provisionally by the ecotoxicity experts of the A.I.S.E. for the reference product cannot be used as they are not part of the Environmental Footprint flow list. Due to the very high inherent uncertainty around the calculated USEtox product scores, this indicator was judged as not suitable for product comparisons or comparative assertions. Therefore, the USEtox impact results should at present not be reported in any PEF study.

In order to still provide relevant information as regard this impact category, this PEFCR requires the use of the ESC method, as discussed in the previous chapter.

Limitations as regards the modelling (End-of Life)

The EF-compliant dataset prescribed by the EC in autumn 2017 to model Wastewater treatment does not allow the evaluation of specific impacts of a detergent based on its composition. The prescribed model is an average model based on the quantity of wastewater and an average composition of wastewater entering a municipal WWT. Therefore, the result for any impact category (except toxicity impact categories) as regards to this specific life cycle stage will be the same for different HDLLD under study and thus does not allow any differentiation between products with a different composition. In addition, issues with the applied allocation approach had been identified, allocating a disproportionate share of credits to laundry detergents when wasted sewage sludge is used on agricultural soils. After review by the A.I.S.E. TS, a contribution of 9.2%[26] from all heavy duty liquid laundry detergents to the total organic loading to WWT was determined.

Other LCA wastewater treatment models and tools are available to model the end of life impact more accurately and offering the possibility to differentiate between HDLLD products with different composition. The A.I.S.E. PEF TS could not test and propose a suitable wastewater treatment model before the deadline of the PEF Pilot phase. These models can be re-considered during future revision of the PEFCR.

Finally, the datasets provided by the EC for modelling wastewater treatment are not fully compliant with the current EF requirements and consequently the specific results of the

[26] *This contribution for liquid laundry detergents has been specifically evaluated by A.I.S.E. experts, based on available data such as 2017 market sales of all household detergents (5050 g/pp.year for powder and 3700 g/pp.year for liquid), the mass of chemical in the reacted formula of the RP (22.95 g/ dose) and the assumption that 1g chemical in detergent contribute to 1g of COD. The total organic loading is evaluated based on an assumption of 470 mg COD/l sewage and a production of 150 l/pp.day of sewage flow. Such assumptions are issued from 2017 statistic data (drinking water statistics 2017 – VEWIN, Association of water companies in Netherland) as well as technical document on WWT (Document WWT - Civil health technology – CT3220, 2008) published in Netherland.*

WWT phase must be viewed with caution, especially those which are leading to negative results ('credits'), for the following reasons:

- the remodelled EoL approach (CFF), which was elaborated during the pilot phase, has not been taken into account in those datasets;
- disproportionate credits from avoided fertiliser use, due to sludge use on agricultural soils and the need to assess different practices in countries regarding sludge and soil amendment.

Those datasets will be updated during the transition phase and, combined with the knowledge around existing agricultural sludge use practices can be considered as well during future revision of the PEFCR.

Limitations as regards the modelling (Use stage)

The PEFCR defines a set of assumptions about the use stage (i.e. the HDLLD use conditions during machine laundry washing), but on which a detergent company has little direct influence, such as the choice of the wash cycle and washing temperatures which affect energy and water consumption. The applied assumptions are based on studies performed by A.I.S.E. since 1997.

Any PEF study on HDLLD, conducted according to the HDLLD PEFCR, is based on an averaged European wash machine situation, modelled via the A.I.S.E. Laundry Energy model (cf. section VI.5) in which the selected washing temperature is used to calculate the required energy. It is also assumed that the European consumer follows the instructions and recommendations as provided on the product. Therefore, no under-filling or overfilling of the machine, detergent under-dosing or over-dosing or rewashing shall be considered in a PEF study on HDLLD.

Limitations as regards key datasets on ingredients (e.g. builders, surfactants)

The PEFCR users should note that the EF-compliant datasets for surfactants are based on outdated LCI information (LCI published in 1995). While the applied datasets are still relatively accurate for petrochemical-based surfactants (expected to be within a 10-20% range vs. the proposed data), the data for renewable surfactants do not match the current greenhouse gas protocol accounting rules. As a consequence, the greenhouse gas emissions will be underestimated with the EF-compliant datasets, in particular for palm oil-based precursors.

Also the EF-compliant citric acid dataset (available on the ecoinvent node -see section V.6), one of the main builders for liquid detergent, has significantly higher impacts than equivalent citric acid datasets available in databases but that are not EF-compliant (this comparison was performed during the screening study). As a consequence, it may be possible that the contribution from this ingredient on the results may be overestimated.

III.6.2. Geographical scope for the downstream life cycle stage and conditions for any comparison or comparative assertion

As regards the geographical scope, the applicant shall consider the scenarios detailed in Table III-6:

Table III-6: Scenarios to be considered (geographical scope)

Scenarios	Distribution	Product use	End-of-life
EU average **(compulsory)**	Distribution model with EU average energy mix	EU average washing temperature :40°C [27] Average EU consumption electricity mix (consumption evaluated based on the washing temperature and the A.I.S.E. laundry energy model 2014) (see section VI.5) EU average water consumption (50 litres/washing machine cycle)	EU average scenario for wastewater treatment and packaging end-of-life
EU average with specific temperature [28] **(optional)**	Same as EU average scenario	Same as EU average scenario with specific washing temperature	Same as EU average scenario
Specific country of sales **(optional)**	Distribution model with specific country energy mix	Choice between EU average **or** country specific washing temperature for the electricity modelling.	Specific country wastewater treatment (specific country energy mix) Specific country packaging end-of-life
All countries of sales **(optional)**	Same as specific country of sales scenario and each specific country scenario is taken into account in proportion in their share of sales[29]		

The comparison to the benchmark (representative product) is only possible for the EU average scenario.

If the applicant wants to assess a HDLLD detergent considering one of the optional scenarios (e.g. considering specific country(ies) of sales), the applicant shall anticipate the workload and the time required for this task, such as data collection, modelling, etc. Moreover, if the applicant wishes to compare the studied product with an appropriate country(ies) benchmark, the latter shall be redefined and remodelled to be relevant and representative as regard to the geographical scope.

[27] The average washing temperature in Europe, is 41°C (A.I.S.E. consumer habit survey -2011)

[28] Washing Temperature shall be the claimed wash temperature reaching a cleaning performance acceptable to consumers.

[29] Example: Detergent A sold in 3 countries: Germany (50% of sales), UK (30% of sales), France (20% of sales).

The total downstream scenario (distribution-use-end-of life- step 6-10) will be:

Scenario total=50% ScenarioGermany+30% ScenarioUK+20% ScenarioFrance

IV. Most relevant impact categories, life cycle stages, processes

The most relevant impact categories for the product group in scope of this PEFCR are the following:

- Climate change (NB: In a PEF study, the applicant shall report the total climate change as the sum of the three sub-indicators 'Climate change - fossil', 'Climate change - biogenic' and 'Climate change - land use and land transformation as well as separately the sub-indicator "Climate change – biogenic".)
- Resource use, fossils
- Acidification
- Particulate matter
- Ionizing radiation – human health

It should be noticed that these impact categories are strongly interconnected via the use of fossil resources for energy generation and transport.

The PEFCR Guidance v6.3 (Dec 2017) requires that the use of USEtox method and results be excluded from the procedure to identify the most relevant impact categories as well as for benchmarking and communication[30]. For this reason, ecotoxicity does not appear in the list of most relevant impact categories. However as indicated in chapter III.5, the A.I.S.E. PEF TS developed a consensus that ecotoxicity is an important consideration, characterising the environmental profile of laundry detergents. Also Table IV-1 includes the most relevant processes contributing to ecotoxicity (in italic text as it is based on A.I.S.E. PEF TS specific analysis and not on the procedure defined by the PEFCR guidance).

The most relevant life cycle stages for the product group in scope of this PEFCR are the following (numbers of life cycle stages correspond to those used on Figure III-1):

Identification on whole life cycle:

- 1. Chemical ingredients sourcing and manufacturing
- 3. Transport to processing plant for the ingredients
- 8. Product use
- 9. Wastewater treatment

NB: The use stage contributes to more than 50% for 3 among the 5 most relevant indicators (Climate change, Resource use, fossils and Ionizing radiation-human health). In line with the PEF Guidance v. 6.3, the most relevant life cycle stages and processes must be identified for the whole life cycle excluding the use stage and at the level of the use stage for these 3 indicators. For Acidification and Particulate matter, the most relevant processes are identified for the whole life cycle.
Therefore, the following stages are added to the list of most relevant life cycle stages:

- 2. Packaging raw materials sourcing and manufacturing
- 5. HDLLD manufacture
- 6 Transport and Distribution to retail

[30] The A.I.S.E. PEF TS developed a consensus that ecotoxicity is an important consideration, characterising the environmental profile of laundry detergents. In the absence of an aligned, robust USETOX methodology, the PEFCR requires the use of the alternative 'Environmental Safety Check ESC' method as referenced in chapter VII.4. Additional environmental information.

The most relevant processes for the product group in scope of this PEFCR are the following (contribution of each process for the RP is indicated in Annex X.4):

Table IV-1: List of the most relevant processes[31]

Impact category	Processes
Climate change	1.Chemical ingredients sourcing and manufacturing o Alkylbenzene sulfonate (surfactant anionic LAS) o Alcohol Ether sulfate (petro based) (surfactant anionic SLEs) o Alcohol Ether sulfate (oleo based) (surfactant anionic SLEs) o Citric Acid (builder) o Propylene glycol (solvent) o Enzymes 2.Packaging raw materials sourcing and manufacturing (primary packaging) o Plastic bottle material (HDPE granulates) 3.Transport to processing plant for the ingredients o Transport by boat 5.HDLLD manufacture o Electricity consumption 6.Transport and Distribution to Retail o Electricity consumption o Transport by truck 8.Product use o Electricity consumption o Water consumption 9.Wastewater treatment o Wastewater treatment

[31] This list is based on the final results of the representative product.

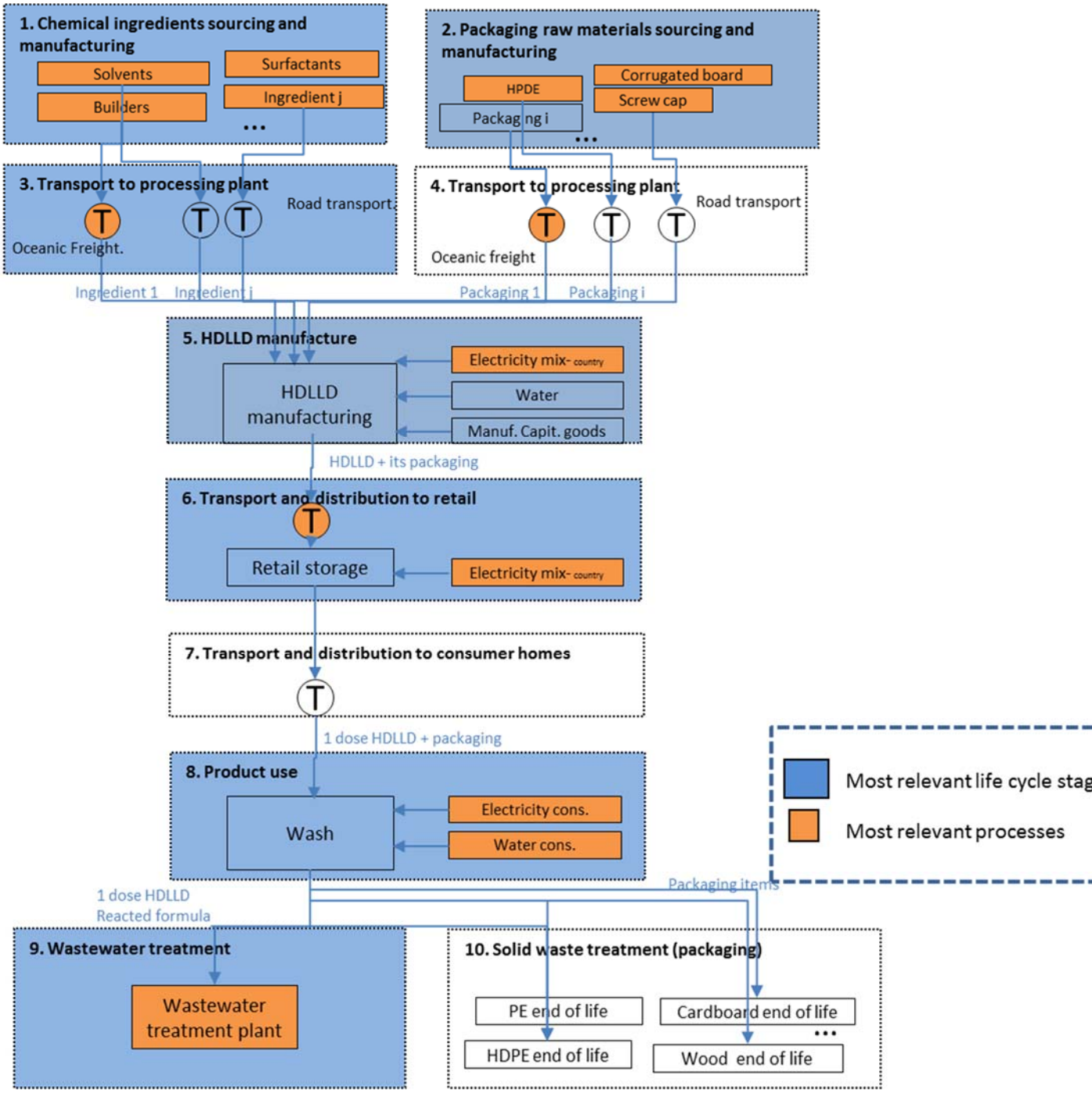
Impact category	Processes
Resource use, fossils	1.Chemical ingredients sourcing and manufacturing o Alkylbenzene sulfonate (surfactant anionic LAS) o Alcohol Ether sulfate (petro based) (surfactant anionic SLEs) o Alcohol Ether sulfate (oleo based) (surfactant anionic SLEs) o Alcohol ethoxylate petro 3 M (surfactant non-ionic) o Alcohol ethoxylate petro 7 M (surfactant non-ionic) o Propylene glycol (solvent) o Citric acid (builder) o AlcoholEthoxylate oleo >20 moles (surfactant non-ionic) o AlcoholEthoxylate oleo 7 moles (surfactant non-ionic) o Polycarboxylate (polymer) 2.Packaging raw materials sourcing and manufacturing (primary and secondary packaging) o Plastic bottle material (HDPE granulates) o Screw cap o Corrugated box 3.Transport to processing plant for the ingredients o Transport by boat 5.HDLLD manufacture o Electricity consumption 6.Transport and Distribution to Retail o Electricity consumption o Transport by truck (diesel production) 8.Product use o Electricity consumption o Water consumption 9.Wastewater treatment o Wastewater treatment

Impact category	Processes
Acidification	1.Chemical ingredients sourcing and manufacturing o Citric Acid (builder) o Alkylbenzene sulfonate (surfactant anionic LAS) o Propylene glycol (solvent) 3.Transport to processing plant for the ingredients o Transport by boat 4.Transport to processing plant for the packaging o Transport by boat 8.Product use o Electricity consumption o Water consumption 9.Wastewater treatment o Wastewater treatment
Particulate matter	1.Chemical ingredients sourcing and manufacturing o Alcohol Ether sulfate (oleo based) (surfactant anionic SLEs) o Alcohol Ether sulfate (petro based) (surfactant anionic SLEs) o Propylene glycol (solvent) o Alkylbenzene sulfonate (surfactant anionic LAS) 3.Transport to processing plant for the ingredients o Transport by boat 4.Transport to processing plant for the packaging o Transport by boat 8.Product use o Electricity consumption o Water consumption 9.Wastewater treatment

Impact category	Processes
	o Wastewater treatment
Ionising radiation – human health	1.Chemical ingredients sourcing and manufacturing o Citric Acid (builder) o Propylene glycol (solvent) o Enzymes o Sodium hydroxide (alkalinity sources) 2.Packaging raw materials sourcing and manufacturing (primary packaging) o Injection moulding o HDPE granulates o Stretch blow moulding 3.Transport to processing plant for the ingredients o Transport by boat 5.HDLLD manufacture o Electricity consumption 6.Transport and Distribution to Retail o Electricity consumption 8.Product use o Electricity consumption o Water consumption 9.Wastewater treatment o Wastewater treatment
Ecotoxicity Freshwater	*9.Wastewater treatment* o *Ingredients (ESC assessment for each ingredient is required; specific ingredients assessments via USEtox only once USEtox will be included in PEFCR).*

Figure IV-1 presents the system diagram with the most relevant life cycle stages and processes.

Figure IV-1: System diagram with most relevant life cycle stages and processes



V. Life cycle inventory

All newly created processes shall be EF-compliant.

This PEFCR does not allow data sampling. The applicant shall collect all specific data required.

V.1. List of mandatory company-specific data

The following data shall be company-specific:

- The **quantity of detergent for one recommended dosage** (one dose) as defined in the functional unit (in ml and its density in g/ml);
- The **bill of ingredients for the detergent** (see section V.1.1);
- The **bill of materials for primary packaging and secondary packaging** with **number of doses and stored volume per sale unit** (see section V.1.2);
- The **recommended temperature** to fulfil the functional unit as indicated on the packaging. The default temperature is 40°C. If another temperature is recommended, please refer to section III.6.2 for comparison to the benchmark.

V.1.1. Bill of ingredients

The applicant shall collect and use the bill of ingredients that is specific to the HDLLD under study.

The applicant shall make sure to collect the following different information about the ingredients:

- The **Bill of Ingredients '100% active content' (unreacted formulation)**: which shall be used in the Ingredients sourcing and manufacturing stage. Please see chapter VI.1.1 for the different categories of ingredients to consider.

- The **Bill of Ingredients 'as bought from the suppliers'** which shall be used for the transport of ingredients to the manufacturing plant stage.

- The **Bill of Ingredients '100% active content' (reacted formulation)** which shall be used for the evaluation of the impacts at the end of life stage. The chemical substances listed in 'reacted formulation' are also expressed as 100% active content.

The definitions of each term is given in the Definitions section at the beginning of this PEFCR.

A PEF study shall be performed for a specific and unique bill of ingredients. This bill of Ingredients, expressed in the three above-mentioned different manners in order to appropriately assess the different stages of the detergent life cycle, shall be expressed for one dose of detergent (reference flow of the functional unit). The applicant shall describe the period and countries of sales considered.

V.1.2. Bill of materials for primary packaging and secondary packaging

The primary packaging[32] is the material that contains, preserves and protects the liquid detergent, and it provides information to the end user. It is the smallest unit of distribution and can also include dosing devices.

The secondary packaging refers to any packaging that includes primary packed products and is often used to group primary packs together to protect them during storage, transport and distribution.

The bill of materials for the primary packaging and secondary packaging and the quantity of detergent per bottle (volume and mass) shall be collected by the applicant.

The stored volume of one sale unit is the rectangular prism occupied by one bottle (length x width x height).

As the detergent under study can be sold in different packaging formats or sizes, these data shall be representative of all formats available for the period and countries of sales considered (see previous section). The way the bill of materials for primary packaging and secondary packaging is evaluated shall be described in detail.

See the chapter VI.1.3.1 for the different packaging part to be provided.

There are no direct elementary flows to be collected for any processes.

V.2. List of processes expected to be run by the company

The only process expected to be run by the applicant is the HDLLD manufacturing (HDLLD manufacture stage).

It consists mainly in mixing of ingredients and involves energy and water consumption. As indicated in chapter III.4, air and water emissions as well as waste occurring at this stage are excluded based on the cut-off rules. Therefore, only activity data are to be collected.

These activity data are:

- energy consumption (electricity and heat)
- water consumption.

According to the TS members experience and the experience gained via the supporting studies performed during the pilot phase, most companies may encounter some difficulties when collecting such company-specific data. Please refer to section VI.2 for default data for such consumptions.

[32] The three levels of packaging are considered in a PEF study: primary, secondary and tertiary packaging (see definition of each level at the beginning of this PEFCR).

However, if such data are collected on site(s), these data shall be collected on one year of production at least. In case of a multi-site production, all sites shall be considered in proportion of their ratios of production of the HDLLD under study[33].

V.3. Data gaps

For some ingredients, datasets are not available in the database nodes as provided by the European Commission at the time of publication of the PEFCR; hence proxy data shall be used. The following table summarizes the concerned ingredients:

Table V-1: Data gaps in default datasets as regards chemical ingredients - proxy to be used in PEF studies or in case of missing proxy, ingredients to be excluded from the PEFCR

Ingredients	Proxy or comments on default dataset used	Excluded or proxy
Surfactants	ERASM SLE 2014 data are not available in the database node as provided by the EC due to insufficient level of disaggregation (as required). ecoinvent v2.2 datasets from EC databased node are used instead. The PEFCR users should be advised that the EF-compliant datasets are based on outdated LCI information. While the datasets for petrochemical-based surfactants are still relatively accurate (expected to be within a 10-20% range vs. the expected actuals), the data for renewable surfactants do not account for the current greenhouse gas protocol accounting rules. As a consequence, the greenhouse gas emissions will be underestimated in the EF-compliant datasets, in particular for palm oil-based precursors.	Proxy
Fragrance	The 4 datasets available in EC nodes do not cover all the possible fragrance ingredients used by HDLLD manufacturers. As a proxy, the average of the 4 shall be used.	Proxy
Phosphonate	Sodium Phosphate is used as a proxy	Proxy
Dye	No proxy available. The consequence of such a data gap is limited as dye's impacts are not significant and dye quantity is very limited. In case the applicant wishes to provide its own dataset, it shall comply with section V.6 requirement.	Excluded
Others - other ingredients	No proxy available. The consequence of such a data gap is limited as the quantity of those other ingredients is very limited; hence the impact of those ingredients is not significant. In case the applicant wishes to provide its own dataset, this shall comply with section V.6 requirement.	Excluded

[33] For example, the electricity consumption shall reflect the ratios of production: E.g. detergent B is manufactured in 3 countries: Germany (40% of production), UK (25% of production), France (35% of sales). The electricity consumption will be: Electricity cons.=40% Elec cons Germany+25% Elec cons UK +35% Elec cons France.

When such data is not available, the average EU residual consumption mix (EU-28 +EFTA), or region representative residual mix, shall be used to determine the ratio of production a physical unit shall be used (e.g. sales units or dose).

Water-soluble film for unit dose capsules	No proxy is available to model the water-soluble film. The applicant will have to provide its own dataset in compliance with section V.6 requirement.	Excluded.

These data gaps shall be mentioned in any PEF study where they are relevant.

Also, some other processes along the life cycle have been excluded from the PEFCR due to missing datasets (these shall not be filled in by the applicant) or require the use of proxy.

Table V-2: List of other processes that are excluded due to missing datasets or for which proxies are used

Life cycle stage (see Figure III-1)	**Processes**	**Excluded or proxy**
Manufacturing (stage 5)	Heat production	No proxy available – the applicant shall provide a dataset compliant with the requirements as listed in chapter V.6.
Transport (stage 3,4,6)	Maintenance and End-of-life of truck Maintenance and End-of Life of boat Road, maintenance and End-of Life of road	Excluded Excluded Excluded
Transport (stage 7)	Public transport/bicycle from retail to consumer	Not modelled (in line with PEF guidance v6.3)
End of Life – Detergent (stage 9)	Wastewater treatment	Proxy: Wastewater treatment with average waste flow (no possibility to evaluate specific impact of the detergent) (see section III.6.1 for detail)
End of life – packaging (stage 10)	Recycling process of wood pallet Recycling of LDPE and Recycling of HDPE	Wood pallet: Excluded Recycling of PP as proxy for HDPE and LDPE recycling

V.4. Data quality requirements

The data quality of each dataset and the total EF study shall be calculated and reported. The calculation of the DQR shall be based on the following formula with 4 criteria:

$$\mathbf{DQR} = \frac{\overline{\mathbf{Te_R}} + \overline{\mathbf{G_R}} + \overline{\mathbf{Ti_R}} + \overline{\mathbf{P}}}{\mathbf{4}}$$

Equation V-1

where

Te_R is the Technological-Representativeness,

G_R is the Geographical-Representativeness,

Ti_R is the Time-Representativeness, and

P is the Precision/uncertainty.

The representativeness (technological, geographical and time-related) characterises to what degree the processes and products selected are depicting the system analysed, while the precision indicates the way the data is derived and related level of uncertainty.

The next chapters provide tables with the criteria to be used for the semi-quantitative assessment of each criterion. If a dataset is constructed with company-specific activity data, company -specific emission data and secondary sub-processes, the DQR of each shall be assessed separately.

V.4.1. **Company-specific datasets**

The score of criteria P cannot be higher than 3 while the score for Ti_R, Te_R, and G_R cannot be higher than 2 (the DQR score shall be ≤1.6). The DQR shall be calculated at the level-1 disaggregation, before any aggregation of sub-processes or elementary flows is performed. The DQR of company-specific datasets shall be calculated as following:

1) Select the most relevant sub-processes and direct elementary flows that account for at least 80% of the total environmental impact of the company-specific datasets, listing them from the most contributing to the least contributing one.

2) Calculate the DQR criteria Te_R, Ti_R, G_R and P for each most relevant process and each most relevant direct elementary flow. The values of each criterion shall be assigned based on Table V-3.

2.a) Each most relevant elementary flow consists of the amount and elementary flow naming (e.g. 40 g carbon dioxide). For each most relevant elementary flow, evaluate the 4 DQR criteria named $Te_{R\text{-}EF}$, $Ti_{R\text{-}EF}$, $G_{R\text{-}EF}$, P_{EF} in Table V-3.

It shall be evaluated for example, the timing of the flow measured, for which technology the flow was measured and in which geographical area.

2.b) Each most relevant process is a combination of activity data and the secondary dataset used. For each most relevant process, the DQR is calculated by the applicant of the PEFCR as a combination of the 4 DQR parameters for activity data and the secondary dataset: (i) Ti_R and P shall be evaluated at the level of the activity data (named $Ti_{R\text{-}AD}$, P_{AD}) and (ii) Te_R, Ti_R and G_R shall be evaluated at the level of the secondary dataset used (named $Te_{R\text{-}SD}$, $Ti_{R\text{-}SD}$ and $G_{R\text{-}SD}$). As Ti_R is evaluated twice, the mathematical average of $Ti_{R\text{-}AD}$ and $Ti_{R\text{-}SD}$ represents the Ti_R of the most relevant process.

3) Calculate the environmental contribution of each most-relevant process and elementary flow to the total environmental impact of all most-relevant processes and elementary flows, in % (weighted using 13 EF impact categories, with the exclusion of the 3 toxicity-related ones). For example, the newly developed dataset has only two most relevant processes, contributing in total to 80% of the total environmental impact of the dataset:

- Process 1 carries 30% of the total dataset environmental impact. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).
- Process 1 carries 50% of the total dataset environmental impact. The contribution of this process to the total of 80% is 62.5% (the latter is the weight to be used).

4) Calculate the Te_R, Ti_R, G_R and P criteria of the newly developed dataset as the weighted average of each criterion of the most relevant processes and direct elementary flows. The weight is the relative contribution (in %) of each most relevant process and direct elementary flow calculated in step 4.

5) The applicant of the PEFCR shall the total DQR of the newly developed dataset using the Equation V-2, where $\overline{\mathrm{Te_R}}, \overline{\mathrm{G_R}}, \overline{\mathrm{Ti_R}}, \overline{\mathrm{P}}$ are the weighted average calculated as specified in point 4).

$$DQR = \frac{\overline{Te_R}+\overline{G_R}+\overline{Ti_R}+\overline{P}}{4}$$

Equation V-2

NOTE: in case the newly developed dataset has most relevant processes filled in by non-EF-compliant datasets (and thus without DQR), then these datasets cannot be included in step 4 and 5 of the DQR calculation. (1) The weight of step 3 shall be recalculated for the EF-compliant datasets only. Calculate the environmental contribution of each most-relevant EF-compliant process and elementary flow to the total environmental impact of all most-relevant EF-compliant processes and elementary flows, in %. Continue with step 4 and 5. (2) The weight of the non-EF-compliant dataset (calculated in step 3) shall be used to increase the DQR criteria and total DQR accordingly. For example:

- Process 1 carries 30% of the total dataset environmental impact and is ILCD entry level compliant. The contribution of this process to the total of 80% is 37.5% (the latter is the weight to be used).
- Process 1 carries 50% of the total dataset environmental impact and is EF-compliant. The contribution of this process to all most-relevant EF-compliant processes is 100%. The latter is the weight to be used in step 4.
- After step 5, the parameters $\overline{\mathrm{Te_R}}, \overline{\mathrm{G_R}}, \overline{\mathrm{Ti_R}}, \overline{\mathrm{P}}$ and the total DQR shall be multiplied with 1.375.

Table V-3: How to assess the value of the DQR criteria for datasets with company-specific information

	P_{EF} and P_{AD}[34]	$Ti_{R\text{-}EF}$ and $Ti_{R\text{-}AD}$[35]	$Ti_{R\text{-}SD}$[36]	$Te_{R\text{-}EF}$ and $Te_{R\text{-}SD}$[37]	$G_{R\text{-}EF}$ and $G_{R\text{-}SD}$[38]
1	Measured/calculated and externally verified	The data refers to the most recent annual administration period with respect to the EF report publication date	The EF report publication date happens within the time validity of the dataset	The elementary flows and the secondary dataset reflect exactly the technology of the newly developed dataset	The data(set) reflects the exact geography where the process modelled in the newly created dataset takes place
2	Measured/calculated and internally verified, plausibility checked by reviewer	The data refers to maximum 2 annual administration periods with respect to the EF report publication date	The EF report publication date happens not later than 2 years beyond the time validity of the dataset	The elementary flows and the secondary dataset is a proxy of the technology of the newly developed dataset	The data(set) partly reflects the geography where the process modelled in the newly created dataset takes place
3	Measured/calculated/literature and plausibility not checked by reviewer OR Qualified estimate based on calculations plausibility checked by reviewer	The data refers to maximum three annual administration periods with respect to the EF report publication date	Not applicable	Not applicable	Not applicable
4-5	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

[34] Precision criteria evaluated at the level of the elementary flow (P_{EF}) and at the level of the activity data (P_{AD})

[35] Time-representativeness evaluated at the level of the elementary flow ($Ti_{R\text{-}EF}$)and at the level of the activity data ($Ti_{R\text{-}AD}$)

[36] Time-representativeness evaluated at the level of the secondary dataset *($Ti_{R\text{-}SD}$)*

[37] Technological-Representativeness evaluated at the level of the elementary flow (Te_{R}-EF) and at the level of the secondary dataset($Te_{R\text{-}SD}$)

[38] Geographical-Representativeness evaluated at the level of the elementary flow ($G_{R\text{-}EF}$) and at the level of the secondary dataset ($G_{R\text{-}SD}$).

V.5. Data needs matrix (DNM)

All processes required to model the product and outside the list of mandatory company-specific (listed in section V.1) shall be evaluated using the Data Needs Matrix (see Table V-4). The DNM shall be used by the PEFCR applicant to evaluate which data is needed and shall be used within the modelling of its PEF, depending on the level of influence the applicant (company) has on the specific process. The following three cases are found in the DNM and are explained below:

1. **Situation 1**: the process is run by the company applying the PEFCR
2. **Situation 2**: the process is not run by the company applying the PEFCR but the company has access to (company-) specific information.
3. **Situation 3**: the process is not run by the company applying the PEFCR and this company does not have access to (company-) specific information.

Table V-4: Data Need Matrix (DNM)[39]

*Disaggregated datasets shall be used.

		Most relevant process	Other process
Situation 1: process run by the company applying the PEFCR	**Option 1**	Provide company-specific data (as requested in the PEFCR) and create a company specific dataset partially disaggregated at least at level 1 (DQR ≤1.6). Calculate the DQR values (for each criterion + total)	
	Option 2		Use default secondary dataset in PEFCR, in aggregated form (DQR ≤3.0). Use the default DQR values
Situation 2: process not run by the company applying the PEFCR but with access to (company-)specific information	**Option 1**	Provide company-specific data (as requested in the PEFCR) and create a company specific dataset partially disaggregated at least at level 1 (DQR ≤1.6). Calculate the DQR values (for each criterion + total)	
	Option 2	Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF-compliant datasets (DQR ≤3.0).* Re-evaluate the DQR criteria within the product specific context	
	Option 3		Use company-specific activity data for transport (distance), and substitute the sub-processes used for electricity mix and transport with supply-chain specific EF-compliant datasets (DQR ≤4.0).

[39] The options described in the DNM are not listed in order of preference

		Most relevant process	Other process
			Use the default DQR values
Situation 3: process not run by the company applying the PEFCR and without access to (company)-specific	**Option 1**	Use default secondary dataset, in aggregated form (DQR ≤3.0). Re-evaluate the DQR criteria within the product specific context	
	Option 2		Use default secondary dataset in PEFCR, in aggregated form (DQR ≤4.0) Use the default DQR values

V.5.1. **Processes in situation 1**

For each process in situation 1 there are two possible options:

- The process is in the list of most relevant processes as specified in the PEFCR or is not in the list of most relevant process, but still the company wants to provide company specific data (option 1);
- The process is not in the list of most relevant processes and the company prefers to use a secondary dataset (option 2).

Situation 1 / Option 1

For all processes run by the company and where the company applying the PEFCR uses company specific data. The DQR of the newly developed dataset shall be evaluated as described in V.4.1.

$\overline{\mathrm{Te_R}}, \overline{\mathrm{G_R}}, \overline{\mathrm{Ti_R}}, \overline{\mathrm{P}}$ DQR $= \frac{\overline{\mathrm{Te_R}}+\overline{\mathrm{G_R}}+\overline{\mathrm{Ti_R}}+\overline{\mathrm{P}}}{4}$ **Situation 1 / Option 2**

For the non-most relevant processes only, if the applicant decides to model the process without collecting company-specific data, then the applicant shall use the secondary dataset listed in the PEFCR together with its default DQR values listed here.

If the default dataset to be used for the process is not listed in the PEFCR, the applicant of the PEFCR shall take the DQR values from the metadata of the original dataset.

V.5.2. **Processes in situation 2**

When a process is not run by the company applying the PEFCR, but there is access to company-specific data, then there are two possible options:

- The company applying the PEFCR has access to extensive supplier-specific information and wants to create a new EF-compliant dataset[40] (Option 1);
- The company has some supplier-specific information and want to make some minimum changes (Option 2).

[40] The review of the newly created dataset is optional

- The process is not in the list of most relevant processes and the company prefers to use a secondary dataset (option 3).

Situation 2 / Option 1

For all processes run by the company and where the company applying the PEFCR uses company specific data. The DQR of the newly developed dataset shall be evaluated as described in section V.4.1.

Situation 2 / Option 2

Company-specific activity data for transport are used and the sub-processes used for electricity mix and transport with supply-chain specific EF-compliant datasets are substituted starting from the default secondary dataset provided in the PEFCR.

Please note that, the PEFCR lists all dataset names together with the UUID of their aggregated dataset. For this situation, the disaggregated version of the dataset is required.

The applicant of the PEFCR shall make the DQR values of the dataset used context-specific by re-evaluating Te_R and Ti_R, using the table(s) provided. The criteria G_R shall be lowered by 30%[41] and the criteria P shall keep the original value.

Situation 2 / Option 3

For the non-most relevant processes, the applicant may use the corresponding secondary dataset listed in the PEFCR together with its DQR values.

If the default dataset to be used for the process is not listed in the PEFCR, the applicant of the PEFCR shall take the DQR values from the original dataset.

Table V-5: How to assess the values of the DQR criteria when secondary datasets are used

	Ti_R	Te_R	G_R
1	The EF report publication date happens within the time validity of the dataset	The technology used in the EF study is exactly the same as the one in scope of the dataset	The process modelled in the EF study takes place in the country the dataset is valid for
2	The EF report publication date happens not later than 2 years beyond the time validity of the dataset	The technologies used in the EF study is included in the mix of technologies in scope of the dataset	The process modelled in the EF study takes place in the geographical region (e.g. Europe) the dataset is valid for
3	The EF report publication date happens not later than 4 years beyond the time validity of the dataset	The technologies used in the EF study are only partly included in the scope of the dataset	The process modelled in the EF study takes place in one of the geographical regions the dataset is valid for

[41] In situation 2, option 2 it is proposed to lower the parameter G_R by 30% in order to incentivise the use of company specific information and reward the efforts of the company in increasing the geographic representativeness of a secondary dataset through the substitution of the electricity mixes and of the distance and means of transportation.

	Ti_R	Te_R	G_R
4	The EF report publication date happens not later than 6 years beyond the time validity of the dataset	The technologies used in the EF study are similar to those included in the scope of the dataset	The process modelled in the EF study takes place in a country that is not included in the geographical region(s) the dataset is valid for, but sufficient similarities are estimated based on expert judgement.
5	The EF report publication date happens later than 6 after the time validity of the dataset	The technologies used in the EF study are different from those included in the scope of the dataset	The process modelled in the EF study takes place in a different country than the one the dataset is valid for

V.5.3. **Processes in situation 3**

When a process is not run by the company applying the PEFCR and the company does not have access to company-specific data, there are two possible options:

- It is in the list of most relevant processes (situation 3, option 1)
- It is not in the list of most relevant processes (situation 3, option 2)

Situation 3 / Option 1

In this case, the applicant of the PEFCR shall make the DQR values of the dataset used context-specific by re-evaluating Te_R, Ti_R and G_r , using the table(s) provided. The criteria P shall keep the original value.

Situation 3 / Option 2

For the non-most relevant processes, the applicant shall use the corresponding secondary dataset listed in the PEFCR together with its DQR values.

If the default dataset to be used for the process is not listed in the PEFCR, the applicant of the PEFCR shall take the DQR values from the original dataset.

V.6. Which datasets to use?

The secondary datasets to be used by the applicant are those listed in this PEFCR. Whenever a dataset needed to calculate the PEF-profile is not among those listed in this PEFCR, then the applicant shall choose between the following options (in hierarchical order):

- Use an EF-compliant dataset available on one of the following nodes:
  - http://eplca.jrc.ec.europa.eu/EF-node
  - http://lcdn.blonkconsultants.nl
  - http://ecoinvent.lca-data.com
  - http://lcdn-cepe.org
  - https://lcdn.quantis-software.com/PEF/
  - http://lcdn.thinkstep.com/Node
- Use an EF-compliant dataset available in a free or commercial source;
- Use another EF-compliant dataset considered to be a good proxy. In such case this information shall be included in the "limitation" section of the PEF report.

- Use an ILCD-entry level-compliant dataset that has been modelled according to the modelling requirements included in the Guidance version 6.3. In such case this information shall be included in the "limitations" section of the PEF report.
- Use an ILCD-entry level-compliant dataset. In such case this information shall be included in the "data gap" section of the PEF report.

V.7. How to calculate the average DQR of the study

In order to calculate the average DQR of the EF study, the applicant shall calculate separately the TeR, TiR, GR and P for the EF study as the weighted average of all most relevant processes, based on their relative environmental contribution to the total single score (excluding the 3 toxicity-related ones). The calculation rules explained in chapter V.4 shall be used. $\overline{\mathrm{Te_R}}$, $\overline{\mathrm{G_R}}$, $\overline{\mathrm{Ti_R}}$, $\overline{\mathrm{P}}$.

V.8. Allocation rules

The table below gives the allocation rules that shall be used by PEF studies and how the modelling and calculations shall be made.

Table V-6: Allocation rules to be used in PEF studies

Process	Allocation rule	Modelling instructions
HDLLD manufacture (stage 5) - Energy consumption - Water consumption	No physical allocation between co-products or with by-product. Physical allocation in case of several production lines	No specific allocation is required since the detergent manufacturing process does not entail co-products or by-products. However, if there are several different production lines in the same plant, the data collection shall be performed using the following rules: o Provide data for the specific product studied; o Use mass allocation if data are only available at the plant level.
Transport (stages 3, 4, 6)	Physical allocation	o Mass allocation shall be applied[42] for the distance covered for the HDLLD (ingredients; raw packaging and final product.) Mass allocation shall be applied in the case of several providers for the same ingredient.

[42] Except for cases where it is clearly known that the product is volume limited.

Process	Allocation rule	Modelling instructions
Transport and distribution to consumer homes (stage 7)	Physical allocation	o Volume allocation in the car trunk with the following assumption: (car trunk maximum volume=0,2 m^3 (around 1/3 of 0,6 m^3). o See distribution chapter (section VI.4) for default scenario retained by the TS. In case of another distribution scenario is studied, see PEFCR guidance v6.3 for other default scenarios.
Solid waste treatment (packaging) (stage 10)	Physical allocation	Circular end-of-life formula shall be applied

V.9. Electricity modelling

The guidelines in this section shall only be used for the processes where company-specific information is collected (situation 1 / Option 1 & 2 / Option 1of the DNM).

The following electricity mix shall be used in hierarchical order:

(i) Supplier-specific electricity product shall be used if:
  (a) available, and
  (b) the set of minimum criteria to ensure the contractual instruments are reliable is met.

(ii) The supplier-specific total electricity mix shall be used if:
  (a) available, and
  (b) the set of minimum criteria that to ensure the contractual instruments are reliable is met.

(iii) As a last option the 'country-specific residual grid mix, consumption mix' shall be used (available at http://lcdn.thinkstep.com/Node/). Country-specific means the country in which the life cycle stage occurs. This may be an EU country or non-EU country. The residual grid mix characterizes the unclaimed, untracked or publicly shared electricity. This prevents double counting with the use of supplier-specific electricity mixes in (i) and (ii).

Note: if for a country, there is a 100% tracking system in place, case (i) shall be applied.

Note: for the use stage, the consumption grid mix shall be used.

The environmental integrity of the use of supplier-specific electricity mix depends on ensuring that contractual instruments (for tracking) **reliably and uniquely convey claims to consumers**. Without this, the PEF lacks the accuracy and consistency necessary to drive product/corporate electricity procurement decisions and accurate consumer (buyer

of electricity) claims. Therefore, a set of minimum criteria that relate to the integrity of the contractual instruments as reliable conveyers of environmental footprint information has been identified. They represent the minimum features necessary to use supplier-specific mix within PEF studies.

Set of minimal criteria to ensure contractual instruments from suppliers:

A supplier-specific electricity product/mix may only be used when the applicant ensures that any contractual instrument meets the criteria specified below. If contractual instruments do not meet the criteria, then 'country-specific residual grid mix, consumption mix' shall be used in the modelling.

A contractual instrument used for electricity modelling shall:

1. Convey attributes:
    - Convey the energy type mix associated with the unit of electricity produced.
    - The energy type mix shall be calculated based on delivered electricity, incorporating certificates sourced and retired on behalf of its customers. Electricity from facilities for which the attributes have been sold off (via contracts or certificates) shall be characterized as having the environmental attributes of the country residual consumption mix where the facility is located.
2. Be a unique claim:
    - Be the only instruments that carry the environmental attribute claim associated with that quantity of electricity generated.
    - Be tracked and redeemed, retired, or cancelled by or on behalf of the company (e.g. by an audit of contracts, third-party certification, or may be handled automatically through other disclosure registries, systems, or mechanisms).
3. Be as close as possible to the period to which the contractual instrument is applied.

Modelling 'country-specific residual grid mix, consumption mix':

Datasets for residual grid mix, per energy type, per country and per voltage have been purchased by the European Commission and are available in the dedicated node (http://lcdn.thinkstep.com/Node/). In case the necessary dataset is not available, an alternative dataset shall be chosen according to the procedure described in section V.9. If no dataset is available, the following approach may be used:

Determine the country consumption mix (e.g. X% of MWh produced with hydro energy, Y% of MWh produced with coal power plant) and combine them with LCI datasets per energy type and country/region (e.g. LCI dataset for the production of 1MWh hydro energy in Switzerland):

- Activity data related to non-EU country consumption mix per detailed energy type shall be determined based on:
    - Domestic production mix per production technologies
    - Import quantity and from which neighbouring countries
    - Transmission losses
    - Distribution losses
    - Type of fuel supply (share of resources used, by import and / or domestic supply)

  These data may be found in the publications of the International Energy Agency (IEA).

- Available LCI datasets per fuel technologies in the node. The LCI datasets available are generally specific to a country or a region in terms of:
    - Fuel supply (share of resources used, by import and / or domestic supply),
    - Energy carrier properties (e.g. element and energy contents)
    - Technology standards of power plants regarding efficiency, firing technology, flue-gas desulphurisation, NOx removal and de-dusting.

Allocation rules:

The table below summarizes the physical relationship and the modelling instructions that shall be used by PEF studies as regards electricity consumption along the life cycle.

Table V-7: Allocation rules for electricity

Process	Physical relationship	Modelling instructions
HDLLD manufacture (stage 5) - Energy consumption (electricity)	Mass	At the scale of the production line, no specific allocation is required since the detergent manufacturing process does not entail co-products or by-products. However, if there are several different production lines in the same plant, the data collection shall be performed using the following rules: o Provide data for the specific product studied; o Use mass allocation if data are only available at the plant level. In case of several HDLLD production sites, the ratios of production of each country of production shall be considered.
Product Use stage (stage 8) • Electricity consumption	Mass	In case of several countries of sale, the ratios of sales (in mass) shall be considered.
End-of-Life (stages 9 and 10) • Electricity consumption	Mass	In case of several countries of sale, the ratios of sales (in mass) shall be considered.

If the consumed electricity comes from more than one electricity mix, each mix source shall be used in terms of its proportion in the total kWh consumed. For example, if a fraction of this total kWh consumed is coming from a specific supplier a supplier-specific electricity mix shall be used for this part. See below for on-site electricity use.

A specific electricity type may be allocated to one specific product in the following conditions:

a. The production (and related electricity consumption) of a product occurs in a separate site (building), the energy type physical related to this separated site can be used.
b. The production (and related electricity consumption) of a product occurs in a shared space with specific energy metering or purchase records or electricity bills, the product specific information (measure, record, bill) may be used.
c. All the products produced in the specific plant are supplied with a public available PEF study. The company who wants to make the claim shall make all PEF studies available. The allocation rule applied shall be described in the PEF study, consistently applied in all PEF studies connected to the site and verified. An example is the 100% allocation of a greener electricity mix to a specific product.

On-site electricity generation:

If on-site electricity production is equal to the site own consumption, two situations apply:

- No contractual instruments have been sold to a third party: the own electricity mix (combined with LCI datasets) shall be modelled.
- Contractual instruments have been sold to a third party: the 'country-specific residual grid mix, consumption mix' (combined with LCI datasets) shall be used.

If electricity is produced in excess of the amount consumed on-site within the defined system boundary and is sold to, for example, the electricity grid, this system can be seen as a multifunctional situation. The system will provide two functions (e.g. product + electricity) and the following rules shall be followed:

- If possible, apply subdivision.
- Subdivision applies both to separate electricity productions or to a common electricity production where you can allocate based on electricity amounts the upstream and direct emissions to your own consumption and to the share you sell out of your company (e.g. if a company has a wind mill on its production site and export 30% of the produced electricity, emissions related to 70% of produced electricity should be accounted in the PEF study.
- If not possible, direct substitution shall be used. The country-specific residual consumption electricity mix shall be used as substitution[43].
- Subdivision is considered as not possible when upstream impacts or direct emissions are closely related to the product itself.

V.10. Climate change modelling

The impact category 'climate change' shall be modelled considering three sub-categories:

1. Climate change – fossil: This sub-category includes emissions from peat and calcination/carbonation of limestone. The emission flows ending with '(fossil)' (e.g., 'carbon dioxide (fossil)'' and 'methane (fossil)') shall be used if available.
2. Climate change – biogenic: This sub-category covers carbon emissions to air (CO_2, CO and CH_4) originating from the oxidation and/or reduction of biomass by means of its transformation or degradation (e.g. combustion, digestion, composting,

[43] For some countries, this option is a best case rather than a worst case.

landfilling) and CO_2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or aboveground plant residues such as litter and dead wood. Carbon exchanges from native forests[44] shall be modelled under sub-category 3 (incl. connected soil emissions, derived products, residues). The emission flows ending with '(biogenic)' shall be used.

No simplified modelling approach shall be used when modelling the foreground emissions. All biogenic carbon emissions and removals shall be modelled separately. However, note that the corresponding characterisation factors for biogenic CO_2 uptakes and emissions within the EF impact assessment method are set to zero.

Neither the product life cycle, nor a part of the life cycle has a lifetime beyond 100 years, therefore no credits from biogenic carbon storage shall be modelled.

3. Climate change – land use and land transformation: This sub-category accounts for carbon uptakes and emissions (CO_2, CO and CH_4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (incl. soil carbon emissions). For native forests, all related CO_2 emissions are included and modelled under this sub-category (including connected soil emissions, products derived from native forest[45] and residues), while their CO_2 uptake is excluded. The emission flows ending with '(land use change)' shall be used.

   For land use change, all carbon emissions and removals shall be modelled following the modelling guidelines of PAS 2050:2011 (BSI 2011) and the supplementary document PAS2050-1:2012 (BSI 2012) for horticultural products. PAS 2050:2011 (BSI 2011): Large emissions of GHGs can result as a consequence of land use change. Removals as a direct result of land use change (and not as a result of long-term management practices) do not usually occur, although it is recognized that this could happen in specific circumstances. Examples of direct land use change are the conversion of land used for growing crops to industrial use or conversion from forestland to cropland. All forms of land use change that result in emissions or removals are to be included. Indirect land use change refers to such conversions of land use as a consequence of changes in land use elsewhere. While GHG emissions also arise from indirect land use change, the methods and data requirements for calculating these emissions are not fully developed. Therefore, the assessment of emissions arising from indirect land use change is not included.

   The GHG emissions and removals arising from direct land use change shall be assessed for any input to the life cycle of a product originating from that land and shall be included in the assessment of GHG emissions. The emissions arising from the product shall be assessed on the basis of the default land use change values provided in PAS 2050:2011 Annex C, unless better data is available. For countries and land use changes not included in this annex, the emissions arising from the product shall be assessed using the included GHG emissions and removals occurring as a result of direct land use change in accordance with the relevant sections of the

[44] Native forests – represents native or long-term, non-degraded forests. Definition adapted from table 8 in Annex V C(2010)3751 to Directive 2009/28/EC.

[45] Following the instantaneous oxidation approach in IPCC 2013 (Chapter 2).

IPCC (2006). The assessment of the impact of land use change shall include all direct land use change occurring not more than 20 years, or a single harvest period, prior to undertaking the assessment (whichever is the longer). The total GHG emissions and removals arising from direct land use change over the period shall be included in the quantification of GHG emissions of products arising from this land on the basis of equal allocation to each year of the period.

1) Where it can be demonstrated that the land use change occurred more than 20 years prior to the assessment being carried out, no emissions from land use change should be included in the assessment.

2) Where the timing of land use change cannot be demonstrated to be more than 20 years, or a single harvest period, prior to making the assessment (whichever is the longer), it shall be assumed that the land use change occurred on 1 January of either:

- the earliest year in which it can be demonstrated that the land use change had occurred; or
- on 1 January of the year in which the assessment of GHG emissions and removals is being carried out.

The following hierarchy shall apply when determining the GHG emissions and removals arising from land use change occurring not more than 20 years or a single harvest period, prior to making the assessment (whichever is the longer):

1. where the country of production is known and the previous land use is known, the GHG emissions and removals arising from land use change shall be those resulting from the change in land use from the previous land use to the current land use in that country (additional guidelines on the calculations can be found in PAS 2050-1:2012);
2. where the country of production is known, but the former land use is not known, the GHG emissions arising from land use change shall be the estimate of average emissions from the land use change for that crop in that country (additional guidelines on the calculations can be found in PAS 2050-1:2012);
3. where neither the country of production nor the former land use is known, the GHG emissions arising from land use change shall be the weighted average of the average land use change emissions of that commodity in the countries in which it is grown.

Knowledge of the prior land use can be demonstrated using a number of sources of information, such as satellite imagery and land survey data. Where records are not available, local knowledge of prior land use can be used. Countries in which a crop is grown can be determined from import statistics, and a cut-off threshold of not less than 90% of the weight of imports may be applied. Data sources, location and timing of land use change associated with inputs to products shall be reported.

Soil carbon storage shall not be modelled, calculated and reported as additional environmental information.

The sum of the three sub-categories shall be reported.

The sub-category 'Climate change-biogenic' shall be reported separately.

The sub-category 'Climate change-land use and land transformation' shall not be reported separately.[46]

V.11. Modelling on Waste and Recycling content

The waste of products used during the manufacturing, distribution, retail, the use stage or after use shall be included in the overall modelling of the life cycle of the organisation. Overall, this should be modelled and reported at the life cycle stage where the waste occurs. This section gives guidelines on how to model the End-of-Life of products as well as the recycled content.

The Circular Footprint Formula is used to model the End-of-Life of products as well as the recycled content and is a combination of "material + energy + disposal", i.e.:

Material $(1-R_1)E_V + R_1 \times \left(AE_{recycled} + (1-A)E_V \times \frac{Q_{Sin}}{Q_p}\right) + (1-A)R_2 \times \left(E_{recyclingEoL} - E_V^* \times \frac{Q_{Sout}}{Q_P}\right)$

Energy $(1-B)R_3 \times (E_{ER} - LHV \times X_{ER,heat} \times E_{SE,heat} - LHV \times X_{ER,elec} \times E_{SE,elec})$

Disposal $(1-R_2-R_3) \times E_D$

With the following parameters:

A: allocation factor of burdens and credits between supplier and user of recycled materials.

B: allocation factor of energy recovery processes: it applies both to burdens and credits. It shall be set to zero for all PEF studies.

Qs_{in}: quality of the ingoing secondary material, i.e. the quality of the recycled material at the point of substitution.

Qs_{out}: quality of the outgoing secondary material, i.e. the quality of the recyclable material at the point of substitution.

Q_p: quality of the primary material, i.e. quality of the virgin material.

R_1: it is the proportion of material in the input to the production that has been recycled from a previous system.

R_2: it is the proportion of the material in the product that will be recycled (or reused) in a subsequent system. R2 shall therefore take into account the inefficiencies in the collection and recycling (or reuse) processes. R2 shall be measured at the output of the recycling plant.

R_3: it is the proportion of the material in the product that is used for energy recovery at EoL.

[46] For the Representative product, the contribution of this sub-category is far below 5% based on data used for the benchmark results; the same is expected for most HDLLD. However, this may be different for HDLLD mainly made of agro-based ingredients or in the case that some ingredients datasets are updated. Therefore, the applicant shall monitor the contribution of this sub-category and report it if it is reaches more than 5% for the climate change category.

$E_{recycled}$ (E_{rec}): specific emissions and resources consumed (per functional unit) arising from the recycling process of the recycled (reused) material, including collection, sorting and transportation process.

$E_{recyclingEoL}$ (E_{recEoL}): specific emissions and resources consumed (per functional unit) arising from the recycling process at EoL, including collection, sorting and transportation process.

E_v: specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material.

E^*_v: specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material assumed to be substituted by recyclable materials.

EER: specific emissions and resources consumed (per functional unit) arising from the energy recovery process (e.g. incineration with energy recovery, landfill with energy recovery, …).

$E_{SE,heat}$ and $E_{SE,elec}$: specific emissions and resources consumed (per functional unit) that would have arisen from the specific substituted energy source, heat and electricity respectively.

ED: specific emissions and resources consumed (per functional unit) arising from disposal of waste material at the EoL of the analysed product, without energy recovery.

$X_{ER,heat}$ and $X_{ER,elec}$: the efficiency of the energy recovery process for both heat and electricity.

LHV: Lower Heating Value of the material in the product that is used for energy recovery.

The parameters that shall be used in PEF studies are summarized in Table VI-7 and Table VI-17.

VI. Life cycle stages

VI.1. Raw material acquisition and pre-processing

VI.1.1. Ingredients sourcing and manufacturing

The ingredients are the raw materials which are mixed during the HDLLD manufacturing process. The ingredients constitute the **Bill of Ingredients** (unreacted formulation).

Most liquid detergent ingredients delivered by the suppliers are aqueous solutions. The concentration of the active ingredient may vary according to the suppliers. Therefore, to ensure a consistent Bill of Ingredients, one needs to express the amount of ingredients as 100% active (i.e. without water and/or list of all components of the solution). This Bill will be called **Bill of Ingredients 'in 100% active content' (unreacted formulation)**[47].

It will differ from the **Bill of Ingredients 'as bought from the suppliers'**, that considers each ingredient and its quantity of solution as bought from the suppliers and necessary to produce one dose of the detergent under study. This bill will be used for the transport of ingredients to the manufacturing plant.

The Table VI-1 gives the list of possible ingredients families with for each family, its functional description, the different types of chemicals and some examples.

Table VI-1: Ingredients families used in the HDLLD manufacturing[48]

Ingredients families	Description of function[49]	Type	Example of Chemicals
Water			Water
Builders	Reduces the effect of water hardness by removing calcium and magnesium ions and increases the effectiveness of the detergent.		Citric acid, salts of citric acid and other salts
Sequestrants	Prevents free metal ions from causing any adverse effects on product performance, appearance, or stability by reacting with them.	Phosphonates	Sodium phosphonate
Dye	Add a colour to or change the colour of something		Pigment Yellow 1
Enzymes	Enzymes are catalysts that increase the rate of chemical reactions, such as digestion and growth processes. In the detergent industry, commercial enzymes are used to help ensure a high degree of stain removal, whiteness, fabric and colour care, and overall cleaning performance.		Mannanase, protease, amylase, pectinase, lipase, other enzymes.
Fragrances	Offer an aesthetic experience for the packed detergent, during/after the washing and when wearing the washed fabrics.		Fragrances[50]

[47] Refer to the definitions at the beginning of the PEFCR for all Bills of Ingredients to be considered for a PEF study and the difference between reacted formulation and unreacted formulation.

[48] The level of granularity in the Bill of ingredients is defined based on the ingredient families and their role in the formulation.

[49] The description of functions according to the Cleanright website (http://uk.cleanright.eu/).

[50] Fragrances have a complex composition and common business practice is to treat the composition confidentially. For the modelling, a mix of 4 fragrances compounds for which datasets are available shall be considered (see Table VI-2).

Ingredients families	Description of function[49]	Type	Example of Chemicals
Optical brighteners	Makes the fabrics look brighter and whiter		Biphenyl disulfonate Sodium Polyaryl Sulfonate
Surfactant system (anionic – non-ionic)	Used to change the surface tension of water to assist cleansing, wetting surfaces, foaming and emulsifying (the suspension of one liquid evenly within another).	Anionic surfactants	Sodium alkyl ether sulfates (SLES), linear alkylbenzene sulfonate (LAS)
		Soap	Saponified fatty acid (cocoate, palm kernel, etc.)
		Non-ionic surfactants	Ethoxylates oleochemicals + petrochemical) & other non-ionic surfactants
Alkalinity sources	Increases the alkalinity of the product to aid dissolution of dirt.		Sodium hydroxide, triethanolamine
Solvents	Used to dissolve other ingredients		Glycerine, glycols
Other ingredients		Preservatives, polymers, salts, others	
Hydro-soluble film for Unit-dose capsule		Polymer film	Polyvinyl alcohol (PVA) film

The 'ingredient sourcing' and 'manufacturing' step shall be considered for each ingredient individually. It shall include mining and extraction of resources, processing of chemicals and transportation between extraction and the chemical manufacturing site.

The table below gives the detail of all mandatory company specific quantities of ingredients to be provided by the applicant and the default datasets (and mix of datasets) used to model each ingredients family or sub-family of the representative product. In case no better dataset in compliance with section V.6 can be used to model an ingredient used for the detergent under study, the default dataset or mix of datasets proposed in this table shall be used to model the ingredient.

Table VI-2: Raw material acquisition and processing (bill of ingredients in 100% active content)

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
Water	g	0	Mandatory company-specific data	De-ionised water production technology mix production mix, at plant 100% active substance RER[51]	http://ecoinvent.lca-data.com/	8040e11a-715f-4cd9-823c-a57124a553b2	2	1	1	2	N
Builders – Citric Acid	g (quantity in 100% active content)	0	Mandatory company-specific data	Citric acid production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	d0becc20-49c4-4e8f-9ff8-8c392d5610ed	2	1	1	1	Y
Builders - Salts of citric acid and other salts	g (quantity in 100% active content)	0	Mandatory company-specific data	0.744 g of Citric acid production technology mix production mix, at plant 100% active + 0.465 g of Sodium hydroxide production technology mix production mix, at plant 100% active substance RER[52]	http://ecoinvent.lca-data.com/	d0becc20-49c4-4e8f-9ff8-8c392d5610ed and 2ba49ead-4683-4671-bded-d52b80215e9e	2 2	1 1	1 1	1 2	Y
Sequestrants	g (quantity in 100% active content)	0	Mandatory company-specific data	sodium phosphate production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	cafbb6ae-42e4-4020-bc57-06a7cca9583c	2	2	1	2	N

[51] Since the default LCI considered water already as deionised, the company shall ensure that energy for water deionising (if made on site) is not double counted.

[52] On the basis of the following chemical equation: C6H8O7 + 3NaOH --> Na3C6H5O7 + 3H2O, 1kg of salt of citric acid is modeled by 0,744 kg of citric acid and 0,465 kg of sodium hydroxide.

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
Dye	g (quantity in 100% active content)	0	Mandatory company-specific data	No dataset[53]							N
Enzymes	g (quantity in 100% active content)	0	Mandatory company-specific data	enzymes production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	c2ec381a-5480-45e3-a5e9-10e13152f2fd	2	1	1	1	Y
Fragrances	g (quantity in 100% active content)	0	Mandatory company-specific data	Mix of - 1/4 dihydromyrcenol production technology mix production mix, at plant 100% active substance GLO, - 1/4 hexylcinnamic aldehyde production technology mix production mix, at plant 100% active substance GLO, - 1/4 hexyl salicylate production technology mix production mix, at plant 100% active substance GLO, and - 1/4 beta-pinene production technology mix production mix, at plant 100% active substance GLO	http://ecoinvent.lca-data.com/	6795d81d-d681-453d-b9f6-110b81c02416 and 0f919310-c8a9-4705-a594-2f5a6a243283 and 94fa2391-9feb-485a-bbf3-bb0340e9bd59 and bcbdb7df-1766-483a-94a3-4a92090f25e5	2 2 2 2	1 1 1 1	2 2 2 2	2 2 2 2	N

[53] There is no default dataset for this ingredient and no proxy such as “average organic chemical" production dataset (for dye and other chemicals) in the free database nodes proposed by the European Commission (see section V.6 for list of free nodes and datasets selection procedure).

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
Optical Brighteners	g (quantity in 100% active content)	0	Mandatory company-specific data	Mix of - ½ Optical brightener, distyrylbiphenyl production technology mix production mix, at plant 100% active substanceGLO and - ½ Optical brightener, triazinylaminostilben production technology mix production mix, at plant 100% active substanceGLO	http://ecoinvent.lca-data.com/	c42c8575-1f87-4bf4-951c-1c891272815a and 235d5d5c-e2f3-47a2-abd8-2dff8dde752a	2 2	1 1	2 2	2 2	N
Surfactants (anionic) Sodium alkyl ether sulphates (SLES)	g (quantity in 100% active content)	0	Mandatory company-specific data	Mix of - Alcohol ether sulphate (oleo based) production technology mix production mix, at plant 100% active substance RER and Alcohol ether sulphate (petro based) production; technology mix; production mix, at plant; 100% active substance	http://ecoinvent.lca-data.com/	f15a2afd-48d1-464d-b453-94719379d9cf and 8673cb0f-fd66-4a63-9004-74d367130b79	2 2	1 1	1 1	2 2	Y
Surfactants (anionic) alkylbenzene sulfonate (LAS)	g (quantity in 100% active content)	0	Mandatory company-specific data	Alkylbenzene sulfonate production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	85920571-c596-4cb7-b220-2cc9e5b45203	2	1	2	2	Y

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
Surfactants (soap)	g (quantity in 100% active content)	0	Mandatory company-specific data	Soap production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	ab044617-c138-48a3-8d5a-7c310550aeb5	2	1	2	2	N
Surfactants (non-ionic) ethoxylates (oleo) and (petro)	g (quantity in 100% active content)	0	Mandatory company-specific data	Mix of: Alcohol Ethoxylate (oleo) production, 3 moles EO technology mix production mix, at plant 100% active substanceRER and Alcohol Ethoxylate (oleo) production, 7 moles EO technology mix production mix, at plant 100% active substanceRER and AlcoholEthoxylate (oleo), >20 moles EO production technology mix production mix, at plant 100% active substance RER and AlcoholEthoxylate (petro) production, 3 moles EO technology mix production mix, at plant 100% active substance RER and AlcoholEthoxylate (petro) production, 7 moles EO technology mix	http://ecoinvent.lca-data.com/	1b217e35-36c6-43fc-88e1-5e830cfc6285 and 1df0a3a5-0357-47d1-8bee-16aadabcf778 and c6c623f1-bcda-47d9-be0a-a7fa59a40943 and fe089fe5-6cf4-456f-a514-2f02e604837e and 958f23fe-d0f3-44d4-98c5-bc3748620ee6	2 2 2 2 2	1 1 1 1 1	1 1 2 1 1	2 2 2 2 2	Y

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
				production mix, at plant 100% active substance RER							
Alkalinity sources – Sodium hydroxide	g (quantity in 100% active content)	0	Mandatory company-specific data	Sodium hydroxide production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	2ba49ead-4683-4671-bded-d52b80215e9e	2	1	1	2	Y
Alkalinity sources - Triethanolamine	g (quantity in 100% active content)	0	Mandatory company-specific data	Triethanolamine production technology mix production mix, at plant 100% active substance GLO	http://ecoinvent.lca-data.com/	3161598d-fa4c-438b-9f93-0907b1dee282	2	1	2	2	N
Solvents - glycerin	g (quantity in 100% active content)	0	Mandatory company-specific data	Mix of: Glycerine, from vegetable oil production technology mix production mix, at plant 100% active substance GLO and Glycerine, from rape oil production technology mix production mix, at plant 100% active substance GLO and Glycerine, from palm oil production technology mix production mix, at plant 100% active substance GLO and Glycerine, from soybean oil production technology mix production	http://ecoinvent.lca-data.com/	4c1fa863-6c92-427c-973e-3bfda4264e87 and 7c90ba0d-5b40-436c-b68a-3562af3688eb and 076091d7-c752-4b73-9e80-45f4546f814e and 5f3f4ae1-5a9d-4be3-be70-0702687b8c59	2 2 2 2	1 1 1 1	2 2 2 2	2 2 2 2	N

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
				mix, at plant 100% active substance GLO							
Solvents – glycols and others	g (quantity in 100% active content)	0	Mandatory company-specific data	Propylene glycol production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	f08552b4-a251-42f5-921d-3b39b8f7ecd8	2	1	2	2	Y
Others-Preservative	g (quantity in 100% active content)	0	Mandatory company-specific data	Benzo[thia]diazole-compounds at plant per kg of active ingredientEU-28+3	http://ecoinvent.lca-data.com/	21034bcb-099c-4e50-bcc8-35dfcbf415eb	2	2	2	1	N
Others-Polymers	g (quantity in 100% active content)	0	Mandatory company-specific data	Polycarboxylate production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	dbdbd19e-38e7-47e7-8894-f6c51ee1a90c	2	1	1	2	Y
Others-Salts	g (quantity in 100% active content)	0	Mandatory company-specific data	Sodium chloride powder production technology mix production mix, at plant 100% active substance RER	http://ecoinvent.lca-data.com/	bd92e590-afa8-430c-8089-6491c32163fb	2	1	2	2	N
Others-others	g (quantity in 100% active content)	0	Mandatory company-specific data	no default dataset available. See footnote 53							N

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
Hydrosoluble film for unit dose capsule	g (quantity in 100% active content)	0	Mandatory company-specific data	no default dataset available. See footnote 53							N

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

VI.1.2. **Transport of ingredient to HDLLD manufacturing plant**

The following table provides default distance and datasets for transport of ingredients to the HDLLD manufacturing plant(s).

Table VI-3: Transport of Ingredients (Bill of ingredients as bought from the suppliers)

Process name*	Unit of measurement (output)	Default (per FU)	Default (per FU)			Default dataset	Dataset source	UUID	Default DQR				Most relevant [Y/N]
		Quantity transported	Distance	Utilisation ratio*	Empty return				P	TiR	GR	TeR	
Any ingredient of the bill of ingredients – road transport	g (quantity as bought from the suppliers- eg. aqueous solution)	Mandatory company-specific data	1000 km by truck	64%	included in the utilisation rate	Articulated lorry transport, Euro 4, Total weight 28-32 t (without fuel); diesel driven, Euro 4, cargo; consumption mix, to consumer; 28 - 32t gross weight / 22t payload capacity	http://lcdn.thinkstep.com/Node/	730c76f7-9ba2-4336-be98-f44458dab695	2	1	1	1	N

Process name*	Unit of measurement (output)	Default (per FU)	Default (per FU)			Default dataset	Dataset source	UUID	Default DQR				Most relevant [Y/N]
		Quantity transported	Distance	Utilisation ratio*	Empty return				P	TiR	GR	TeR	
						with Diesel at refinery; from crude oil; production mix, at refinery; 10 ppm sulphur		With 66a4e262-23ce-4140-9112-0a654a00b86d					
Any ingredient of the bill of ingredients – sea transport	g (quantity as bought from the suppliers- eg. aqueous solution)	Mandatory company-specific data	18000 km by boat (container ship).	-	-	Transoceanic ship, containers heavy fuel oil driven, cargo consumption mix, to consumer 27.500 dwt payload capacity, ocean going GLO	http://lcdn.thinkstep.com/Node/	6ca61112-1d5b-473c-abfa-4accc66a8a63	2	1	2	1	Y

*The applicant of this PEFCR shall always check the utilisation ratio applied in the default dataset and adapt it accordingly.

VI.1.3. **Packaging raw material sourcing and manufacturing**

The three levels of packaging shall be considered: primary, secondary and tertiary packaging.[54]

The packaging sourcing and manufacturing step shall be considered for each packaging material individually. Also, it shall include mining and extraction of resources, processing of packaging and transportation between extraction and packaging manufacturing site.

VI.1.3.1. Primary packaging

The table below gives the detail of all mandatory company specific quantities of raw materials to be provided by the applicant and the default datasets (and mix of datasets) used to model the primary packaging of the representative product. The applicant shall use datasets in compliance with section V.6 to model each part of the primary packaging of the detergent under study according to the kind of plastics and other material used.

In case no better dataset in compliance with section V.6 can be used to model a part of the primary packaging of the detergent under study, the default dataset or mix of datasets proposed in this table shall be used.

[54] See definitions of each packaging level (primary, secondary and tertiary) at the beginning of the PEFCR report

Table VI-4: Raw material acquisition and processing for primary packaging

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		*P*	*TiR*	*GR*	*TeR*	
Label - Kraft paper	g /dose	Company-specific or 0 by default	Company-specific data or 0 by default	Label, paper Kraft pulping process, label production mix, at plant thickness: 77 µm, grammage: 90 g/m2EU-28+EFTA	http://lcdn.thinkstep.com/Node/	7db01ade-8476-4c20-9c0b-7faff30d9f9f	2	2	2	2	N
HDPE for packaging - bottle	g/dose	Company-specific data or 0 by default	Mandatory company-specific data	HDPE granulates Polymerisation of ethylene production mix, at plant 0.91- 0.96 g/cm3, 28 g/mol per repeating unit EU-28+EFTA and Injection moulding plastic injection moulding production mix, at plant for PP, HDPE and PEEU-28+EFTA and Stretch blow moulding stretch blow moulding production mix, at plant 3% loss, 5MJ electricity consumptionEU-28+EFTA	http://lcdn.thinkstep.com/Node/	3aefe5b-33c9-4f0c-87ec-d0291445cc61 and ec9ca75e-abdb-4d2e-9e18-ca1f5709a76d and 6d55b9c3-ac73-424a-8a68-b76cf0e162d3	2 2 2	1 3 3	1 3 2	1 2 2	Y
PP for packaging Screw cap	g/dose	Company-specific data or 0 by default	Mandatory company-specific data	Screw cap, PP raw material production, plastic injection moulding production mix, at plant 0.91 g/cm3, 42.08 g/mol per repeating unitEU-28+EFTA	http://lcdn.thinkstep.com/Node/	05a26a08-1ab5-4523-b25f-41b9be0ffc76	2	2	2	2	Y

The number of doses in a bottle of detergent shall be a company-specific data.

The use of refillable/reusable primary packaging is not common practice in Europe and consequently no general description of the activity nor default data on reuse rates are available at this stage. In case of refillable/reusable primary packaging use, the applicant shall:

- describe the refilling system in detail,

- calculate the reuse rate using one of the approaches described below,
- calculate the net raw material consumption of reusable packaging by dividing the actual weight of the packaging by the reuse rate,
- account for any additional energy and resource used for cleaning, repairing or refilling.

Reuse rate calculation
For company owned packaging pools the reuse rate shall be calculated using supply-chain-specific data. Depending on the data available within the company, two different calculation approaches – option a and b - may be used. Returnable glass bottles are used as example, but the calculations also apply for other company owned reusable packaging.

Option a: The use of supply-chain-specific data, based on accumulated experience over the lifetime of the previous glass bottle pool. This is the most accurate way to calculate the reuse rate of bottles for the previous bottle pool and can be a proper estimate for the current bottle pool. The following supply-chain-specific data is collected:

- Number of bottles filled during the lifetime of the bottle pool (#Fi)
- Number of bottles at initial stock plus purchased over the lifetime of the bottle pool (#B)

$$\textbf{Reuse rate of the bottle pool} = \frac{\#\textbf{Fi}}{\#\textbf{B}}$$

Equation VI-1

$$\textbf{The net glass use (kg glass per l beverage)} = \frac{\#\textbf{B} * (\textbf{kg glass per bottle})}{\#\textbf{Fi}}$$

Equation VI-2

This calculation option shall be used:

- With data of the previous bottle pool when the previous and current bottle pool are comparable. Meaning, the same product category, similar bottle characteristics (e.g., size), comparable return systems (e.g., way of collection, same consumer group and outlet channels), etc.
- With data of the current bottle pool when future estimations/extrapolations are available on (i) the bottle purchases, (ii) the volumes sold, and (iii) the lifetime of the bottle pool.

The data shall be supply-chain-specific and shall be verified by an external verification, including the reasoning of this method choice.

Option b: When no real data is tracked the calculation shall be done partly based on assumptions. This option is less accurate due to the assumptions made and therefore conservative/safe estimates shall be used. The following data is needed:

- Average number of rotations of a single bottle, during one calendar year (if not broken). One loop consists of filling, delivery, use, back to brewer for washing (#Rot)
- Estimated lifetime of the bottle pool (LT, in years)
- Average percentage of loss per rotation. This refers to the sum of losses at consumer and the bottles scrapped at filling sites (%Los)

$$\textbf{Reuse rate of the bottle pool} = \frac{\textbf{LT}}{(\textbf{LT} * \%\textbf{Los}) + (\frac{\mathbf{1}}{\#\boldsymbol{Rot}})}$$

Equation VI-3

This calculation option shall be used when option a) is not applicable (e.g., the previous pool is not usable as reference). The data used shall be verified by an external verification, including the reasoning of this method choice.

VI.1.3.2. Secondary packaging

The table below gives the detail of the mandatory company-specific quantities of raw materials to be provided by the applicant and the default datasets (and mix of datasets) used to model the secondary packaging of the representative product. The applicant shall use datasets in compliance with section V.6 to model each part of the secondary packaging of the detergent under study according to the material used.

In case no better dataset in compliance with section V.6 can be used to model a part of the secondary packaging of the detergent under study, the default dataset or mix of datasets proposed in this table shall be used.

Table VI-5: Raw material acquisition and processing for secondary packaging

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
Cardboard box-corrugated board	g/dose	Company-specific data or	Mandatory company-specific data	Corrugated box, uncoated Kraft Pulping Process, pulp pressing and drying production mix, at plant 280 g/m2EU-28+EFTA	http://lcdn.thinkstep.com/Node/	95051bb3-46cc-40c1-8b6d-6d58ac334bb9	2	1	1	1	Y

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
		0.88 by default									
LDPE plastic film	g/dose	Company-specific data or 0 by default	Mandatory company-specific data	Plastic Film, PE raw material production, plastic extrusion production mix, at plant grammage: 0.0943 kg/m2EU-28+EFTA	http://lcdn.thinkstep.com/Node/	cc8ee5f1-84b3-4e04-bae3-6a531aafb606	2	2	2	2	N

VI.1.3.3. Tertiary packaging

Tertiary packaging has lower influence on the results and default data may be used.

The default secondary packaging considered for the Representative Product is a cardboard box of 600 g for 6 unit of sales (bottle of detergent), each box wrapped in 40 g of LDPE film (100 g of cardboard and 6.66 g of LDPE film per sale unit).

Concerning the default tertiary packaging, the cardboard boxes are considered to be transported by group of 32 (i.e. 192 unit of sales[55]) on wood pallet of 25 kg each (0.13 kg/unit of sales). The reuse rate of the wood pallet is considered to be 25.

The boxes are separated by cardboard intercalary of 400g each (3 per pallet) (i.e. 6.25 g/ sales product unit). Each pallet is wrapped up with 235 g of LDPE plastic film/pallet (1.22 g/unit of sales).

Therefore, the default data and dataset to be considered by the applicant are the following:

[55] In this assumption, the unit of sales is a plastic bottle.

Table VI-6: Raw material acquisition and processing for tertiary packaging

Process name*	Unit of measurement (output)	Default				UUID	Default DQR				Most relevant process [Y/N]
		R_1	Amount per FU	Dataset	Dataset source		P	TiR	GR	TeR	
Cardboard intercalary	g/dose	0.88	6.25/# of doses per unit of sales	Carton box Kraft Pulping Process, pulp pressing and drying, box manufacturing production mix, at plant 280 g/m2EU-28+EFTA	http://lcdn.thinkstep.com/Node/	6cd700a3-0065-44ac-ac7c-a10266d36c67	2	2	2	2	N
Wood pallet	g/dose	0	130/25 times used/# of doses per unit of sales	Pallet, wood (80x120) sawing, piling, nailing single route, at plant 25 kg/piece, nominal loading capacity of 1000kgEU-28+EFTA	http://lcdn.thinkstep.com/Node/	3203d6d8-2760-4b7b-b1c6-f82681e9e2f	2	2	2	2	N
LDPE plastic film Tertiary packaging	g/dose	0	1.22/# of doses per sale unit	Plastic Film, PE raw material production, plastic extrusion production mix, at plant grammage: 0.0943 kg/m2EU-28+EFTA	http://lcdn.thinkstep.com/Node/	cc8ee5f1-84b3-4e04-bae3-6a531aafb606	2	2	2	2	N

VI.1.3.4. Modelling the recycled content

The following formula is used to model the recycled content:

$$(1 - R_1)E_V + R_1 \times \left(AE_{recycled} + (1 - A)E_V \times \frac{Q_{Sin}}{Q_p} \right)$$

The R_1 values applied shall be supply-chain or default as provided in the table above, in relation with the DNM. Material-specific values based on supply market statistics are not accepted as a proxy. The applied R_1 values shall be subject to PEF study verification.

When using supply-chain specific R_1 values other than 0, traceability throughout the supply chain is necessary. The following general guidelines shall be followed when using supply-chain specific R_1 values:

- The supplier information (through e.g., statement of conformity or delivery note) shall be maintained during all stages of production and delivery at the converter;
- Once the material is delivered to the converter for production of the end products, the converter shall handle information through their regular administrative procedures;
- The converter for production of the end products claiming recycled content shall demonstrate through his management system the [%] of recycled input material into the respective end product(s).
- The latter demonstration shall be transferred upon request to the user of the end product. In case a PEF profile is calculated and reported, this shall be stated as additional technical information of the PEF profile.
- Company-owned traceability systems can be applied as long as they cover the general guidelines outlined above.

The following default parameters shall be applied:

Table VI-7: parameters for the circular footprint formula for recycled content

	Primary packaging	Secondary packaging	Tertiary packaging
A	A=0.5 for plastics and 0.2 for cardboard and 0.8 for wood pallet (in accordance with annex C of PEFCR guidance v6.3)		
$E_{recycled}$	No default datasets [56]		
Qsint and Qsout/Qp	Qsin/Qp and Qsout/Qp shall be considered as 0.9 for plastics (PET, PP and HDPE) as 0.75 for LDPE film and 1 for cardboard		

[56] For cardboard box as secondary packaging, $E_{recycled}$ included in E_v (corrugated box). For other materials considered for HDLLD packaging, no default data is available in the EF-compliant database as provided by the EC.

VI.1.4. **Transport of packaging to HDLLD manufacturing plant**

The following table provides default distance for packaging suppliers inside or outside Europe[57] and datasets for transport of packaging to the HDLLD manufacturing plant(s).

Table VI-8: Transport of Packaging to the HDLLD manufacturing plant

Process name*	Unit of measurement (output)	Default (per FU)			Default dataset	Dataset source	UUID	Default DQR				Most relevant [Y/N]
		Distance	Utilisation ratio	Empty return				P	TiR	GR	TeR	
For suppliers outside Europe												
Any packaging– road transport	g	1000 km by truck	64%	included in the utilisation rate	Articulated lorry transport, Euro 4, Total weight 28-32 t (without fuel); diesel driven, Euro 4, cargo; consumption mix, to consumer; 28 - 32t gross weight / 22t payload capacity with Diesel at refinery; from crude oil; production mix, at refinery; 10 ppm sulphur	http://lcdn.thinkstep.com/Node/	730c76f7-9ba2-4336-be98-f44458dab695 With 66a4e262-23ce-4140-9112-0a654a00b86d	2	1	1	1	N
Any packaging – sea transport	g	18000 km by boat (container ship).	-	-	Transoceanic ship, containers heavy fuel oil driven, cargo consumption mix, to consumer 27.500 dwt payload capacity, ocean going GLO	http://lcdn.thinkstep.com/Node/	6ca61112-1d5b-473c-abfa-4accc66a8a63	2	1	1	2	Y

[57] For the Representative Product it was assumed that packaging suppliers would be located outside Europe.

Process name*	Unit of measurement (output)	Default (per FU)			Default dataset	Dataset source	UUID	Default DQR				Most relevant [Y/N]
		Distance	Utilisation ratio	Empty return				P	TiR	GR	TeR	
For suppliers inside Europe												
Any packaging–road transport	g	230 km by truck	64%	included in the utilisation rate	Articulated lorry transport, Euro 4, Total weight 28-32 t (without fuel); diesel driven, Euro 4, cargo; consumption mix, to consumer; 28 - 32t gross weight / 22t payload capacity with Diesel at refinery; from crude oil; production mix, at refinery; 10 ppm sulphur	http://lcdn.thinkstep.com/Node/	730c76f7-9ba2-4336-be98-f44458dab695 With 66a4e262-23ce-4140-9112-0a654a00b86d	2	1	1	1	N
Any packaging–rail transport	g	280 km by train			Freight train, average (without fuel); technology mix, electricity and diesel driven, cargo; consumption mix, to consumer; average train, gross tonne weight 1000t / 726t payload capacity	http://lcdn.thinkstep.com/Node/	02e87631-6d70-48ce-affd-1975dc36f5be	2	1	1	1	N
Any packaging–river transport	g	360 km			Barge; technology mix, diesel driven, cargo; consumption mix, to consumer; 1500 t payload capacity	http://lcdn.thinkstep.com/Node/	4cfacea0-cce4-4b4d-bd2b-223c8d4c90ae	2	1	1	1	N

VI.2. Agricultural modelling

Some ingredients such as surfactants or some packaging raw material can be agro/forestry-based. For such ingredients or raw materials, the agricultural and forestry steps are covered by default datasets.

However, in case the applicant wants to apply a specific EF-compliant dataset, the requirements of PEFCR guidance v6.3 section 7.10 have to be followed.

VI.3. Manufacturing

The manufacturing process consists mainly in mixing of chemical ingredients. Thus, this stage shall consider the energy (electricity and heat) and water consumption necessary for the HDLLD manufacturing process.

As indicated in section IV.2, default data are defined in this PEFCR in case the applicant have difficulties to evaluate such consumptions:

- **Energy consumption** (electricity, heat from grid, others): Due to several product types manufactured on site, the energy consumption for the liquid detergent under study may require allocation. In case such allocation is difficult, a default approach shall be applied, considering an electricity consumption of 0.16 kWh[58] for the total energy consumption / kg of detergent (leaving the factory). No heat consumption is considered by default.
- **Water use** (excluding water in the detergent): For the same above mentioned reason, a default water consumption of 0.6[59] litres/kg of detergent (leaving the factory) shall be considered.

In addition, any emissions and discharge are under the cut-off criteria and therefore shall be excluded.

The capital goods (including infrastructures) shall be taken into account. The assumptions considered are representative of an average HDLLD manufacturing site. These shall be considered by default by the applicant:

- Production & storage: 5 000 m² building hall for medium or big plants (7 m high), life-time 50 years
- Administration: 100 x 10 x 3 = 3 000 m³ building, multi storey, life-time 50 years
- Equipment – machinery: 6 000 t facilities, Equipment life-time 20 years
- For a chemical production 60 000 t/year, based on data collection from companies (re A.I.S.E. Activity and Sustainability Report 2016/2017, p 9 - Charter KPI reporting data)

As for modelling electricity, the applicant shall follow the requirements of section V.9. The table below provides the default datasets to be used.

[58] Franke et al, 1995. Oekobilanzierung – Sachbilanz für die Waschmittel-Konfektionierung. Tenside surfactant and Detergent 32: 508-5.

[59] These data do not take into account incorporation of water in the detergent product. Source: Estimation based on KPI performance named "consumed water" as published in the A.I.S.E. activity and sustainability report 2013-2014. Actually, the "consumed water" KPI corresponds to water use: 1.3 m³/t of production (covering A.I.S.E. complete product portfolio). Water consumption at HDLLD manufacture = 1.3 [l/kg] - average quantity of water in HDLLD [l/kg] = 1.3 -0.7022 ≈ 0.6 [l/kg]

Table VI-9: Manufacturing

Name of the process*	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	Ti_R	G_R	Te_R	
Electricity consumption	kWh/ dose of detergent produced	company-specific data or (0.16*weight in kg of one dose) by default	Residual grid mix; AC, technology mix; consumption mix, to consumer; 1kV - 60kV	http://lcdn.thinkstep.com/Node/	8fb75312-431d-42f6-9a4f-22fa886f7fe3	2	1	1	1	Y
Heat consumption	KWh/ dose of detergent produced	company-specific data or 0 by default	No proxy (the applicant shall provide its own dataset in compliance with chapter V.6)	http://lcdn.thinkstep.com/Node/						N
Water	Litre/ dose of detergent produced	company specific data or (0.6 *weight in kg of one dose) by default	Tap water technology mix at user per kg water	http://lcdn.thinkstep.com/Node/	212b8494-a769-4c2e-8d82-9a6ef61baad7	2	2.4	2	2	N
Capital goods – production and storage building	m^3 of building / dose of detergent produced	1.17E-05m^3 *weight in kg of one dose	Building, reinforced concrete frame construction (1 m^3 gross volume = 242 kg)	http://lcdn.thinkstep.com/Node/	36a74991-0d96-46b5-b75b-3a96dcfc5a03	2	1	2	2	N
Capital goods – administration building	m^3 of building / dose of detergent produced	1E-06m^3*weight in kg of one dose	Building, administration type (1 m^3 gross volume = 432 kg)	http://lcdn.thinkstep.com/Node/	d7cfc448-6eca-418a-8c14-7b496e375e3f	2	1	2	2	N
Capital goods – equipment	Kg of equipment / dose of detergent produced	5E-03kg*weight in kg of one dose	Steel electrogalvanized coil	http://lcdn.thinkstep.com/Node/	50209559-8f2d-4287-b81a-74ab900edc54	2	3	2	2	N

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

As indicated in chapter III.4, the waste production at the manufacturing site can be excluded because they are under the cut-off threshold.

VI.4. Distribution stage

The transport from factory to final client (including consumer transport) shall be modelled within this life cycle stage. The final client is defined as the consumer who washes his/her fabrics.

In case supply-chain-specific information is available for one or several transport parameters, they may be applied following the Data Needs Matrix.

Therefore, this life cycle stage includes two sub-stages:

- The transport and distribution to retail
- The transport and distribution to consumer home

The default scenario is that 100% of HDLLD are transported to retail center (with default modelling proposed by the PEFCR guidance v6.3). Then the default transport scenario from retail to final consumer is considered (62% by car -5 km, 5% by van -5km and 33% by other transport such as public transport, bicycle and by foot which are not modelled). The following table lists all processes taking place in this default scenario.

Table VI-10: Distribution

Process name*	Unit of measurement (output)	Default (per FU)			Default dataset	Dataset source	UUID	Default DQR				Most relevant [Y/N]
		Distance	Utilisation ratio	Empty return				P	Ti_R	G_R	Te_R	
Transport from factory to retail	g (dose	1200	64%	-	Articulated lorry transport, Euro 4,	http://lcdn.thinkstep.com/Node/	730c76f7-9ba2-4336-be98-f44458dab695	2	1	1	1	N

Process name*	Unit of measurement (output)	Default (per FU)			Default dataset	Dataset source	UUID	Default DQR				Most relevant [Y/N]
		Distance	Utilisation ratio	Empty return				P	Ti_R	G_R	Te_R	
	+3 packaging level)				Total weight 28-32 t (without fuel); with Diesel at refinery; from crude oil; production mix, at refinery; 10 ppm Sulphur		With 66a4e262-23ce-4140-9112-0a654a00b86d (default DQR not evaluated)	- 3	- 2	- 3	- 3	

Table VI-11: Distribution – storage in retail space

*Name of the process**	*Unit of measurement (output)*	*Default amount per FU*	*Default dataset to be used*	*Dataset source*	*UUID*	*Default DQR*				*Most relevant process [Y/N]*
						P	*Ti_R*	*G_R*	*Te_R*	
Capital goods – retail space building	m^3 of building / dose of detergent stored in retail	4.31E-02[60] * volume stored[61] in m^3 of detergent unit sale/# of doses	Building, reinforced concrete frame construction (1 m³ gross volume = 242 kg)	http://lcdn.thinkstep.com/Node/	36a74991-0d96-46b5-b75b-3a96dcfc5a03	2	1	2	2	N

[60] Retail space infrastructure: 2000 m^2 (7 meters high by assumption) of building (50-year life time) storing 104000 m^3-weeks/year. The product is supposed to be stored on 4 times its volume for 4 weeks. Calculation is 2000m^2*7m/50years/104000m^3-weeks/year*4weeks*4*stored volume of detergent/# of doses per sales unit (bottle).

[61] The stored volume of a detergent unit sale is a company-specific data (see definition in section V.1.2)

Name of the process*	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	Ti_R	G_R	Te_R	
Capital goods – parking	Kg of bitumen / dose of detergent stored in retail	1.23E-02[62] *volume stored in m^3 of detergent unit sale/# of doses	Bitumen at refinery from crude oil production mix, at refinery 38.7 MJ/kg net calorific valueEU-28+3	http://lcdn.thinkstep.com/Node/	09d54c40-dd77-46cf-b9bd-e196a40402d1	2	1	1	1	N
Water consumption	m^3/ dose of detergent stored in retail	0.56[63] *volume stored in m^3 of detergent unit sale/# of doses	Tap water technology mix at user per kg waterEU-28+3	http://lcdn.thinkstep.com/Node/	212b8494-a769-4c2e-8d82-9a6ef61baad7	2	2.4	2	2	N
Electricity consumption	KWh / dose of detergent stored in retail	92[64]*volume stored in m^3 of detergent unit sale/# of doses	Electricity grid mix 1kV-60kV AC, technology mix consumption mix, at consumer 1kV - 60kVEU-28+3	http://lcdn.thinkstep.com/Node/	34960d4d-af62-43a0-aa76-adc5fcf57246	2	1	1	1	Y
Repacking	g/ dose of detergent stored in retail	0.47g[65]/weight in kg of one dose	Plastic Film, PE raw material production, plastic extrusion production mix, at plant grammage: 0.0943 kg/m2EU-28+EFTA	http://lcdn.thinkstep.com/Node/	cc8ee5f1-84b3-4e04-bae3-6a531aafb606	2	2	2	2	N

The applicant shall report the DQR values (for each criterion + total) for all the datasets used

The waste of packaging (secondary and tertiary) during the distribution and retail are included in the End-of-Life stage (section VI.6.2).

[62] Retail space parking: 4000 m2 of parking (with 1kg of bitumen/m2) related to the retail storage. Calculation is 4000m2*1kg/50years/104000m^3-weeks/year*4weeks*4*stored volume of detergent/# of doses per sales unit (bottle).

[63] Water consumption: 3650 m^3/year. Calculation 3650/104000m^3-weeks/year*4weeks*4*stored volume of detergent/# of doses per sales unit (bottle).

[64] Electricity consumption: 300 kWh/m^2.year for average building. Calculation: 300 kWh/m2.year *2000m^2 /104000m^3-weeks/year*4weeks*4*stored volume of detergent/# of doses per sales unit (bottle).

[65] Default assumption for repacking: 0,47 g of LDPE film/kg of product

There is no loss of detergent product at the distribution and retail stage that shall be considered.[66]

The following table give the modelling for the Transport from retail to consumer's home. The allocation shall be the volume of the packaging of the unit of sales (one bottle)/# of dose/0,2 m^3 [67].

Table VI-12: Distribution from retail to consumer's home (consumer transport)

Process name*	Unit of measurement (output)	Default (per FU)			Default dataset	Dataset source	UUID	Default DQR				Most relevant [Y/N]
		Distance	Utilisation ratio	Empty return				P	Ti_R	G_R	Te_R	
Transport from retail to final consumer - 62% by car	vkm	5 km (passenger car)			Passenger car, average technology mix, gasoline and diesel driven, Euro 3-5, passenger car consumption mix, to consumer engine size from 1,4l up to >2l	http://lcdn.thinkstep.com/Node/	1ead35dd-fc71-4b0c-9410-7e39da95c7dc	3	1	3	3	N
Transport from retail to final consumer - 5% by van	vkm	5 km (van)	20% (for the van)		Articulated lorry transport, Euro 3, Total weight <7.5 t (without fuel) diesel driven, Euro 3 With Diesel at refinery; from crude oil; production mix, at refinery; 10 ppm Sulphur	http://lcdn.thinkstep.com/Node/	aea613ae-573b-443a-aba2-6a69900ca2ff With 66a4e262-23ce-4140-9112-0a654a00b86d	2	1	1	1	N

[66] According to industry experts, the loss of detergent at these stages is non-significant (<1%) – otherwise, those would have been addressed already for economic reasons. Therefore, no loss shall be considered.

[67] around 1/3 of a trunk of 0.6 m^3

Process name*	Unit of measurement (output)	Default (per FU)			Default dataset	Dataset source	UUID	Default DQR				Most relevant [Y/N]
		Distance	Utilisation ratio	Empty return				P	Ti_R	G_R	Te_R	
							(default DQR not evaluated)					
Transport from retail to final consumer:33% not modelled (public transport, bicycle, etc.)					No modelling							N

VI.5. Use stage

The use stage starts at the moment when the end user uses the product, until it enters the end-of-life cycle stage, including the necessary transports.

The product use stage is defined by the following data:

- Specific dosage recommended to the consumer (in ml)
- Wash temperature
- Water consumption

The Wash electricity consumption based on the A.I.S.E. laundry Energy model 2014 is presented below.

A.I.S.E. Laundry energy model 2014

The A.I.S.E. Laundry Energy model 2014 is a generic model connecting wash temperature (in range of ~15-90 degrees C) with the total energy used in an automatic laundry wash 'standard' cycle:

*Electricity consumption (kWh) = b[0] +b[1] * washing temperature (°C)*
where
b[0] = -0,1342
b[1] = 0,0193

The A.I.S.E. laundry energy model 2014 was developed in the context of the A.I.S.E. Pilot Project and details are available on request to A.I.S.E.

Based on variations in consumer habits and in washing machine technology, the following parameters at the use stage may vary and may entail a significant change on total results.

- Product dosing
- Wash temperature
- Water used by the machine

The water-demand for one wash cycle is 50 litres.

The use scenarios (compulsory and optional) are described in Table III-6.

Table VI-13: Use stage

Name of the process*	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	TiR	GR	TeR	
Electricity consumption	kWh/washing	-0,1342 + temperature* 0,0193 (with default temperature for compulsory scenario:40° C and specific	Electricity grid mix 1kV-60kV AC, technology mix consumption mix, at consumer 1kV - 60kVEU-28+3	http://lcdn.thinkstep.com/Node/	34960d4d-af62-43a0-aa76-adc5fcf57246	2	1	1	1	Y

Name of the process*	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	TiR	GR	TeR	
		temperature if different for optional scenarios)								
Water consumption	Litre/washing	50 (for all scenarios)	Tap water technology mix at user per kg water	http://lcdn.thinkstep.com/Node/	212b8494-a769-4c2e-8d82-9a6ef61bad7	2	2.4	2	2	Y

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

For the use stage the consumption grid mix shall be used. The electricity mix shall reflect the ratios of sales between EU countries/regions. To determine the ratio a physical unit shall be used (e.g. number of sales unit or kg of detergent). Where such data are not available, the average EU consumption mix (EU-28 +EFTA), or region representative consumption mix, shall be used.

The waste of products (detergent and packaging) during the use stage is included in the End of Life stage (see section VI.6). The PEFCR considers that 100% of a dose is used for a wash and that 99% of the detergent in the bottle is used. This loss rate is below the 1% cut off criteria and shall not be considered in the reference flow.

VI.6. End of life

The End-of-Life stage is a life cycle stage that in general includes the waste of the product in scope, such as the food waste, primary packaging, or the product left at its end of use.

Here, the end-of-life stage has two sub-stages:

- the wastewater treatment (the HDLLD end-of-life),
- the municipal solid waste management (packaging end-of-life).

VI.6.1. Wastewater treatment

The used detergent is discharged to the sewerage system, which is connected (or not) to a municipal wastewater treatment plant (WWTP).

Table VI-14: End of Life- wastewater treatment

Name of the process*	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	Ti_R	G_R	Te_R	
Wastewater treatment	litre	50 litres* 91,6%[68]	Treatment of detergent wastewater, large plant, 9.2% contribution total organic load, waste water treatment including sludge treatment, EU28+EFTA*	http://lcdn.thinkstep.com/Node/	3b023f1c-6324-4597-90da-954a26e58e9b	2	2	2	2	Y

*Large plant datasets should be manually corrected to be aligned with the assumption in term of geographical distribution of water flows in water consumption dataset at Use Stage. See annex X.5 for further instructions.[69]

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

In order to calculate the toxicology impact indicators, the applicant shall consider each ingredient in proportion of active substances in the reacted formulation, the percentage of removal rate in WWT as obtained following the guidance below as well as the percentage of household connected to a WWTP (91.6% in average in the EU, footnote 67).

Guidance to obtain WWTP removal numbers

The numbers (in % removal) shall be obtained by means of one of the following methods, in decreasing order of preference:

1. Obtain removal numbers from publications in the scientific literature based on monitoring data in real WWTPs. For a large number of detergent ingredients measured removal numbers can be found in the ingredient dossiers on www.heraproject.com. The monitoring data selected should be sufficiently robust and be broadly representative for the geographic region of interest and its wastewater technology.
2. Use the removal numbers for detergent ingredients represented in the EU DID list. These values can be seen as averages.
3. Use removal numbers from an OECD 303A laboratory test or similar.

[68] 91.6% of households are connected to Wastewater treatment plant in the EU. (Source: Eurostat (2009-2010 data), average performance of 18 member countries of the European Union + EFTA (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_ww_con&lang=en).
The remaining flow is considered to be released directly into the environment.

[69] This alignment procedure has been defined with the EC team in order to reduce the bias due to inhomogeneous assumptions within the PEF databases. Such approach, detailed in annex X.5, neglects the indirect impacts due to the production of tap water as well as the use of consumables at the Wastewater treatment stage. However, these indirect impacts are considered as not significant.

4. Model the % removal with the SimpleTreat model based on the following input parameters: logP (or Kd value), and degradation rate estimated based on the results of a ready biodegradability tests (OECD 301). See also REACH TDG Chapter R.16 for further guidance.

Table VI-15: Removal rate for ingredient family and specific ingredients used for detergent (A.I.S.E. HDLLD reference product)

Name	CAS number	Removal rate in WWTP (%)	Source of removal rate
Builders / Salts of citric acid and other salts	68-04-2	93%	[1]
Sequestrants / HEDP, /tetra Na salt (Phosphonates)	3794-83-0	60%	[1]
Dye / pigment yellow 1	2512-29-0	60%	[1]
Enzyme / amylase	9000-92-4	87%	[1]
Fragrances / dihydromyrcenol	18479-58-8 / 2436-90-0	99.9%	[5]
Fragrances / hexylcinnamic aldehyde	101-86-0	99.8%	[2]
Fragrances / hexyl salicilate	6259-76-3	99.8%	[2]
Fragrances / beta-pinene	127-91-3	90%	[3]
Optical brighteners / biphenyl disulfonate (FWA5)	27344-41-8	60%	[1]
Optical brighteners / Sodium Polyaryl Sulfonate	16090-02-1		[1]
Surfactant / sodium alkyl ether sulfates (SLES)	68891-38-3	98%	[1]
Surfactant / alkylbenzene sulfonate (LAS)	68411-30-3	95%	[1]
Surfactant / C12 Fatty Acid Na salt (soap)	629-25-4	95%	[1]
Surfactant / Alcohols, C12-15, ethoxylated, C12-15EO11, C12-15EO7, C12-15EO7, C12-15EO7, C9-11EO5	68131-39-5	95%	[1]
Alkalinity sources / Triethanolamine	102-71-6	96%	[4]
Solvents / Glycerol	56-81-5	87%	[4]
Solvents / Propylen glycol	57-55-6		
Preservatives / 1.2-Benzisothiazol-3-one	2634-33-5	50%	[4]
Polymers	9010-92-8	60%	[4]

Sources for removal rates:

[1]: Comparative Life Cycle Assessment (LCA) of Ariel "Actif à froid" (2006), a laundry detergent that allows to wash at colder wash temperatures, with previous Ariel laundry detergents (1998, 2001), Procter&Gamble, April 2006.

[2]: Simonich, S.L., Federle, T.W., Eckhoff, W.S., Rottiers, A., Webb, S.,Sabaliunas, D., de Wolf, W., 2002. Removal of fragrance material during US and European wastewater treatment.

[3]: interim value (expert judgment based on ready biodegradation results and logP)

[4]: ESC tool

[5]: Klaschka, U.,& Carsten, P., von der Ohe, Bschorer, A., Krezmer, S., Sengl, M., Letzel, M., 2012. Occurrences and potential risks of 16 fragrances in five German sewage treatment plants and their receiving waters

VI.6.2. **Municipal Solid waste management**

The following table provides the modelling for the end of life of packaging.

Table VI-16: End of Life- Packaging

Name of the process *	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	Ti_R	G_R	Te_R	
HDPE bottle – End of Life	g/dose	see Table VI-4	$Erecycling EoL$: Recycling of polypropylene (PP) plastic	http://lcdn.thinkstep.com/Node/	47a967ec-a648-4ede-afb6-23a2289baef9	2	1	1	3	N
			$E*_V$: HDPE granulates Polymerisation of ethylene production mix, at plant 0.91- 0.96 g/cm3, 28 g/mol per repeating unitEU-28+EFTA		a3aefe5b-33c9-4f0c-87ec-d0291445cc61	2	1	1	1	N
			$EER-LHV \times XER, heat \times ESE, heat-LHV \times XER, elec \times ESE, elec$: Waste incineration of PE waste-to-energy plant with dry flue gas treatment, including transport and pre-treatment production mix, at consumer polyethylene wasteEU-28+EFTA (heat and electricity production are included)		0370baaf-8923-4e26-b3b8-abcebb89f974	2	1	1	2	N
			ED: Landfill of plastic waste landfill including leachate treatment and with transport without collection and pre-treatment production mix (region specific sites), at landfill site The carbon and water content are respectively of 62%C and 0% Water (in weight %)EU-28+EFTA		f2bea0f5-e4b7-4a2c-9f34-4eb32495cbc6	2	2	2	2	N

Name of the process *	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	Ti_R	G_R	Te_R	
PP screw cap- End of Life	g/dose	see Table VI-4	$E_{recyclingEoL}$: Recycling of polypropylene (PP) plastic	http://lcdn.thinkstep.com/Node/	47a967ec-a648-4ede-afb6-23a2289baef9	2	1	1	3	N
			E^*_v:Polypropylene (PP) fibers polypropylene production, spinning production mix, at plant 5% loss, 3.5 MJ electricity World w/o EU-28+EFTA		7e2fea51-351e-4170-a62f-8e3beef7f89d	2	2	3	3	N
			$E_{ER-LHV \times XER, heat \times ESE, heat-LHV \times XER, elec \times ESE, elec}$: Waste incineration of PP waste-to-energy plant with dry flue gas treatment, including transport and pre-treatment production mix, at consumer polypropylene wasteEU-28+EFTA (heat and electricity production are included)		7b75dda4-b006-4d8c-8949-e16c2e0dd5c0	1	2	1	2	N
			E_D: Landfill of plastic waste landfill including leachate treatment and with transport without collection and pre-treatment production mix (region specific sites), at landfill site The carbon and water content are respectively of 62%C and and 0% Water (in weight %)EU-28+EFTA		f2bea0f5-e4b7-4a2c-9f34-4eb32495cbc6	2	2	2	2	N
Cardboard box or intercalary– End of Life	g/dose	see Table VI-17	$E_{recyclingEoL}$: Mix (50/50) of Testliner (2015); technology mix, thermal energy sold/used externally; production mix, at plant; 1.09 kg waste paper input per kg Testliner	http://lcdn.thinkstep.com/Node/	a0c91472-4293-acf5-0ec97a514bfd	2	2	2	2	N
			E^*_v: Corrugated board, uncoated Kraft Pulping Process, pulp pressing and drying production mix, at plant flute thickness 0.8- 2.8 mmEU-28+EFTA		574bdb1e-2ed3-46f1-bd14-bb76f739bb71	2	1	1	1	N
			$E_{ER-LHV \times XER, heat \times ESE, heat-LHV \times XER, elec \times ESE, elec}$: Waste incineration of paper and board waste-to-energy plant with dry flue gas treatment, including transport and pre-treatment production mix, at consumer paper wasteEU-28+EFTA (heat and electricity production are included)		b6ce954d-deb4-4c16-907a-c67b71e1e862	2	1	1	2	N

Name of the process *	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	Ti_R	G_R	Te_R	
			ED: Landfill of paper and paperboard waste landfill including leachate treatment and with transport without collection and pre-treatment production mix (region specific sites), at landfill site The carbon and water content are respectively of 30%C and and 22% Water (in weight %)EU-28+EFTA		86ff0001-4794-4df5-a1d4-083a9d986b62	2	2	2	2	N
LDPE film – End of Life	g/dose	see Table VI-17	$ErecyclingEoL$: Recycling of polypropylene (PP) plastic	http://lcdn.thinkstep.com/Node/	47a967ec-a648-4ede-afb6-23a2289baef9	2	1	1	3	N
			E^*_v: Plastic Film, PE raw material production, plastic extrusion production mix, at plant grammage: 0.0943 kg/m2EU-28+EFTA		cc8ee5f1-84b3-4e04-bae3-6a531aafb606	2	2	2	2	N
			$EER-LHV \times XER, heat \times ESE, heat-LHV \times XER, elec \times ESE, elec$: Waste incineration of PE waste-to-energy plant with dry flue gas treatment, including transport and pre-treatment production mix, at consumer polyethylene wasteEU-28+EFTA (heat and electricity production are included)		0370baaf-8923-4e26-b3b8-abcebb89f974	2	1	1	2	N
			ED: Landfill of plastic waste landfill including leachate treatment and with transport without collection and pre-treatment production mix (region specific sites), at landfill site The carbon and water content are respectively of 62%C and and 0% Water (in weight %)EU-28+EFTA		f2bea0f5-e4b7-4a2c-9f34-4eb32495cbc6	2	2	2	2	N
Wood pallet-End of Life	g/dose	see Table VI-17	$ErecyclingEoL$: Data gap (excluded)	http://lcdn.thinkstep.com/Node/						
			E^*_v: Data gap (excluded)							
			$EER-LHV \times XER, heat \times ESE, heat-LHV \times XER, elec \times ESE, elec$: Waste incineration of processed wood; waste-to-energy plant with dry flue gas treatment, including		034b2afb-2aa4-4d64-99b5-f39f700f3d44	2	1	1	2	N

Name of the process *	Unit of measurement (output)	Default amount per FU	Default dataset to be used	Dataset source	UUID	Default DQR				Most relevant process [Y/N]
						P	Ti_R	G_R	Te_R	
			transport and pre-treatment; production mix, at consumer; wood waste							
			ED: landfill of processed wood; landfill including leachate treatment and with transport without collection and pre-treatment; production mix (region specific sites), at landfill site; The carbon and water content are respectively of 45%C and 8% Water (in weight %)		0907b969-c8a5-4317-84b3-04ad0a04447e	2	2	2	2	N

The applicant shall report the DQR values (for each criterion + total) for all the datasets used.

The end of life shall be modelled using the formula and guidance provided in chapter 'End of life modelling' of this PEFCR together with the default parameters listed in the table below.

Before selecting the appropriate R_2 value, an evaluation for recyclability of the material shall be done and the PEF study shall include a statement on the recyclability of the materials/products. The statement on the recyclability shall be provided together with an evaluation for recyclability that includes evidence for the following three criteria (as described by ISO 14021:1999, section 7.7.4 'Evaluation methodology'):

1. The collection, sorting and delivery systems to transfer the materials from the source to the recycling facility are conveniently available to a reasonable proportion of the purchasers, potential purchasers and users of the product;
2. The recycling facilities are available to accommodate the collected materials;
3. Evidence is available that the product for which recyclability is claimed is being collected and recycled.

Point 1 and 3 can be proven by recycling statistics (country specific) derived from industry associations or national bodies. Approximation to evidence at point 3 can be provided by applying for example the design for recyclability evaluation outlined in EN 13430 Material recycling (Annexes A and B) or other sector-specific recyclability guidelines if available[70].

Following the evaluation for recyclability, the appropriate R_2 values (supply-chain specific or default) shall be used. If one criterion is not fulfilled or the sector-specific recyclability guidelines indicate a limited recyclability an R_2 value of 0% shall be applied.

Company-specific R_2 values (measured at the output of the recycling plant) shall be used when available. If no company-specific values are available and the criteria for evaluation of recyclability are fulfilled (see below), application-specific R_2 values shall be used as listed in the table below,

- If an R_2 value is not available for a specific country, then the European average shall be used.
- If an R_2 value is not available for a specific application, the R_2 values of the material shall be used (e.g. materials average).
- In case no R_2 values are available, R_2 shall be set equal to 0 or new statistics may be generated in order to assign an R_2 value in the specific situation.

The applied R_2 values shall be subject to the PEF study verification.

In case of refillable packaging, the reuse rate determines the quantity of packaging material (per product sold) to be treated at end of life. The amount of packaging treated at end of life shall be calculated by dividing the actual weight of the packaging by the number of times this packaging was reused.

[70] E.g. the EPBP design guidelines (http://www.epbp.org/design-guidelines), or Recyclability by design (http://www.recoup.org/)

The following table provides all the parameters to be used by the applicant to implement the CFF in the EU average scenario. Only R1 coefficient for primary packaging may differ from these default data.

In case of other geographical scope (see section III.6.2) the applicant shall refer to the Annex C of the PEFCR guidance v6.3 and use the parameters specific to the concerned country(ies). The mentioned below parameter shall be used only if no better parameter is available.

Table VI-17: Parameters for the circular footprint formula

	HDPE	PP	LDPE	Cardboard	Wood
A	A=0.5 for plastics			A= 0.2	A=0.8
	PEFCR guidance v6.3 -Annex C			PEFCR guidance v6.3 -Annex C	PEFCR guidance v6.3 - Annex C
B	B=0 (as default data according to PEFCR guidance v6.3)				
R_1	0%	0%	0%	88%	0%
	PEFCR guidance v6.3 -Annex C – value for Generic plastics (packaging generic)			PEFCR guidance v6.3 -Annex C – value for packaging - corrugated - pads/box/inserts	PEFCR guidance v6.3 - Annex C – value for wood pallets
R_2[71]	29%	29%	0.00%	75%	30%
	PEFCR guidance v6.3 -Annex C – value for Generic plastics (packaging generic)		Conservative assumption	PEFCR guidance v6.3 -Annex C)	PEFCR guidance v6.3 - Annex C – value for wood pallets
R_3	31.95%	31.95%	45.00%	11.25%	31.5%
	Calculation based on Fraction of non-recycled municipal solid wastes that are incinerated - Eurostat 2013 data (annex C) (1-R2)*Fraction of non-recycled municipal solid wastes that are incinerated				
LHV (MJ/kg)	41.2	41.2	41.2	10.4	15.8
	Thinkstep dataset for PE incineration	Thinkstep dataset for PP incineration	Thinkstep dataset for PE incineration	Thinkstep dataset for cardboard incineration	Thinkstep dataset for wood incineration
$X_{ER,heat}$	31%				
	Thinkstep dataset				
$X_{ER,elec}$	10.1%				
	Thinkstep dataset				
Qs/Qp (Qsint and Qsout/Qp)	0.9	0.9	0.9 for bottle part and 0.75 for film	1	1
	PEFCR guidance v6.3 -Annex C -				

[71] It is assumed that all packaging waste from selective collection is sent to recycling

VII. PEF results

VII.1. Benchmark values

Table VII-1: Characterized benchmark values for the A.I.S.E. HDLLD RP

Impact category	Unit	Life cycle excl. use stage	Use stage	Total Life Cycle
Climate change	kg $CO_{2\ eq}$	2.30E-01	2.87E-01	5.17E-01
Of which Climate change - biogenic		3.32E-02	9.99E-04	3.42E-02
Ozone depletion	kg CFC-11 eq	5.05E-09	3.08E-10	5.36E-09
Particulate matter	disease incidence	1.13E-08	9.25E-09	2.05E-08
Ionising radiation, human health	kBq U^{235} eq	1.68E-02	1.18E-01	1.35E-01
Photochemical ozone formation, human health	kg NMVOC eq	8.08E-04	4.79E-04	1.29E-03
Acidification	mol H+ eq	1.16E-03	8.79E-04	2.04E-03
Eutrophication, terrestrial	mol N eq	3.39E-03	1.76E-03	5.15E-03
Eutrophication, freshwater	kg P eq	7.08E-05	1.04E-06	7.18E-05
Eutrophication, marine	kg N eq	6.87E-04	1.72E-04	8.58E-04
Land use	Dimensionless (pt)	2.75	2.08	4.84
Water use	m^3 world eq	-2.08[72]	2.19	1.10E-01
Resource use, minerals and metals	kg Sb eq	4.03E-07	1.42E-07	5.45E-07
Resource use, fossils	MJ	2.53	4.91	7.44

[72] Waste Water Treatment is excluded from the Use Phase and is accounted for in the "End-Of-life" phase. This means that the uptake of water is accounted for in the use phase and releasing water is included in the end-of-life phase. This generates negative results for water use in the benchmark results for the life cycle excluding the use stage.

Table VII-2: Normalised benchmark values for the A.I.S.E. HDLLD RP (per person, EU 28)

Impact category	Life cycle excl. use stage	Use stage	Total Life Cycle
Climate change	2.96E-05	3.70E-05	6.66E-05
Of which Climate change - biogenic			
Ozone depletion	2.16E-07	1.32E-08	2.30E-07
Particulate matter	1.77E-05	1.45E-05	3.22E-05
Ionising radiation, human health	3.97E-06	2.80E-05	3.19E-05
Photochemical ozone formation, human health	1.99E-05	1.18E-05	3.17E-05
Acidification	2.08E-05	1.58E-05	3.66E-05
Eutrophication, terrestrial	1.92E-05	9.93E-06	2.91E-05
Eutrophication, freshwater	2.77E-05	4.07E-07	2.81E-05
Eutrophication, marine	2.43E-05	6.08E-06	3.04E-05
Land use	2.06E-06	1.56E-06	3.62E-06
Water use	-1.81E-04[73]	1.91E-04	9.56E-06
Resource use, minerals and metals	6.97E-06	2.45E-06	9.42E-06
Resource use, fossils	3.88E-05	7.52E-05	1.14E-04

Table VII-3: Weighted benchmark values for the A.I.S.E HDLLD RP

Impact category	Life cycle excl. use stage	Use stage	Total Life Cycle
Climate change	6.57E-06	8.21E-06	1.48E-05
Of which Climate change - biogenic			
Ozone depletion	1.46E-08	8.90E-10	1.55E-08
Particulate matter	1.69E-06	1.39E-06	3.07E-06
Ionising radiation, human health	2.13E-07	1.50E-06	1.72E-06
Photochemical ozone formation, human health	1.02E-06	6.02E-07	1.62E-06
Acidification	1.38E-06	1.05E-06	2.43E-06

[73] See footnote 72

Impact category	Life cycle excl. use stage	Use stage	Total Life Cycle
Eutrophication, terrestrial	7.49E-07	3.88E-07	1.14E-06
Eutrophication, freshwater	8.18E-07	1.20E-08	8.30E-07
Eutrophication, marine	7.58E-07	1.90E-07	9.47E-07
Land use	1.74E-07	1.31E-07	3.05E-07
Water use	-1.64E-05[74]	1.72E-05	8.64E-07
Resource use, minerals and metals	5.63E-07	1.98E-07	7.61E-07
Resource use, fossils	3.46E-06	6.71E-06	1.02E-05
TOTAL	**1.02E-06**	**3.76E-05**	**3.86E-5**

VII.2. PEF profile

The applicant shall calculate the PEF profile of its product in compliance with all requirements included in this PEFCR. The following information shall be included in the PEF report:

- full life cycle inventory;
- characterised results in absolute values, for all impact categories (including toxicity; as a table);
- normalised and weighted result in absolute values, for all impact categories (including toxicity; as a table);
- the aggregated single score in absolute values

Together with the PEF report, the applicant shall develop an aggregated EF-compliant dataset of its product in scope. This dataset shall be made available on the EF node (http://eplca.jrc.ec.europa.eu/EF-node). The disaggregated version may stay confidential.

VII.3. Additional technical information

No additional technical information. A technical dossier gathering all detailed background information on methodological choices taken during the development of the PEFCR is available on demand.

VII.4. Additional environmental information

VII.4.1. Alternative method for ecotoxicity Freshwater: the Environmental Safety Check (ESC)

The risk-based 'Environmental Safety Check (ESC)' method is used since 2010 in the A.I.S.E. Charter for Sustainable Cleaning where it is applied to qualify detergents and cleaning products as achieving 'Advanced Sustainability Profile' (ASP) status for the relevant product category, specifically to confirm the environmental safety of each ingredient in the assessed product. The ESC-check is implemented through a user-friendly

[74] See footnote 72

spreadsheet tool which uses an internal database of key ingredient parameters including predicted no-effect concentration (PNEC) and removal rate. The ESC tool includes market volume information for product types and ingredients in order to run a risk-based calculation. Conservative projections include the assumption of a 100% market share for the studied product and a factor-based approach to provide a conservative estimate of background ingredient concentrations which might arise from other uses, both within the detergent sector as well as in other industries. The ESC tool performs calculations based on the core concept of risk assessment: it conservatively projects Predicted Environmental Concentrations (=PEC) for the environment and compares these to relevant Predicted No Effect Concentrations (=PNEC). The result is expressed as a Projected Environmental Safety Ratio (PEC/PNEC = PESR). In order to pass the ESC check, the Projected Environmental Safety Ratio (PESR) for each ingredient as formulated and dosed must be less than 1. This corresponds to the PEC/PNEC < 1 criterion which is the basis for concluding no significant risk of adverse effects in the REACH legislation. The tool itself and a user manual are publicly available via http://www.sustainable-cleaning.com/content_attachments/documents/ESC_Calculation_Tool_Version_7_4_20160407.zip and http://www.sustainable-cleaning.com/content_attachments/documents/ESC_Summary_1Oct2010.pdf.

VII.4.2. **Biodiversity**

Since detergents can contain bio-based ingredients, biodiversity is potentially relevant for this PEFCR.

Biodiversity is only partially covered by the impact categories listed in section III.5. However, the existing methods and certification schemes that address the topic fit a broader approach based on life cycle thinking and management which go beyond the scope of the current PEF method.

Hence, the TS concluded to not refer to or communicate on biodiversity aspects per se in the context of the PEF pilot.

VII.5. Other impact results

As indicated in section III.5, this PEFCR requires to calculate the Environmental Safety check to address the freshwater ecotoxicity. The ESC indicator is described in the previous chapter VII.4.

The ESC results for the A.I.S.E. Heavy Duty Liquid Laundry Representative Product are reported below. For ease of reference, PESR values on the ESC Check Sheet are colour-coded:

- Ingredients coloured Green have a PESR below 0.5–'Clear' result;
- Ingredients coloured Amber have a PESR between 0.5 and 1 – 'Clear' result;
- Ingredients coloured Red have a PESR >1.

Figure VI-4: ESC tool assessment for 'A.I.S.E. Heavy Duty Liquid Laundry Reference Formulation'

Company	PEF Screening
Product Name	Reacted formulation
Product Category (drop down list!)	Liquid Laundry Detergent
Formulation #	enter internal ref number
Date	10/30/2014
Recommended product dosage (g/use)	75

ESC Tool v7.0 issued 1/10/2014

CAS# search*	Ingredient #
	#N/A
#N/A	

* enter CAS# and cell J2 will return Ing# where available

Ing.#	Ingredient	w/w % in Formulation	Status	ESC PNEC mg/l	Projected EC Category mg/l	PESR Category	PESR Total AISE	PESR Total All Inds	ESC Result
115	Citrate and citric acid	2.28	HERA OK						HERA OK
119	Phosphonates	0.41	HERA OK						HERA OK
141	Enzymes (Protease, Amylase, Cellulase, Lipase)	0.58	HERA OK						HERA OK
150	FWA 5	0.03	HERA OK						HERA OK
149	FWA 1	0.03	HERA OK						HERA OK
8	Alkyl ether sulphates	3.55	HERA OK						HERA OK
1	Linear alkyl benzene sulphonates	6.83	HERA OK						HERA OK
15	Soap C>12-22	2.41	HERA OK						HERA OK
20	Alcohol ethoxylates C8-18, 0-22 EO	5.91	HERA OK						HERA OK
140	Na-/Mg-/KOH	2.31	Exempt						Exempt
244	Triethanolamine	2.31	Calc	0.32	0.0027	0.0086	0.0294	0.0606	0.0606
112	Glycerol	2.85	Exempt						Exempt
174	Propylene glycol	2.85	Calc	32	0.0110	0.0003	0.0015	0.0060	0.0060
80	1,2-Benzisothiazol-3-one	0.072	Calc	0.004	0.0011	0.2671	0.3597	0.4985	0.4985
110	Silicones	1.85	Calc	0.25	0.0220	0.0879	0.0997	0.2063	0.2063
134	Calcium- and sodiumchloride	1.85	Exempt						Exempt
142	Perfume - IFRA standards compliant	0.71	Exempt						Exempt
225	Dye NC-80% Removal	0.03	Calc	0.1	0.0002	0.0018	0.0036	0.0107	0.0107

Note: Excerpt from ESC Calculations.

Fragrances (Perfumes) are exempt from the ESC calculation, provided that they are compliant with IFRA Standards.

To pass the ESC Check in respect of fragrance compounds included in the formulation, companies must obtain confirmation from suppliers that:

a) the supplier complies in all respects concerning the manufacture, handling and supply of the fragrance with the IFRA Code of Practice http://www.ifraorg.org/en-us/code_of_practice_1 and:

b) that the fragrance compound complies with all IFRA standards relating to potential environmental risks in respect of all its constituents http://www.ifraorg.org/en-us/standards_1 Perfumes for which companies have such confirmation from supplier(s) may be entered as Ingredient 142 – Perfume, IFRA Standards Compliant. This is exempt from calculation.

Other ingredients

A range of non-hazardous substances are considered exempt from the ESC check as their properties are such that use in detergents clearly poses no risk to the aquatic environment when disposed of via sewage treatment. These include both simple inorganics such as sodium chloride and some organics from natural sources such as starch. Some simple acids and bases which may be hazardous in concentrated form (e.g. hydrochloric acid and sodium hydroxide) are exempt on the basis that they are routinely diluted and neutralised during sewage treatment. Where these substances already appear in the DID list, an exemption is applied directly by the ESC Tool.

Apart from this, companies may assign other non-hazardous inorganic and organic substances not on the list to ingredient numbers 208 and 209 respectively, and thus be exempted from PESR calculation, if they meet the following criteria:

- Ingredient 208 - Any soluble salts composed only of the following ions: Na, K, Ca, Mg, NH4 or H with Cl, SO4, OH, CO3, SiO4, HCO3, NO2, SO3 Relevant examples include: Magnesium chloride, hydrochloric acid
- Ingredient 209 - Any organic substance exempted from REACH registration through listing on Annexes IV and V of REACH (Commission Regulation (EC) No 987/2008; http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:268:0014:0019:EN:PDF) Relevant examples include: Coconut oil

VIII. Verification

The verification of an EF study/report carried out in compliance with this PEFCR shall be done according to all the general requirements included in Section 8 of the PEFCR Guidance v 6.3 and the requirements listed below.

The verifier(s) shall verify that the EF study is conducted in compliance with this PEFCR.

These requirements will remain valid until an EF verification scheme is adopted at European level or alternative verification approaches applicable to EF studies/report are included in existing or new policies.

The verifier(s) shall validate the accuracy and reliability of the quantitative information used in the calculation of the study. As this can be highly resource intensive, the following requirements shall be followed:

- the verifier shall check if the correct version of all impact assessment methods was used. For each of the most relevant impact categories, at least 50% of the characterisation factors (for each of the most relevant EF impact categories) shall be verified, while all normalisation and weighting factors of all ICs shall be verified. In particular, the verifier shall check that the characterisation factors correspond to those included in the EF impact assessment method the study declares compliance with[75];
- all the newly created datasets shall be checked on their EF compliancy (for the meaning of EF-compliant datasets refer to Annex H of the Guidance). All their underlying data (elementary flows, activity data and sub processes) shall be validated;
- the aggregated EF-compliant dataset of the product in scope (meaning, the EF study) is available on the EF node (http://eplca.jrc.ec.europa.eu/EF-node).
- for at least 70% of the most relevant processes in situation 2 option 2 of the DNM, 70% of the underlying data shall be validated. The 70% data shall include all energy and transport sub processes for those in situation 2 option 2;
- for at least 60% of the most relevant processes in situation 3 of the DNM, 60% of the underlying data shall be validated;
- for at least 50% of the other processes in situation 1, 2 and 3 of the DNM, 50% of the underlying data shall be validated.

In particular, it shall be verified for the selected processes if the DQR of the process satisfies the minimum DQR as specified in the DNM.

The selection of the processes to be verified for each situation shall be done ordering them from the most contributing to the less contributing one and selecting those contributing up to the identified percentage starting from the most contributing ones.

In case of non-integer numbers, the rounding shall be made always considering the next upper integer.

These data checks shall include, but should not be limited to, the activity data used, the selection of secondary sub-processes, the selection of the direct elementary flows and the CFF parameters. For example, if there are 5 processes and each one of them includes 5 activity data, 5 secondary datasets and 10 CFF parameters, then the verifier(s) has to check at least 4 out of 5 processes (70%) and, for each process, (s)he shall check at least 4 activity data (70% of the total amount of activity data), 4 secondary datasets (70% of

[75] Available at: http://eplca.jrc.ec.europa.eu/LCDN/developer.xhtm

the total amount of secondary datasets), and 7 CFF parameters (70% of the total amount of CFF parameters), i.e. the 70% of each of data that could be possible subject of check.

The verification of the EF report shall be carried out by randomly checking enough information to provide reasonable assurance that the EF report fulfils all the conditions listed in section 8 of the PEFCR Guidance.

IX. References

- PEF Guide, Annex to Commission 2013/179/EU on the use of common methods to measure and communicate the life cycle environmental performance of products and organizations (April 2013) and available at http://ec.europa.eu/environment/eussd/smgp/index.htm
- Product Environmental Footprint Pilot Guidance, Guidance for the implementation of the EU Product Environmental Footprint (PEF) during the Environmental Footprint (EF) pilot phase, version 6.3, European Commission.
- Detergent Regulation, Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents
- A.I.S.E. Charter for Sustainable Cleaning: http://www.sustainable-cleaning.com/en.companyarea_documentation.org and http://www.sustainable-cleaning.com/content_attachments/documents/ASPs_LLD1stReview_1April2016.pdf
- The French Grenelle and pilot case for laundry detergents on environmental information: http://www.afise.fr/Default.aspx?lid=1&rid=121&rvid=135
- Cleanright.eu website: http://uk.cleanright.eu/
- 'I prefer 30°' consumer engagement campaign, A.I.S.E., expert study 2013, www.iprefer30.eu
- Comparative Life Cycle Assessment (LCA) of Ariel "Actif à froid" (2006), a laundry detergent that allows to wash at colder wash temperatures, with previous Ariel laundry detergents (1998, 2001), Procter&Gamble, April 2006.
- Simonich, S.L., Federle, T.W., Eckhoff, W.S., Rottiers, A., Webb, S.,Sabaliunas, D., de Wolf, W., 2002. Removal of fragrance material during US and European wastewater treatment.
- Franke et al, 1995. Oekobilanzierung - Sachbilanz fuer die Waschmittel-Konfektionierung. Tenside Surfactant and Detergent 32: 508-514

X. Annex

X.1. List of EF normalisation and weighting factors

Global normalisation factors are applied within the EF. The normalisation factors as the global impact per person are used in the EF calculations.

Impact category	Unit	Normalisation factor	Normalisation factor per person	Impact assessment robustness	Inventory coverage completeness	Inventory robustness	Comment
Climate change	kg CO_2 eq	5.35E+13	7.76E+03	I	II	I	
Ozone depletion	kg CFC-11 eq	1.61E+08	2.34E-02	I	III	II	
Human toxicity, cancer	CTUh	2.66E+05	3.85E-05	II/III	III	III	
Human toxicity, non-cancer	CTUh	3.27E+06	4.75E-04	II/III	III	III	
Particulate matter	disease incidence	4.39E+06	6.37E-04	I	I/II	I /II	NF calculation takes into account the emission height both in the emission inventory and in the impact assessment.
Ionising radiation, human health	kBq U^{235} eq	2.91E+13	4.22E+03	II	II	III	
Photochemical ozone formation, human health	kg NMVOC eq	2.80E+11	4.06E+01	II	III	I/II	
Acidification	mol H+ eq	3.83E+11	5.55E+01	II	II	I/II	
Eutrophication, terrestrial	mol N eq	1.22E+12	1.77E+02	II	II	I/II	

Impact category	Unit	Normalisation factor	Normalisation factor per person	Impact assessment robustness	Inventory coverage completeness	Inventory robustness	Comment
Eutrophication, freshwater	kg P_{eq}	1.76E+10	2.55E+00	II	II	III	
Eutrophication, marine	kg N_{eq}	1.95E+11	2.83E+01	II	II	II/III	
Land use	pt	9.20E+15	1.33E+06	III	II	I I	The NF is built by means of regionalised CFs.
Ecotoxicity, freshwater	CTUe	8.15E+13	1.18E+04	II/III	III	III	
Water use	m^3 world $_{eq}$	7.91E+13	1.15E+04	III	I	II	The NF is built by means of regionalised CFs.
Resource use, fossils	MJ	4.50E+14	6.53E+04	III	I	II	
Resource use, minerals and metals	kg Sb_{eq}	3.99E+08	5.79E-02	III			

Weighting factors for Environmental Footprint

	Aggregated weighting set	Robustness factors	Calculation	**Final weighting factors**
	(50:50)	(scale 1-0.1)		
WITHOUT TOX CATEGORIES	A	B	C=A*B	C scaled to 100
Climate change	15.75	0.87	13.65	**22.19**
Ozone depletion	6.92	0.6	4.15	**6.75**
Particulate matter	6.77	0.87	5.87	**9.54**
Ionizing radiation, human health	7.07	0.47	3.3	**5.37**
Photochemical ozone formation, human health	5.88	0.53	3.14	**5.1**
Acidification	6.13	0.67	4.08	**6.64**
Eutrophication, terrestrial	3.61	0.67	2.4	**3.91**
Eutrophication, freshwater	3.88	0.47	1.81	**2.95**
Eutrophication, marine	3.59	0.53	1.92	**3.12**
Land use	11.1	0.47	5.18	**8.42**
Water use	11.89	0.47	5.55	**9.03**
Resource use, minerals and metals	8.28	0.6	4.97	**8.08**
Resource use, fossils	9.14	0.6	5.48	**8.92**

X.2. Check-list for PEF study

Each PEF study shall include this annex, completed with all the requested information[76].

ITEM	Included in the study (Y/N)	Section	Page
	[The PEF study shall indicate if the item is included or not in the study]	[The PEF study shall indicate in which section of the study the item is included]	[The PEF study shall indicate in which page of the study the item is included]
Summary			
General information about the product			
General information about the company			
Diagram with system boundary and indication of the situation according to DNM			
List and description of processes included in the system boundaries			
List of co-products, by-products and waste			
List of activity data used			
List of secondary datasets used			

[76] This requirement does not apply to PEFCRs developed during the Environmental Footprint pilot phase (2013-2017).

ITEM	Included in the study (Y/N)	Section	Page
Data gaps			
Assumptions			
Scope of the study			
(sub)category to which the product belongs			
DQR calculation of each dataset used for the most relevant processes and the new ones created.			
DQR (of each criteria and total) of the study			

X.3. Critical review report of the PEFCR

X.3.1. Final review report June/July 2019

AISE PEF PEFCR review report after errata changes

Author: Hélène Lelièvre, independent LCA consultant, Enviroconseil, France

Date: 22 July 2019

1. Goal and scope of the review

This new round of external review was carried out in June/July 2019 after the modifications done on the modelling of the Representative Product, on the calculations of its PEF results and on the PEFCR within the A.I.S.E. Household Heavy Duty Liquid Laundry Detergents (HDLLD) PEF pilot. As a reminder, the previous external review report is dated June 2018 and took place after the remodeling exercise commissioned by the European Commission that was performed between autumn 2016 and spring 2018.

The external review was performed on the following documents, transmitted by A.I.S.E.:

- product Environmental Footprint Category Rules (PEFCR), Household Heavy Duty Liquid Laundry Detergents (HDLLD) for machine wash, June 2019, Version 1.1, Time validity: 31st December 2020,
- several Excel files containing the LCA midpoint results and the contribution analysis for the representative product after the modifications done, dated June 2019,

The reviewer did not have access to:

- the detailed LCA inventory of the representative product (detail per environmental flow),
- the model itself.

As for the June 2018 review, this new round of review is focused as asked by AISE and agreed by the European Commission on the following aspects:

- "(i) the benchmark calculation,
- (ii) the classes of performance (if relevant),
- (iii) the selection of most relevant processes and (iv) the selection of most relevant impact categories."

There was no review of the classes of performances as their definition has been removed from the PEFCR guidance version 6.3.
As a reminder, a more comprehensive external review was performed by an external review panel (Pr. Roland Clift, chair of the panel, Martin Wildenberg, Global 2000 (Austrian NGO) and Hélène Lelièvre, Enviroconseil):

- beginning of 2015 on the PEF screening report on HDLLD, dated 3 December 2014,
- during autumn 2016: on the PEFCR on HDLLD, DRAFT Final, 1st version, dated 3 April 2016.

The results of this new round of review do not replace these 2 previous review works but are complimentary to them.

2. Main findings

Most of the comments edited during this final review step were taken into account with modifications of the final PEFCR (see the Excel file detailing the main comments in annex). The selection of the most relevant impact categories is in compliance with the PEFCR guidance version 6.3 of December 2017.

The results of the selection of the most relevant life cycle stages were modified in order to add 3 missing life cycle stages (Distribution-store, HDLLD Manufacture and Primary

packaging). The most relevant processes were updated to follow the procedure "7.4.5 Dealing with negative numbers" of the PEFCR guidance version 6.3.

The use of a specific EC wwtp dataset has been better documented in the PEFCR and the assumptions used to calculate the 9.2% allocation factor of this specific dataset have been displayed (section VI-6.1. Wastewater treatment).

During the future revision of the HDLLD PEFCR, it is recommended to:

- Revise the assumption on the ratio g Chemical Organic Demand (COD) per g of non water ingredient[77] of the liquid laundry detergent. The current assumption of 1 g COD/g ingredient seems too low (the value is calculated to 2 g COD/g ingredient with an approach based on the OECD guidance 301 dealing with biodegradability and theoretical oxygen demand).
- Refine the instructions described in section "X-5 Instructions for aligning the treatment of detergent wastewater dataset to the water consumption dataset at the use phase (EU average scenario)" by distinguishing:
  - the direct impact of the tap water consumption
  - the direct impact of the wwtp.
- Describe the representative product using 3 series of data: formulation expressed at the raw materials level (it will have to be added in annex X.4), formulation at the constituent level, unreacted (that is expressed as 100% pure chemical, unreacted), necessary for the chemical ingredient production LCA model and formulation at the constituent level, reacted (that is expressed as 100% pure chemical, reacted), necessary for the wwtp LCA model.

As a reminder, the 2 following remarks (identified in the June 2018 3rd external review round) are maintained:

- The default transportation data on packaging parts used for the representative product seem overestimated (18 000 km by boat and 1000 km by road) and it is highly recommended during the revision of the PEFCR to collect primary data from participating companies to update the PEF results of the representative product. In addition, the default values proposed by the EC in the guidance version 6.3 for the transport from suppliers to factory (case of suppliers located in Europe) should be reviewed as it is assessed that the systematic use of a fluvial barge is not the classical industrial practice for this step (as a reminder, current default values from the PEFCR guidance v6.3 are 360 km by fluvial barge versus 230 km by truck and 280 km by train).
- The contribution of the storage of the HDLLD at retail has a larger contribution than the production of the laundry detergent for 3 indicators (climate change, fossil energy and acidification). It would be interesting to better understand this and refine the data of the LCA model if necessary.

The following key limitations of the current model and default datasets are identified:

- The dosage of the representative product (75 ml chosen) will have to be updated in the revision of the liquid laundry detergent PEFCR as it is probably currently out of date;
- The default datasets for the surfactants production, main ingredients of the liquid laundry detergent are out of date and more recent datasets derived from the recent ERASM LCI work should be envisaged in the coming years;
- The modeling of the wastewater treatment step is not specific to the product under study, which highly alters the LCA results from this step. Additional work by the EC on this part (common to many products) is highly recommended; This, in addition to the above remarks linked to the wastewater treatment step will allow to get a more accurate assessment;

[77] that is all ingredients except water (example: surfactants, builders, solvents..)

- There are key limitations of the USEtox LCA results due to data gaps in the characterization factors for specific ingredients and previous remark. Ongoing work currently carried out by the EC with ECHA will hopefully allow to get comprehensive results.

The following table presents the detailed comments.

Chapter	paragraph, figure, table	type[78]	review comment	review reco	practitioner response
IV. Most relevant impact categories, life cycle stages, processes		technical	The results of the selection of the most relevant life cycle stages should be modified in order to add 3 missing life cycle stages (Distribution-store, HDLLD Manufacture and Primary packaging). These life cycle stages were identified when following the procedure of section "7.4 Identification of most relevant impact categories, life cycle stages, processes and elementary flows" (same wording between guidance v6.3 December 2017 and guidance v6.3 May 2018) and "7.4.5 Dealing with negative numbers" of the PEFCR guidance version 6.3 of May 2018 . The figure IV-1 should be updated accordingly ("Figure IV-1: System diagram with most relevant life cycle stages and processes") . Same for Table X-3 of the annex (" Table X-3: Most relevant life cycle stages and processes- contribution for the RP") .	Add these 3 life cycle stages and update figure and table displaying the most relevant life cycle stages.	Amendment is made on page 45 as well as on figure III-1 as well as in annex X4 – Representative Product. On page 45, I will present separately the list of LCs that join the list of most relevant because of this 50% rule. In Annex X4, both contribution (in real value and absolute value) are now displayed for the main life cycle stages.
IV. Most relevant impact categories, life cycle stages, processes		technical	The selection of the most relevant processes should follow the procedure "7.4.5 Dealing with negative numbers" of the PEFCR guidance version 6.3 (for main processes, the procedure is the same between guidance v6.3 of December 2017 and version of May 2018). This will impact the list and contribution values (%) displayed in table IV-1 and table X-3 of the PEFCR.	Follow the procedure "7.4.5 Dealing with negative numbers" for identifying the main processes.	The list of main processes has been updated following the procedure "7.4.5 Dealing with negative numbers". In Annex X4, both contribution (in real value and absolute value) are now displayed.
II-3-Review panel and review requireme		general	The description of the external review rounds should be more accurate in regards the role of each reviewer (section" II-3-Review panel and review requirements of the PEFCR"). In particular in the sentence "The reviewers have verified that the following requirements have been fulfilled..." , the word "reviewers" should be replaced by the "reviewer".	Change the wording.	The wording has been changed to clarify the description of the critical review process and the different rounds.

[78] Type can be "general" or "technical". Editorial comments made by the critical reviewed were removed (all of them were addressed).

Chapter	paragraph, figure, table	type[78]	review comment	review reco	practitioner response
nts of the PEFCR					
VI-6.1. Wastewater treatment		general	The use of a specific EC wwtp dataset should be better documented in the PEFCR and the 9.2% allocation factor should be explained for transparency reason.	Add the assumptions used to calculate the allocation factor of 9.2% and their sources.	The assumptions have been described as well as the information sources provided in the footnote 26.
VI-6.1. Wastewater treatment		technical	The assumption on the ratio g Chemical Organic Demand (COD) per g of non water ingredient of the liquid laundry detergent seems too low: 1 g COD/g ingredient versus a calculated value of 2 g COD/g ingredient with an approach based on the OECD guidance 301 dealing with biodegradability and theoretical oxygen demand.	Consider more accurate assumptions and calculation in the future revision of the HDLLD PEFCR when a better model of the wastewater treatment plant will be developed.	This will be considered in the future revision.
X.5. Instructions for aligning the treatment of detergent wastewater dataset to the water consumption dataset at the use phase (EU average scenario)		technical	The instructions described in section "X-5 Instructions for aligning the treatment of detergent wastewater dataset to the water consumption dataset at the use phase (EU average scenario)" should be refined by distinguishing: - the direct impact of the tap water consumption and the direct impact of the wwtp - the fact that some water is contained in the sludge produced in the wwtp so 1 liter of water entering the wwtp process does not give necessarily 1 liter released at the wwt plant.	Consider a more detailed procedure in the future revision of the HDLLD PEFCR when a better and more disaggregated model of the wastewater treatment plant will be developed.	The limitations of the current procedure were highlighted in the footnote 69.
X.5. Instruction		technical	What is the calculation method behind the value "5.5 kg powder laundry detergent/capita/year", resp 3.7 kg liquid laundry	NA	We normally use market data/statistics from

Chapter	paragraph, figure, table	type[78]	review comment	review reco	practitioner response
s for aligning the treatment of detergent wastewater dataset to the water consumption dataset at the use phase (EU average scenario)			detergent/capita/year used in the calculation of the 9.2% allocation factor ?		reliable sources to calculate the amounts. For the calculation of the average dose we did the same, using also data from our compaction projects. A.I.S.E. does not run surveys for this type of data, since. manufacturing companies do not report to us their selling volumes and market data – hence, data from reliable sources are used to derive the figures. The specific starting point is either 'IKW (our German member association) figures' or 'Euromonitor'. IKW has collected some quantitative data for Germany that have been extrapolated into kg/capita/year figures for the EU.
X.5. Instructions for aligning the treatment of detergent wastewater dataset to the water consumption dataset at the use phase		technical	What is the calculation method/source of the average quantity per dose used respectively for a powder laundry detergent dose and a liquid detergent dose used in the 9.2% calculation (here respectively 100 g/dose and 70 g/dose)?		

Chapter	paragraph, figure, table	type[78]	review comment	review reco	practitioner response
(EU average scenario)					

X.3.2. **Final review report June 2018**

AISE PEF PEFCR final review report

Author: Hélène Lelièvre, independent LCA consultant, Enviroconseil, France

Date: 20 June 2018

1. Goal and scope of the review

This final external review was carried out during 2018 spring after the remodelling exercise commissioned by the European Commission on the AISE Household Heavy Duty Liquid Laundry Detergents (HDLLD) pilot. The remodelling exercise was performed between autumn 2016 and spring 2018.

The external review was performed on the following documents, transmitted by AISE:

- Product Environmental Footprint Category Rules (PEFCR), Household Heavy Duty Liquid Laundry Detergents (HDLLD) for machine wash, April 2018, Version 1.0, Time validity: 31st December 2020, Final and the same document, June 2018 after recalculation of the results.
- an Excel file containing the LCA midpoint results and the contribution analysis for the representative product after the remodelling exercise and supplied to AISE by the remodelling team, April 2018 and an updated version of the file, June 2018
- an Excel file with the assumptions and the list of PEF compliant datasets used in the HDLLD model by the remodelling team.

The reviewer did not have access to:

- the detailed LCA inventory of the representative product (detail per environmental flow),
- the model itself.

This final review focused as asked by AISE and agreed by the European Commission on the following aspects:

- "(i) the benchmark calculation,
- (ii) the classes of performance (if relevant),
- (iii) the selection of most relevant processes and (iv) the selection of most relevant impact categories."

As a reminder a more comprehensive external review was performed by an external review panel (Pr. Roland Clift, chair of the panel, Martin Wildenberg, Global 2000 (Austrian NGO) and Hélène Lelièvre, Enviroconseil):

- beginning of 2015 on the PEF screening report on HDLLD, dated 3 December 2014,
- during autumn 2016: on the PEFCR on HDLLD, DRAFT Final, 1st version, dated 3 April 2016.

The results of this final review do not replace these previous review works but are complimentary to them.

2. Main findings

Most of the comments edited during this final review step were taken into account with modifications of the final PEFCR (see in annex the Excel file detailing the comments). For the few ones remaining, a satisfactory answer was brought like for the type of product that can be studied in a PEF study (a given formulation over a period and the average of all packaging formats for a given sales country).

A detailed review of the model and used datasets was not in the scope of this review but results of the representative product show reasonably coherent values. The 2 following remarks can be mentioned:

- The proposed default transportation data on packaging parts seem overestimated (18 000 km by boat and 1000 km by road) and it is advised to replace them by primary data to get more representative results.
- The default data (supplied by the EC) on the energy consumption during the storage of the products at retail may be overestimated as this step has a larger contribution than production of the detergent for 3 indicators (climate change, fossil energy and particulate). It would be interesting to see if this step appears as a relevant process in other PEF pilots.

There was no review of the classes of performances as their definition has been removed from the PEFCR guidance version 6.3.

The selection of the most relevant processes and the selection of the most relevant impact category are in compliance with the PEFCR guidance version 6.3.

The following key limitations of the current model and default datasets are reminded (all of them are mentioned in the limitations of the HDLLD PEFCR):

- the default datasets for the surfactants production, main ingredients of the liquid laundry detergent are out of date and more recent datasets derived from the recent ERASM LCI work should be envisaged in the coming years;
- the citric acid production for which default dataset is derived from literature appears as a key process step whereas its content is lower than other key surfactants. Additional refinement of the default dataset currently proposed by the European Commission is encouraged;
- the modeling of the wastewater treatment step is not specific to the product under study, which highly alters the LCA results from this step. Additional work by the EC on this part (common to many products) is recommended;
- there are key limitations of the USEtox LCA results due to data gaps in the characterization factors for specific ingredients and previous remark. Ongoing work currently carried out by the EC with ECHA will hopefully allow to get comprehensive results.

The following table presents the detailed comments.

Chapter	paragraph, figure, table	type[79]	review comment	review reco	practitioner response
II.2. Consultation and stakeholders		general	Mention the remodelling exercise with new EC datasets before the final PEFCR edition		ok, the text will be amended.
II.3. Review panel and review requirements of the PEFCR		general	To avoid any misleading information, describe below the table the 3 steps of review done by the critical review and recap timing and scope of review. The whole panel reviewed screening study and first version of PEFCR (2015-2016). The last step of review was done on the final version of PECFR after the remodelling exercise and was performed in spring 2018 by one expert (as agreed by the EC).	Add information on the review steps and scope	ok, the text will be amended as follows: Paragraph added below table II-3 "The critical review has been performed concurrently with the whole pilot process. The whole panel reviewed the screening study and the first version of PEFCR (2015- Nov 2016). The last step of review was done on the final version of PECFR in spring 2018 by Helene Lelièvre. This procedure was agreed with the European Commission."
III.6.1. Limitations linked to current state of development of the PEF methodology and databases		general	Limitations on key datasets on ingredients (mainly surfactants, citric acid) could be mentioned here in an additional paragraph on the limitations due to modelling (ingredients production). The advantage is to get, in the same section, the key limitations of the current results.		ok, the following paragraph is added: Limitations as regards key datasets on ingredients (e.g. builders, surfactants) Some limitations are due to the datasets recommended in this PEFCR. "The PEFCR users should be advised that the EF-compliant datasets are based on outdated LCI information as regards surfactants (LCI published in 1995). While the datasets for petrochemical-based surfactants are still relatively accurate (expected to be within a 10-20% range vs. the proposed data), the data for renewable surfactants do not account for the current greenhouse gas protocol accounting rules. As a consequence, the greenhouse gas emissions will be underestimated with the EF-compliant datasets, in particular for palm oil-based precursors. Also the citric acid dataset (available on the ecoinvent node -see section V.6), one of the main builders for

[79] Type can be "general" or "technical". Editorial comments made by the critical reviewed were removed (all of them were addressed).

Chapter	paragraph, figure, table	type[79]	review comment	review reco	practitioner response
					liquid detergent, has shown significantly higher impacts than other datasets available in databases that are currently not EF-compliant (this comparison was made available during the screening study). As a consequence, it may be possible that the influence of this ingredient on the results may be overestimated. "
stages, processes		technical	Quantity of dose (x ml/dose) is not mentioned as a mandatory company specific data whereas it is a key data	Add this parameter as a company mandatory specific data	ok, it will be added (paragraph to be added below title V-1)
V.1 List of mandatory company specific data		technical	Temperature of the wash is not mentioned as a mandatory company specific data whereas it is a key data	mention that this parameter is an optional specific data and say that in that case, 2 series of calculation should be done (one at the specific temperature and one at 40°C)	ok, it will be added (paragraph to be added below title V-1)
V.1 List of mandatory company specific data		technical	Density of product of product and volume of product per bottle are not mentioned but it is however used in the calculation to get the amount of each ingredient per dose and the pack material per dose. In case of reusable primary packaging, the reuse rate shall be company specific (said in bottom of page 70)	Add these 2 parameters as a company mandatory specific data. Add a sentence saying that in case of reusable pack, the reusable rate shall be also company specific.	ok, it will be added (see paragraph added below title V-1-2)
V.1 List of mandatory company specific data		general	"...and no average of quantities shall be used." It is not clear what average means. If this means no average between different product formulations cannot be used, it is not understood why because as far as the PEF study is transparent concerning the product that is studied (ie for instance a given	Give the flexibility to study any type of product (one shot or average over a period) but be prescriptive about the transparency of the choices and	According to TS experts, this flexibility does not make sense as a specific detergent refers to a unique formulation and a PEF study covering several different detergents is not meaningful. However, the same detergent (same formulation) can be sold in different formats (small, big, version with refill system) and it make sense to consider the average of the proposed packaging. To clarify the representativity of the data,

Chapter	paragraph, figure, table	type[79]	review comment	review reco	practitioner response
			formulation at a given time or the weighted average of successive formulations for one fiscal year), it is considered to be fair. The PEFCR should not be prescriptive about what can be and what cannot be studied. However, it may be worth to require that a PEF study be very clear about the description of the studied product (requirement for the PEF study template).	description of the studied product	we propose to ask the applicant to describe in detail the period and countries of sales considered and ensure the average is made on this basis. Paragraph to be added for the detergent: "A PEF study shall be performed for a specific and unique bill of ingredients. This bill of Ingredients, expressed in the three above-mentioned different manners in order to appropriately assess the different stages of the detergent life cycle, shall be expressed for one dose of detergent (reference flow of the functional unit). The applicant shall describe the period and countries of sales considered" Paragraph to be added for the packaging: " The bill of materials for the primary packaging, the quantity of detergent per bottle (volume and mass) shall be collected by the applicant. In case of reusable packaging, the reuse rate shall also be collected. As the detergent under study can be sold in different packaging formats, these data shall be representative of all formats available for the period and countries of sales considered (see previous section). The way the bill of materials for primary packaging (and its refill system if available) is evaluated shall be described in detail. "
V.3. Data gaps		technical	V6.3 of guidance specify "This section shall include: - The list of data gaps on the company-specific data to be collected that most frequently are encountered by companies in the specific sectors and how these data gaps may be solved in the context of the PEF". The air and water emissions + waste of HDLL manufacture shall be mentioned here as well as the way they were resolved (introduction of a cut-off of 1%).		The "company-specific data to be collected" refers to the mandatory data and not the processes that are expected to be run by the company (which is covered just the section before). Therefore, we did not include these flows (air/water emissions and waste) here because it is not mandatory to collect them.

Chapter	paragraph, figure, table	type[79]	review comment	review reco	practitioner response
V.3. Data gaps		technical	There are some other proxies for default datasets that shall be mentioned here: -HDPE recycling, -LDPE recycling. -fragrances consitutent production (other than the 4 quoted) Also, it is recommended to quote the wwtp process considering it is an average not including a model allowing to reflect a given HDLL detergent fate.		ok, these proxies will be mentioned (in table V2 for recycling and wwt) and in table v1 for fragrance (the average of the 4 previous fragrances).
V.3. Data gaps		technical	The following other processes are not included due to missing default datasets provided by the EC and shall be quoted: -dye production (mentioned in page 62) -other ingredient production (page 66) -Hydrosoluble film for unit dose capsule (page 67) -transport from retail to final consumer:33% not modelled (public transport, bicycle, etc.) see page 82 -recycling of wood -see page 89 -side process linked to the truck transportation (not quoted in the document but mentioned in the Excel file of assumptions): maintenance and end of life of truck; road construction, maintenance and disposal.		Dye, other chemical and hydrosoluble are already available in table V-1 and will just be repeated here. For hydrosoluble film a specific dataset shall be provided. Recycling of wood is already indicated as well as side process linked to the truck transport (see table V-2)
V.4.7. Climate change modelling		technical	"The sub-category 'Climate change-land use and land transformation' shall not be reported separately." This is true for the representative product but it is difficult to know if the 5% threshold will be reached or not for any new detergent.	The sentence should be completed by "except if this category of emissions represent more than 5% of the total climate change indicator."	in section 7.9 of the guidance, it is explained that the requirement of reporting the sub-categories for any PEF study only depends on the result of the screening (the RP). However, your comment makes a lot of sense and we can add the following footnote in section Climate change modelling: "For the Representative product, this sub-category is far below 5% with the databases used for the benchmark results and the same is expected for most HDLLD. However, this may be different for HDLLD mainly made with agro-based ingredients or if some ingredients datasets are

Chapter	paragraph, figure, table	type[79]	review comment	review reco	practitioner response
					updated. Therefore, the applicant shall monitor the share of this sub-category and report it if it represents more than 5% of the climate change category. "
VI.1.1. Ingredients sourcing and manufacturing	Table VI-2: Raw material acquisition and processing	technical	The score on Time representativity (TiR) for the surfactants (scored as 1, information from EC) seem too low considering the age of the datasets (published in 1995 and representative of older industry data); same comment on the score TeR	report to the EC this inconsistency	ok, this will be reported
VI.1.3.1. Primary packaging	Table VI-4: Raw material acquisition and processing for primary packaging row "HDPE for packaging - bottle"	technical	2 default datasets are prescribed: "injection moulding" and" Stretch blow moulding". To my knowledge, if this is relevant for PET bottles, for HDPE bottles, only the step of "strech blow molding" occurs		This comment was forwarded to the EC as such modelling was made by the remodellers in relationship with the EC (previous choice for the screening study was injection moulding only). The EC's answer is the following "To our knowledge, injection moulding is used for the pre-form, and stretch blow moulding is needed to give the bottle its final size. In case stretch blow moulding is not part of the dataset used for modelling the energy consumption in the factory, then having the extra process is correct." According to the text that accompanies the Stretch blow moulding is still unclear if the injection moulding part is included or not. As the EC and the remodellers were in contact with the database builder, we propose to keep the two processes together (and report the EC to have some clarity on the processes covered by each dataset).
VI.1.3.2. Secondary and Tertiary packaging	Table VI-6: parameters for the CFF for recycled content	technical	For the parameter Erecycled, it is mentioned "No specific default datasets": does it mean this part is not included? There is no consequence when R1 = 0 but there is some when R1 is not 0. Is it possible to define a proxy in case R1 is not 0 (e.g ErecycledEoL?)		it means no datasets are available for the kind of material used. This point will be clarified within the text.

Chapter	paragraph, figure, table	type[79]	review comment	review reco	practitioner response
VI.1.4. Transport of packaging to HDLLD manufacturing plant	Table VI-7: Transport of Packaging to the HDLLD manufacturing plant	technical	default data for packaging part transport (1000 km truck +18 000 km boat) seem overestimated.		This distance is the distance by default as stated by the EC. As this stage is not among the most relevant stages, we did not challenge this default data (or use another data that we should justify). This remark can be conveyed to the EC.
VI.2. Manufacturing	Table VI-8: Manufacturing	technical	The default data to be used for HDLL manufacturing are mentioned in the text as 0.25 kWh/kg detergent and 0.9 litre/kg of detergent. In table there are 0.16 kWh/kg and 0.6 litre/kg. Why is it different?		The text still displayed former default data by mistake. This will be changed and default data are the one used for the RP (screening and remodelling).
VI.2. Manufacturing	Table VI-8: Manufacturing	technical	Row Capital goods –equipment"; DQR score is lacking		ok, this will be added.
VI.3. Distribution stage		technical	"There is no loss of detergent product at the distribution and retail stage." The default data on the losses of cleaning products during distribution is specified as 5% in annex H of guidance v6.3.	Mention and justify why this default data is not used	According to our TS experts, the losses are below 1% as any higher percentage will have brought concerns to their business and required specific measures. Unfortunately, no recent study can be mentioned to support the experts' position. This position will be clarified into the text.
VI.4. Use stage	Table VI-12: Use stage	technical	"The use scenarios (compulsory and optional) are described in Table III-6" : the below table does not specify which data are compulsory and which are optional	Specify which is what (probably add a new row for electricity consumption calculated with specific wash T°) and add compulsory for the water consumption per wash.	ok, this will be added.
VI.5.1. Wastewater treatment		technical	This section does not describe how the fraction of waste water (with detergent) not connected to wwtp (8.4%) is	Please describe the default modelling.	Yes, a direct discharge to the environment has been considered in the screening as well as the remodelling. A text will be added to clarify this point.

Chapter	paragraph, figure, table	type[79]	review comment	review reco	practitioner response
			modelled: is it considered to be directly discharged into the environment		
VI.5.2. Municipal Solid waste management	Table VI-15: End of Life-Packaging	technical	Is it normal that for HDPE recycling, PP recycling process is mentioned (first row of the table).	If this is a proxy, section 7.19.5 of guidance v6.3 requires to list it as a data gap.	yes, this is a proxy. This will be mentioned as a data gap.
VI.5.2. Municipal Solid waste management	Table VI-15: End of Life-Packaging	technical	VI-16 is referred but this table does not show default value of pack material per FU	Correct the reference of the table	ok
VI.5.2. Municipal Solid waste management	Table VI-15: End of Life-Packaging	technical	For ErecyclinEol, a mix of 2 datasets is prescribed but the share of each of them is not specified.	Please mention the default share between the 2 datasets.	50/50, this will be added.
VI.5.2. Municipal Solid waste management	Table VI-15: End of Life-Packaging	technical	DQR scores are lacking for ErecyclingEol: recycling of polypropylene (PP) plastic. Same remark on the use of this dataset for LDPE recycling (proxy?) as above.	Add the scores and justify why this dataset was used. If this is a proxy, section 7.19.5 of guidance v6.3 requires to list it as a data gap.	ok (this is a proxy). Missing scores will be added.
VI.5.2. Municipal Solid waste management		technical	"The following table provides all the parameters to be used by the applicant to implement the CFF. Only R1 coefficient for primary packaging may differ from these default data." What if the geographic scope is not the average Europe Then, R2 and R3 should be adapted, no?	Please add that these data shall be used if the scope is the EU average and a sentence saying what to do in case of other geographical scope.	ok
VI.5.2. Municipal Solid waste management	Table VI-16: Parameters for the CFF	technical	LVH of PP and PE is the same whereas classically LVH PP> LVH PE. Can you check?	Correct if necessary	These are the values as provided in the default datasets. In addition, a check of LVH of PP and LVH of PE by our experts on different sources (e.g. EIA, Franklin, etc.) and very little difference (and even unclear) are mentioned.

Chapter	paragraph, figure, table	type[79]	review comment	review reco	practitioner response
VII.1. Benchmark values	Table VII-1: Characterized benchmark values	Ge	A column total (in addition to the ones life cyle stages excluding ue and use stage) would be relevant. Same rmark for noralised and weighted results.	Add if possible	This possibility has been checked with the EC (Imola Bedo). This amendment was agreed and even requested that we should add a total score (a sum of results on all ICs) for the weighted results.
VII.1. Benchmark values	Table VII-1: Characterized benchmark values	technical	The value for climate change total is read at 0.2869 in the Excel file, which gives with 2 digits rounding 2.87 10-1 instead of 2.86 10-1	Please correct	ok
X.4 Representative product		technical	The bill of ingredients 'as bought from the suppliers' and the Bill of Ingredients '100% active content' (reacted formulation) are lacking (these data are asked in the list of mandatory company-specific data in page 40)	Add them in this annex	The bill of ingredients as bought to the suppliers will be added.
X.4 Representative product		technical	Include the default data used for the density and the volume of detergent per bottle		Density is provided. As for volume per bottle, since the product is virtual, only mass of bottle plastic is available.
X.4 Representative product		technical	In this annex, it would be relevant to remind the dosage and T° of water for the use stage so to have all key data in the same section (and avoid the need to look for them in the whole document)		ok

X.4. Representative product (RP)

Dosage: 75 ml
Density: 1,02g/ml – weight of one dose: 0.0765 kg
Number of doses per sale unit: 24 doses
Stored volume of sale unit (L*W*H): 0.17*0.10*0.26=4.4E-3 m^3
Temperature: 40°C

Table X-1: Bill of ingredients (100% active substances)

Ingredients families	description of function *(source cleanright website)*	Type	Chemicals	CAS number	Unreacted formulation (% by mass)	Reacted formula (% by mass)
Water			water	7732-18-5	70.22%	71.64%
Builders	Reduces the effect of water hardness by removing calcium and magnesium ions and increases the effectiveness of the detergent.		citric acid	77-92-9	1.61%	0%
			salts of citric acid and other salts	68-04-2 6132-04-3	0.67%	2.58%
Sequestrants	Prevents free metal ions from causing any adverse effects on product performance, appearance, or stability by reacting with them.	phosphonates	sodium phosphonate	22042-96-2	0.41%	0.41%
Dye			dye		0.03%	0.03%
Enzymes	Enzymes are catalysts that increase the rate of chemical reactions, such as digestion and growth processes. In the detergent industry, commercial enzymes are used to help ensure a high degree of stain removal, whiteness, fabric and color care, and overall cleaning performance.		mannanase	37288-54-3	0.58%	0.58%
			protease	9014-01-01		
			amylase	9000-90-2		
			pectinase	9015-75-2		
			lipase	9001-62-1		
			other enzymes			
Fragrances	Offer an aesthetic experience for the packed detergent, during/after the washing and when wearing the washed fabrics.		fragrances		0.71%	0.71%
Optical brighteners	Makes the fabrics look brighter and whiter				0.06%	0.06%
Surfactant system	Used to change the surface tension of water to assist cleansing, wetting surfaces,	**anionic surfactants**	sodium alkyl ether sulfates (SLES)	68891-38-3	3.55%	3.55%

Ingredients families	description of function *(source cleanright website)*	Type	Chemicals	CAS number	Unreacted formulation (% by mass)	Reacted formula (% by mass)
(anionic – non-ionic)*	foaming and emulsifying (the suspension of one liquid evenly within another).		alkylbenzene sulfonate (LAS)	25155-30-0 26836-07-7 68910-32-7	6.83%	6.83%
		soap	oleochemicals fatty acid (cocoate, palm kernel, etc.)		2.41%	2.41%
		non-ionic surfactants	ethoxylates oleochemicals + petrochemical) & other non-ionic surfactants		5.91%	5.91%
Alkalinity sources	Increases the alkalinity of the product to aid dissolution of dirt.		sodium hydroxide	1310-73-2	1.72%	0%
			triethanolamine	102-71-6 141-43-5	0.59%	0.59%
Solvents	Used to dissolve other ingredients		glycerine	56-81-5	0.58%	0.58%
			glycols	57-55-6 2163-42-0	2.27%	2.27%
			other solvents			
Other ingredients		**preservatives**			0.02%	0.02%
		polymers			0.70%	0.70%
		salts			0.42%	0.42%
		others			0.70%	0.70%
Total					**100%**	

Bill of ingredients (as bought the suppliers): for the RP, an average concentration ratio of 74% has been considered. The total mass of ingredient transported to the manufacturing site is therefore 28.5g (indeed deionised water added on manufacturing site is not transported).

Packaging description

The Table X-2 presents the primary for *the representative product*.

Table X-2: Packaging description

Packaging components and materials	Representative product	Unit
Primary packaging		
Bottle in HDPE	3.7	g/reference flow
Cap (including dosing device + spout) in PP	0.8	g/reference flow
Paper labels	0.1	g/reference flow
Recycled plastic content	0%	%
Net detergent mass per bottle	1850	g
Secondary packaging		
Cardboard box	100/24	g/reference flow
LDPE plastic film	6.66/24	g/reference flow

The tertiary packaging is the default data as described in section VI.1.3.2.

Table X-3: Most relevant life cycle stages and processes- contribution for the RP

CLIMATE CHANGE	Representative product	contribution (whole LC)	contribution (excl. Use phase)	contribution with absolute value (whole LC)	contribution with absolute value (excl. Use phase)
Life cycle stages on the whole life cycle	1. Chemical ingredients sourcing and manuf	12%		12%	
	8. Product use	56%		55%	
	9. Wastewater treatment	23%		23%	
Life cycle stages on the whole life cycle excluding use phase	1. Chemical ingredients sourcing and manuf		27%		27%
	2. Packaging raw materials sourcing and manuf		6%		6%
	9. Wastewater treatment		51%		51%
Processes on the whole life cycle excluding use phase	**1.Chemical ingredients sourc.& manuf.**				
	Citric Acid (builder)		4%		4%
	Alkylbenzene sulfonate (surfactant anionic LAS)		4%		4%
	Alcohol Ether sulfate (petro based) (surfactant anionic SLEs)		2%		2%
	Alcohol Ether sulfate (oleo based) (surfactant anionic SLEs)				2%
	Propylene glycol (solvent)		3%		3%
	Enzymes		2%		2%
	2.Packaging raw mat. sourc.& manuf.				
	Plastic bottle material (HDPE granulates)		3%		3%
	3.Transport to processing plant for the ingredients				
	Transport by boat		3%		3%
	5.HDLLD manufacture				
	Electricity consumption		3%		2%
	6.Transport and Distribution to Retail				
	Electricity consumption		3%		3%
	Transport by truck		3%		3%
	9.Wastewater treatment				
	Wastewater treatment		51%		49%
Processes on the whole life cycle	**8.Product use**				
	Electricity consumption	52%		52%	
	Water consumption	3%		3%	

ACIDIFICATION	Representative product	contribution (whole LC)	contribution with absolute value (whole LC)
Life cycle stages on whole life cycle	1. Chemical ingredients sourcing and manuf	17%	17%
	3.Transport to processing plant for the ingredients	14%	14%
	8. Product use	43%	42%
	9. Wastewater treatment	15%	15%
Processes on the whole life cycle including use phase	**1.Chemical ingredients sourc.& manuf.**		
	Citric Acid (builder)	2%	2%
	Alkylbenzene sulfonate (surfactant anionic LAS)	2%	2%
	Propylene glycol (solvent)		2%
	3.Transport to processing plant for the ingredients		
	Transport by boat	14%	13%
	4.Transport to processing plant for the packaging		
	Transport by boat	4%	4%
	8.Product use		
	Electricity consumption	40%	39%
	Water consumption	3%	3%
	9.Wastewater treatment		
	Wastewater treatment	15%	15%

RESSOURCES USE-FOSSIL	Representative product	contribution (whole LC)	contribution (excl. Use phase)	contribution with absolute value (whole LC)	contribution with absolute value (excl. Use phase)
Life cycle stages on the whole life cycle	1. Chemical ingredients sourcing and manuf	17%		16%	
	8. Product use	66%		64%	
Life cycle stages on the whole life cycle excluding use phase	1. Chemical ingredients sourcing and manuf		49%		46%
	2. Packaging raw materials sourcing and manuf		16%		15%
	6. Distribution to retail (transport & storage)				5%
	9. Wastewater treatment		17%		16%
Processes on the whole life cycle excluding use phase	**1.Chemical ingredients sourc.& manuf.**				
	Alkylbenzene sulfonate (surfactant anionic LAS)		12%		11%
	Propylene glycol (solvent)		6%		5%
	Citric acid (builder)		5%		5%
	Alcohol Ether sulfate (petro based) (surfactant anionic SLEs)		4%		4%
	Alcohol ethoxylate petro 3 M (surfactant non-ionic)		3%		2%
	Alcohol Ether sulfate (oleo based) (surfactant anionic SLEs)		3%		2%
	Alcohol ethoxylate petro 7 M (surfactant non-ionic)		2%		2%
	AlcoholEthoxylate (oleo), >20 moles (surfactant non-ionic)				2%
	AlcoholEthoxylate (oleo) 7 moles (surfactant non-ionic)				2%
	Polycarboxylate (polymer)				1%
	2.Packaging raw mat. sourc.& manuf.				
	Plastic bottle material (HDPE granulates)		11%		10%
	Screw cap		3%		2%
	Corrugated box				1%
	3.Transport to processing plant for the ingredients				
	Transport by boat		4%		3%
	5.HDLLD manufacture				
	Electricity consumption		4%		4%
	6.Transport and Distribution to Retail				
	Electricity consumption		5%		5%
	Transport by truck (diesel at refinery)		4%		3%
	9.Wastewater treatment				
	Wastewater treatment		17%		15%
Processes on the whole life cycle	**8.Product use**				
	Electricity consumption	63%			
	Water consumption	3%			

PARTICULE MATTER	Representative product	contribution (whole LC)	contribution with absolute value (whole LC)
Life cycle stages on the whole life cycle	1. Chemical ingredients sourcing and manuf	28%	27%
	3.Transport to processing plant for the ingredients	11%	11%
	8. Product use	45%	44%
Processes on the whole life cycle including use phase	**1.Chemical ingredients sourc.& manuf.**		
	Alcohol Ether sulfate (oleo based) (surfactant anionic SLEs)	4%	4%
	Propylene glycol (solvent)	4%	4%
	Alkylbenzene sulfonate (surfactant anionic LAS)	3%	3%
	Alcohol Ether sulfate (petro based) (surfactant anionic SLEs)	3%	3%
	3.Transport to processing plant for the ingredients		
	Transport by boat	11%	10%
	4.Transport to processing plant for the packaging		
	Transport by boat	3%	3%
	8.Product use		
	Electricity consumption	40%	39%
	Water consumption	5%	5%
	9.Wastewater treatment		
	Wastewater treatment	8%	8%

IONISING RADIATION	Representative product	contribution (whole LC)	contribution (excl. Use phase)	contribution with absolute value (whole LC)	contribution with absolute value (excl. Use phase)
Life cycle stages on the whole life cycle	8. Product use	88%		87%	
Life cycle stages on the whole life cycle excluding use phase	1. Chemical ingredients sourcing & manuf		27%		25%
	5. HDLLD manufacture		15%		14%
	6. Distribution to retail (transport & storage)		18%		17%
	9.Wastewater treatment		30%		28%
Processes on the whole life cycle excluding use phase	**1.Chemical ingredients sourc.& manuf.**				
	Citric Acid (builder)		7%		6%
	Propylene glycol (solvent)		3%		3%
	Enzymes		3%		3%
	Sodium hydroxide (alkalinity sources)				2%
	2.Packaging raw mat. sourc.& manuf.				
	injection moulding		5%		5%
	HDPE granulate				3%
	Stretch Blow Moulding				2%
	5.HDLLD manufacture				
	Electricity consumption		14%		13%
	6.Transport and Distribution to Retail				
	Electricity consumption		18%		17%
	9.Wastewater treatment				
	Wastewater treatment		30%		28%
Processes on the whole life cycle	**8.Product use**				
	Electricity consumption	84%		83%	
	Water consumption	3%		3%	

X.5. Instructions for aligning the treatment of detergent wastewater dataset to the water consumption dataset at the use phase (EU average scenario)

The geographical mix for the water consumption in Europe (dataset 212b8494-a769-4c2e-8d82-9a6ef61baad7 Tap Water) is different than the one for the Wastewater Treatment in Europe (dataset 3b023f1c-6324-4597-90da-954a26e58e9b (Treatment of detergent wastewater)). Therefore, the water emissions of the Wastewater Treatment plant dataset should be manually corrected to be aligned with the water consumption dataset at Use Stage.

As the water impact of the indicator Water Scarcity (b2ad66ce-c78d-11e6-9d9d-cec0c932ce01) is regionalized, the consumption of 1 liter of water (with the Tap water dataset) does not show the exact opposite impact of the release of 1 liter of water (with the Wastewater Treatment dataset). The same amount of water is consumed and then released; it is then expected that the impact on Water Scarcity of consumption is exactly compensated by the release. Therefore, a correction is required.

Five steps are required to do this correction

1) **Assess the water impact for the Wastewater Treatment plant dataset.** The impact on Water Scarcity is **-9.95 E-3 m³ eq. water / liter** = Original Water impact of water release.

2) **Create a compensatory dataset to remove the water impact of Wastewater Treatment plant dataset.**
   This dataset must show an impact of **+9.95 E-3 m³ eq. water / liter** = *minus* Original Water impact of water release.
   This can be done in several ways depending on the software used. Here is an example:
   - Pick up any characterized flow in the Water Scarcity indicator and its characterization factor (example: Water emissions to water in Aruba – AW with a CF = *-100 m³ eq. Water / kg*).
   - Create a dataset containing only this flow with an amount equal to the expected impact divided by its characterization factor (example: Water emissions to water in Aruba – AW with an amount = *-9.95E-5 kg*).

   The compensatory dataset is connected to the Wastewater Treatment plant dataset.
   The impact on Water Scarcity of the sum of both datasets (Wastewater Treatment + Compensatory dataset) is now null.

3) **Assess the water impact for the water consumption dataset.**
   The impact on Water Scarcity is **+4.31 E-2 m³ eq. water / liter** = Water impact of water consumption.

4) **Create a correction dataset to add the water impact for Wastewater Treatment plant dataset "corrected".**
   This dataset must show an impact of **-4.31 E-2 m³ eq. water / liter** = *minus* Water impact of water consumption.
   This can be done in several ways depending on the software used. Here is an example:
   - Pick up any characterized flow in the Water Scarcity indicator and its characterization factor (example: Water emissions to water in Aruba – AW with a CF = *-100 m³ eq. Water / kg*).
   - Create a dataset containing only this flow with an amount equal to the expected impact divided by its characterization factor (example: Water emissions to water in Aruba – AW with an amount = *4.31-4 kg*).

   The correction dataset is also connected to the Wastewater Treatment plant dataset.

   The impact on Water Scarcity of the sum of the three datasets (Wastewater Treatment + Compensatory dataset + Correction dataset) does now equal the opposite of the impact of the tap Water dataset (minus 4.31E-2 m³ eq. water / liter).