JOINT RESEARCH CENTRE
Institute for Prospective Technological Studies (IPTS)

Revision of European Ecolabel Criteria for Laundry Detergents

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PRELIMINARY REPORT

for

THE REVISION OF ECOLOGICAL CRITERIA FOR LAUNDRY DETERGENTS: DOMESTIC AND INDUSTRIAL AND INSTITUTIONAL

1) Introduction
2) Legal review, scope and definition
3) Market analysis
4) Technical/environmental analysis
5) Innovation and improvement potential

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October 2014

JRC EUROPEAN COMMISSION

Institute for Prospective Technological Studies

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Working Document

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DG JRC (IPTS) October 2014

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ABBREVIATIONS AND ACRONYMS

A.I.S.E	Association for Soaps, Detergents and Maintenance Products (trade body)
aNBO	aerobically non-biodegradable
anNBO	anaerobically non-biodegradable
APD	alkyl phenol derivative
APEO	alkyl phenol ethoxylate
ASP	Advanced Sustainability Profile
BCF	bioconcentration factor
BOD	biochemical oxygen demand
BRIC	Brazil, Russia, India and China
CAGR	compound annual growth rate
CDV	critical dilution volume
CFC	chloro-fluorocarbon
CLP	(EU Regulation on the) Classification, Labelling and Packaging of Substances and Mixtures
COMEXT	statistical database on trade of goods managed by Eurostat
DF	degradation factor
DID list	Detergents Ingredient Database
DTPA	diethylene triamine pentaacetic acid
EC	European Commission
EC50	median effective concentration
ECHA	European Chemicals Agency
EDTA	ethylenediaminetetracetic acid
EEA	European Economic Area
EU	European Union
ETSA	European Textile Services Association
FSC	Forest Stewardship Council
FWA	fluorescent whitening agent
GDP	gross domestic product
GHG	greenhouse gas
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
GLDA	glutamic acid di-acetic acid
GPP	green public procurement
HSNO	Hazardous Substances and New Organisms (Act)
HDPE	high density polyethylene
I&I	industrial and institutional
IC50	median inhibition concentration
IFRA	International Fragrance Association
IILD	industrial and institutional laundry detergents
IKW	Industrieverband Körperpflege- und Waschmittel e. V.
ISO	International Organisation for Standards
K_{OW}	octanol-water partition coefficient
LCA	life cycle assessment
LCIA	life cycle impact assessment
LC50	median lethal dose
LD	laundry detergents
LDPE	low density polyethylene
LOEC	lowest observed effect concentration
MGDA	methylglycin di-acetic acid
n.e.c.	not elsewhere classified
NOEC	no observed effect concentration
NLT	natural land transformation
n.p.r.s	Not packaged for retail sale
NTA	nitrilo tri-acetic acid

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PBT	persistent, bio-accumulable and toxic
PP	polypropylene
ppm	parts per million
PRODCOM	PRODuction COMmunautaire (Community Production)
p.r.s	Packaged for retail sale
PVC	polyvinyl chloride
REACH	Registration, Evaluation, Authorisation and restriction of CHemicals
SCHER	Scientific Committee on Health and Environmental Risks
SVHC	substances of very high concern
TCmax	total chemicals maximum dosage limit
vPvB	very persistent and very bio-accumulable
WUR	weight/utility ratio

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TERMS AND DEFINITIONS

Domestic laundry detergent (LD)	This term is used to denote laundry detergent products which are intended for use principally in household machines, but may also include use of household machines in laundrettes and common laundries. May be used interchangeably with the term 'household laundry'.
Industrial and institutional laundry detergent (IILD)	This term is used to denote laundry detergent products which are intended for use solely by professional users in the industrial and institutional sector. May be used interchangeably with professional laundry.
Bio-accumulative	The tendency for a substance to be accumulated in an organism due to difference in the rate of intake and loss of the substance from the organism.
Biocide	Chemicals used to suppress organisms that are harmful to human or animal health, or that cause damage to natural or manufactured materials.[1]
Biocidal products	Active substances and preparations containing one or more active substances, put up in the form in which they are supplied to the user, intended to destroy, render harmless, prevent the action of, or otherwise exert a controlling effect on any harmful organism by chemical or biological means.[2]
Detergent	Any substance or preparation containing soaps and/or other surfactants intended for washing and cleaning processes. Detergents may be in any form (liquid, powder, paste, bar, cake, moulded piece, shape, etc.) and marketed for or used in household, or institutional or industrial purposes.[3]
Enzyme	Proteins that speed up the rate of chemical reactions without interacting in the reactions themselves.
ISO 14024 Type I Environmental label	A voluntary multicriteria-based, third party program that awards a license that authorises the use of environmental labels on products indicating overall environmental preferability of a product within a particular product category based on life cycle considerations.
EU Ecolabel	The ISO 14024 Type I environmental label from the European Union that is valid throughout Europe.
Surfactant	Any organic substance and/or mixture used in detergents, which has surface-active properties and that consists of one or more hydrophilic and one or more hydrophobic groups of such a nature and size that it is capable of reducing the surface tension of water, and of forming spreading or adsorption monolayers at the water air interface, and of forming emulsions and/or micro-emulsions and/or micelles, and of adsorption at water-solid interfaces.3
Standard	A document established by consensus and approved by a recognised body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

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[1] For more details see: http://ec.europa.eu/environment/chemicals/biocides/index_en.htm.
[2] Based on Regulation (EC) No 528/2012of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (L 167/1 OJEU 27.8.2012) Available from: http://ec.europa.eu/environment/chemicals/biocides/index_en.htm.
[3] Regulation (EC) No 648/2004 2012of the European Parliament and of the Council of 31 March 2004 on detergents (OJ L 104, 8.4.2004) Available from: http://ec.europa.eu/enterprise/sectors/chemicals/documents/specific-chemicals/detergents/.

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1. INTRODUCTION

1.1 Background

The EU Ecolabel initiative is a policy instrument designed to encourage the production and use of more environmentally friendly products and services through the certification and specification of products or services which have a reduced environmental footprint. It forms part of the European Commission's action plan on Sustainable Consumption and Production and Sustainable Industrial Policy adopted on 16 July 2008.[4]

The EU Ecolabel is a voluntary scheme coordinated by the European Commission[5] which is used to distinguish environmentally beneficial products and services. The EU Ecolabel is awarded through a process in which an applicant has to demonstrate that the specified Ecolabel criteria for a particular product group are met. Successful applicants are then allowed to use the EU Ecolabel logo and to advertise their product as having been awarded the EU Ecolabel.

1.2 Purpose of this document

This document forms part of the process of revising existing EU Ecolabel criteria for laundry detergents and encapsulates the activities and outputs of Tasks 1-4 (i.e. goal and scope definition, market analysis, technical analysis and analysis of innovation and improvement opportunities). This report represents a first evaluation of likely areas for investigation as a result of stakeholder surveys, market analysis and known concerns with existing criteria including, amongst others, changes in hazardous substance classification. In doing so, it identifies where there is scope for strengthening the EU Ecolabel criteria through amendments, removal or further development.

The information contained in this document provides an overview of changes to the laundry detergents market since the last revision of the criteria in 2011, and a technical analysis to understand where the greatest environmental impacts arise in the life cycle of laundry detergents.

This report is also being used as a consultation document to gain feedback, evidence and opinion from stakeholders and experts on proposed changes and significant environmental issues. This document covers the EU Ecolabel criteria for both domestic and industrial & institutional laundry detergents.

1.3 EU Ecolabel for laundry detergents

The EU Ecolabel criteria for laundry detergents (LD) were adopted in 2011 (Commission Decision 2011/264/EU) and the ones for industrial and institutional laundry detergents' (IILD) in 2012 (Commission Decision 2012/721/EU)[6] The aim of these criteria documents was to promote laundry detergents that corresponded to the best 10-20 % of the products available on the Community market in terms of environmental performance considering the whole life-cycle of production, use and disposal. These criteria documents are due to expire in 2016. A breakdown of EU Ecolabel products for the LD and IILD categories can be found in Section 2.2, "Scope and definition", of this report.

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[4] Communication from The Commission to The European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions on the sustainable consumption and production and sustainable industrial policy action plan, Brussels 16.7.2008. Available from: http://ec.europa.eu/environment/eussd/pdf/com_2008_397.pdf

[5] Regulation (EC) No 66/2010 of The European Parliament and of The Council of 25 November 2009 on the EU Ecolabel. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:027:0001:0019:en:PDF

[6] Documents available at http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html

1.4 Investigation overview

The revision process takes the existing criteria documents as the starting point and seeks to update these, taking into account technological and economic changes in the European market, relevant legislative changes and improved scientific knowledge.

To review the existing EU Ecolabels, the following aspects have been investigated:

1) Product definition and categorisation of domestic LD and IILD.
2) The reasons that support keeping the two sets of criteria separate.
3) An economic and market analysis.
4) Technical analysis including environmental performance investigation of the laundry detergents product groups.
5) Product innovations and improvement opportunities for laundry detergents.

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2. LEGAL REVIEW, SCOPE AND DEFINITION

2.1 Introduction

The aim of the first task is to conduct a review of the practicality of the existing product group definition and scope. The areas where the existing criteria and scope are no longer in line with current legislation or market conditions will be identified. The review will consider: feedback from stakeholders, literature reviews, legal reviews and alternative ecolabels. This first task has been divided into the following sub-tasks:

1) An introduction to the existing product scope and definition.
2) A summary of the feedback received from the stakeholder questionnaire.
3) A review of existing EU legislation that is likely to affect the criteria revision.
4) A review of alternative and national ecolabels for laundry detergents.
5) An investigation into the need for separate criteria for LD and IILD.
6) The proposed scope and definitions for the LD and IILD categories.
7) Recommendations for revision of existing criteria based on stakeholder feedback.
8) A summary of the proposed changes to the criteria which require further investigation.

As a key element of this task a stakeholder survey has been conducted, a blank copy of which can be found in Annex I. The survey has been used to gain viewpoints of the successes and failings of the criteria and to guide the development of the criteria revision. The survey addressed principal questions such as: the validity of the product group, definition and scope, the potential for merging LD and IILD criteria, additional technological or environmental matters that have arisen since the previous revision and issues with specific criteria. Outputs from the stakeholder survey have been used throughout this section of the report.

2.2 Scope and definition

2.2.1 ***Product definition***

Before investigating the classification and definition of laundry detergent products, it is important that key concepts of the product, such as its composition, are fully described. Within the context of the EU Ecolabel and this report, the definition used for laundry detergents is taken from Regulation (EC) No 648/2004 (the Detergents Regulation).[7]

> *'Detergent' means any substance or mixture containing soaps and/or other surfactants intended for washing and cleaning processes. Detergents may be in any form (liquid, powder, paste, bar, cake, moulded piece, shape, etc.) and marketed for or used in household, or institutional or industrial purposes.*
>
> *'Auxiliary washing mixture' is intended for soaking (pre-washing), rinsing or bleaching clothes, household linen, etc.*
>
> *'Laundry fabric-softener' is intended to modify feel of fabrics in processes which are to complement the washing of fabrics.*

Before discussing in detail the classification of laundry detergents, it is important that certain key concepts of their composition are described. Laundry detergent formulations are made up of several components which include surfactants, builders, biocides/preservatives, bleaches, enzymes, optical brighteners, fragrances, dyes, solvents and fillers. As a result, the overall composition of detergents varies significantly and this will affect the impact of the product on the environment, human health and costs. A brief overview of the functions of the main ingredients can be found in Annex II.

[7] Regulation (EC) No 648/2004 of the European Parliament and the Council of 31 March 2004 on detergents. Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:104:0001:0035:en:PDF

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2.2.2 *Current EU Ecolabel product scope and definition*

Commission Decision 2011/264/EC[8] establishing the Ecolabel criteria for the award of the EU Ecolabel for laundry detergents and Commission Decision 2012/721/EC[9] establishing the ecological criteria for the award of the EU Ecolabel for Industrial and Institutional Laundry Detergents define 'laundry detergents' and 'industrial and institutional laundry detergents' as the following:

> ***Laundry detergents:*** *The product group 'Laundry Detergents' shall compromise: laundry detergents and pre-treatment stain removers whether in powder, liquid or any other form which are marketed and used for the washing or textiles principally in household machines but not excluding their use in laundrettes and common laundries.*
>
> *Pre-treatment stain removers include stain removers used for direct spot treatment of textiles (before washing in the machine) but do not include stain removers dosed in the washing machine and stain removers dedicated to other uses besides pre-treatment.*
>
> *This product group shall not comprise products that are dosed by carriers such as sheets, cloths or other materials nor washing auxiliaries used without subsequent washing such as stain removers for carpets and furniture upholstery.*
>
> ***Industrial and institutional laundry detergents:*** *The product group 'Industrial and Institutional Laundry Detergents' shall comprise: laundry detergent products performed by professional users in the industrial and institutional sector.*
>
> *Included in this product group are multi-component-systems constituting of more than one component used to build up a complete detergent or a laundering program for automatic dosing system.*
>
> *This product group shall not comprise products for obtaining textile attributes such as water-repellent, waterproof or fire-proof, etc. Furthermore, the product group shall not comprise products that are dosed by carriers such as sheets, cloths or other materials, as well as washing auxiliaries used without subsequent washing, such as stain removers for carpets and furniture upholstery.*
>
> *Consumer laundry products are excluded from the scope of this product group.*

2.3 Feedback from stakeholder consultation

To obtain feedback on the current EU Ecolabel product scope and definition for LD and IILD, a questionnaire was sent to stakeholders (see blank copy in Annex I). The target groups for the questionnaire were European Ecolabel competent bodies, industry, technology institutes and trade associations. Eighteen stakeholders formally responded to the consultation by returning the completed questionnaire. The respondents feature a mixture of stakeholders, as summarised in Table 1.

Table 1: Summary of respondents to questionnaire

Stakeholder	Number of respondents
Competent bodies	3
Environment Agency	1
Industry	10 (5 IILD, 1 LD, 4 both)
Consulting agency	1

[8] Commission Decision of 28 April 2011 on establishing the ecological criteria for the award of the EU Ecolabel for laundry detergents (notified under document C(2011) 2815), 2011/264/EU

[9] Commission Decision of 14 November 2012 on establishing the ecological criteria for the award of the EU Ecolabel for Industrial and Institutional Laundry Detergents, (notified under document C(2012) 8055). 2012/721/EU

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Research institute	1

The consultation invited comments on the proposal to merge LD and IILD criteria, as well as feedback on existing criteria and proposed changes. The responses are summarised for both LD and IILD in Table 2. Further detail of the respondents' suggestions can be found later in this section.

Table 2: Summary of questionnaire analysis

Criterion	No. of responses	Summary of responses
Scope and definition	18/19	60 % of respondents agreed with the existing products in scope for LD, and over 80 % of respondents agreed with the existing products in scope for IILD. For the LD category, respondents called for the addition of fabric softeners and in-wash stain removers. Seven of the respondents suggested that fabric softeners should be included within scope. When asked if the product category should include other stain removers in addition to pre-treatment ones, five of the stakeholders said that in-wash stain removers should be included. No specific reasons were given for why fabric softeners should be included - or indeed excluded - from the criteria. For the IILD category, three of the stakeholders suggested that the scope should be extended to cover products for obtaining textile attributes such as water proofing. It was also added that with the current definition for IILD it is unclear whether or not softeners, rinsing aids and stain removers are covered by multi-component systems. Some useful additional comments were made, such as: “Clearly describe in the application that the product group covers complete powders and complete liquid detergents as well as multi-component systems”. 80 % of respondents considered that the LD and IILD criteria, and therefore EU Ecolabels, should remain separate.
Dosage requirements	17/19	Over 80 % of the respondents thought that the existing criteria for dosage requirements for LD are strict enough. Only 20 % of the respondents thought that additional dosage requirements, such as maximum dosage limits are needed for IILD. In terms of water hardness, the general comments (for both LD and IILD) were that in Europe there are significant differences in water hardness and the criteria should take this into account.
Toxicity to aquatic organisms	16/19	Only 25 % of the respondents thought that the existing critical dilution volume (CDV) values for LD are not effective in distinguishing the best environmentally performing products on the market. All 14 of the respondents to the question agreed that the current CDV criteria for IILD are strict enough for promoting the best top environmental performers A general comment (for both LD and IILD) from the feedback was that the CDV values should be recalculated in accordance with the revised DID list.
Excluded or limited substances	18/19	30 % of respondents considered that there are additional ingredients which should be excluded or limited from EU Ecolabel detergents. Stakeholders provided several suggestions for additional substances/mixtures for which exclusion/limitations should be considered. Including peracetic acid, hydrogen peroxide, endocrine disruptors and surfactants classified with H412. Apart from the feedback received through the stakeholders consultation, DG ENV received a request for derogating the enzyme subsitilisin that has recently changed classification

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Criterion	No. of responses	Summary of responses
Bio-degradability	16/19	The majority of respondents, over 90 %, thought that the current limits set for aNBO and anNBO for LD are strict enough when considering the laundry detergents currently on the market. However, opinion was divided on whether specific requirements should apply to the biodegradability of surfactants for LD. With just under 50 % of respondents to the question, replying that specific requirements should apply and the remaining respondents replying that they should not apply. This question was not asked for IILD as there is already a requirement for all surfactants to be biodegradable in the IILD criteria.
Packaging requirements	15/19	Most stakeholders did not support the suggestion that additional criteria should be set to further promote the use of recycled materials in packaging, with only 15 % of respondents agreeing to this statement. However, the feedback did provide several suggestions for the packaging criteria, such as promoting recyclability through the use of easy-to-access concepts. For IILD one of the stakeholders questioned the relevance of WUR for professional products.
Washing performance	8/19	Stakeholders were asked to give general comments on the washing performance tests. The majority of respondents had no further comments to make and were happy with the current testing procedure.
Points (LD only)	15/19	Almost 75 % of respondents thought that the points system effectively promotes cold water and low temperature products. When asked about what further measures could be taken to promote low temperature washing, stakeholders suggested that more information should be provided to consumers.
User/ consumer information	14/19	Over 90 % of all respondents thought that the requirements for dosage instructions in the existing criteria are efficient. In general few comments were received regarding criteria on user and consumer information. Two of the stakeholders suggested that the consumer information should be up to the manufacturer to propose for LD.

2.4 Review of legislation – key changes since the previous criteria revision

2.4.1 *Ecolabel Regulation*

Regulation EC/1980/2000[10] on a *revised Community eco-label award scheme* was replaced by Regulation EC/66/2010 on the *EU Ecolabel* (the Ecolabel Regulation) to increase its effectiveness and streamline its operation. A number of key changes, relevant to this product group, were incorporated:

1) Criteria would be determined on a scientific basis (Ecolabel Regulation - Art. 6.3).
2) There would be a focus on the most significant environmental impacts over the product life cycle (Ecolabel Regulation - Art. 6.3.a).
3) The substitution of hazardous substances with safer substances (Ecolabel Regulation – Art. 6.3.b).
4) Any substances classified according to CLP[11] as hazardous to the environment, toxic, carcinogenic, mutagenic or toxic for reproduction (CMR) and referred to in Art. 57 of Regulation EC/1907/2006 (REACH Regulation) would be restricted (Ecolabel Regulation - Art. 6.6).

[10] Regulation (EC) No 1980/2000 of the European Parliament and of the Council of 17 July 2000 on a revised Community eco-label award scheme

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5) Derogations may be given in respect of the above, if substitution or use of alternative materials is not technically feasible. However no derogations are possible in respect of substances of very high concern (SVHC) identified in accordance with the procedure set out in REACH - Art. 59 (Ecolabel Regulation - Art. 6.7).

2.4.2 *Revision to the Detergents Regulation*

The 2012 Revision to the Detergents Regulation[12] regulates the use of phosphates and other phosphorus compounds in consumer laundry detergents and consumer automatic dishwasher detergents in the EU (see Regulation (EU) No 259/2012).[13] The Revision limits the use of phosphorus compounds in laundry detergents to reduce their contribution to eutrophication and the cost of their removal during wastewater treatment. The limit applies to both phosphorus and its compounds, so that the one is not simply substituted for the other.

The 2012 Revision defines laundry detergents as *"a detergent for laundry placed on the market for use by non-professionals, including in public laundrettes".* The Revision notes that technically and economically- feasible alternatives to the use of phosphates and phosphorus compounds in IILD are not yet available.

It expresses concern that phosphate-based substitutes (phosphonates) pose a potential risk to the environment. Accordingly, it encourages producers to use alternative substances with a more environmentally-friendly profile than phosphate-based substitutes in the manufacture of laundry detergents. The Revision is clear that these alternative substances should either be risk-free or pose only a limited risk to humans and the environment (under normal conditions of use). Where appropriate, the framework for assessing chemical risk as described by the REACH system will be used to evaluate the suitability of these alternative substances.

The 2012 Revision also lays down requirements for dosage information to be clearly indicated on laundry detergent package labelling. The laundry detergent producer is required to indicate a recommended standard dosage (in either grams or millilitres) for a standard washing machine load[14] operating on a normal washing cycle. The producer should also indicate different dosages for soft, medium, and hard water hardness, and should also make provision for one- or two-cycle washing processes. The producer is also required to indicate, in either millilitres or grams, the capacity of any provided measuring cup. The provided measuring cup should also have markings to indicate the dosage of detergent appropriate for a standard washing machine load at soft, medium and hard water hardness levels.

The Revision also requires manufacturers of *heavy-duty detergents* (standard laundry detergents) to indicate the number of standard washing machine loads of *"normally soiled"* fabrics that can be washed using the contents of the laundry detergent package, with water of medium hardness (2.5 millimoles of $CaCO_3$ per litre). Manufacturers of *light-duty detergents* (detergents for delicate fabrics) are required to indicate the number of standard washing machine loads of *"lightly soiled"* fabrics that can be washed using the contents of the laundry detergent package, with water of medium hardness (2.5 millimoles of $CaCO_3$ per litre).

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[11] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

[12] Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents

[13] Regulation (EU) No 259/2012 of the European Parliament and of the Council of 14 March 2012 amending Regulation (EC) No 648/2004 as regards the use of phosphates and other phosphorus compounds in consumer laundry detergents and consumer automatic dishwasher detergents

[14] Commission Decision 1999/476/EC *establishing the Ecological Criteria for the award of the Community Eco-label to Laundry Detergents* defines a standard washing machine load as 4.5 kg of dry fabric for heavy-duty detergents and 2.5 kg of dry fabric for light-duty detergents. Laundry detergents are generally considered to be *heavy-duty detergents*, unless the primary claim of the manufacturer is that the detergent promotes fabric care (i.e. low temperature wash, delicate fibres and colours), in which case the detergent is classed as a *light-duty detergent.*

2.4.3 *The Biocides Regulation (EC) No 528/2012*

The EU Biocidal Products Directive (98/8/EC)[15] applies to insecticides and products that have anti-microbial properties, including disinfectants. In laundry detergents, biocides may be used in small amounts as preservatives to maintain product quality. The original Biocidal Products Directive (98/8/EC) regulated the placing of biocidal products on the EU market. The Directive applied only to products containing active agents that imparted biocidal properties to the product into which they were incorporated.

Under to the 1998 Biocidal Products Directive, active substances had to be assessed at the Community level. Once an active substance had been assessed, it could be included in Annex I. Each Member State was then required to authorise products containing the biocide before they could be placed on the market in that individual Member State. Once authorised by one EU Member State, the product could then be placed on the market in any other EU Member State.

Regulation (EU) No 528/2012[16] *concerning the making available on the market and use of biocidal products* repeals and replaces the 1998 Biocidal Products Directive. Under the 2012 Biocides Regulation, each EU Member States retains the obligation to authorise products containing biocides before they can be placed on the market in that individual Member State. In addition, the rules on the mutual recognition of existing authorisations have been simplified to speed up decision-making, facilitate market access to other Member States, and avoid duplication.

Under the 2012 Biocides Regulation, the mandate for the regulation of biocidal products has been transferred to the European Chemicals Agency (ECHA), with the aim being further convergence with the biocidal requirements of REACH. The Biocides Regulation also establishes a *Register for Biocidal Products*, which allows the Member States, the Commission and ECHA to make available to each other the particulars and scientific documentation submitted in connection with applications for authorisation of biocidal products.

2.4.4 *Classification, Labelling and Packaging of Chemical Substances and Mixtures*

The use of many (often incompatible) national systems for providing information on hazardous properties and control measures of chemicals requires multiple labels and Safety Data Sheets for the same product. This causes confusion for customers of these chemicals and increases the burden on companies complying with many different regulations. To address this, the EU Regulation (EC) No 1272/2008[17] on the Classification, Labelling and Packaging of Substances and Mixtures (the CLP Regulation) was developed to harmonise the process, requiring only one set of labels for all products sold throughout the EU.

The CLP Regulation entered into force on 20 January 2009 and implemented the UN Globally Harmonised System (GHS) at EU level. The new system of classification, labelling and packaging was implemented by 1 December 2010 for substances, and will be implemented by 1 January 2015 for mixtures. However, substances and mixtures will still have to be classified and labelled according to the predecessor Dangerous Substances Directive (67/548/EEC)[18] and the Dangerous Preparations Directive (1999/45/EC)[19], until 1 June 2015.

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[15] Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market

[16] Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

[17] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

[18] Directive 67/548/EEC of the European Parliament and of the Council of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.

[19] Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations.

2.5 Review of national ecolabelling schemes

The aim of this section is to identify which alternative national labels have product categories for laundry detergents and what are their fundamental criteria. Besides the EU Ecolabel, which operates Europe-wide, there are national labels in Europe that can be sought out for laundry detergents, e.g. Nordic Swan and Czech Ecolabelling. A number of labels are also used elsewhere, including 'Green Seal' (predominantly used in the USA) and the 'Environmental Choice' labelling programme (New Zealand).[20] In general, labels can be categorised as either single-attribute or multi-attribute standards. Single attribute refers to certifications which only relate to one environmental characteristic, whereas multi-attribute certifications relate to more than one environmental characteristic. As the EU Ecolabel is a multi-attribute certification, only multi-criteria ecolabels will be compared in this section. An overview of alternative voluntary labelling schemes is presented in Table 3. A rough review of international standards relevant to laundry detergents revealed that standards are related directly to washing machines and the testing of washing and attributes of ingredients of detergents rather than the laundry detergent itself. Thus they are of little significance for the definition revision.

Table 3: Alternative voluntary labelling schemes and standards

Labelling programs	Region	Product category	Date of adoption/last revision
Nordic Swan	Denmark, Finland, Iceland, Norway, Sweden.	Laundry detergents and stain removers[21]	Version 7.6 – 15 December 2011 to 31 December 2017
		Laundry detergents for professional use[22]	Version 3.0 19 March 2014 – 31 March 2019
Blue Angel	Germany	No criteria for laundry detergents	N/A
Austrian Ecolabel	Austria	No criteria for laundry detergents	N/A
Czech Ecolabelling	Czech Republic	03-2012 Detergents[23]	Revised 2012
		72-2013 Detergents used in industry and institutions[24]	Revised 2013
Bra Miljöval (Good Environmental Choice)	Sweden	Chemical products[25]	December 2006
AFNOR-ADEME	France	BP X30-323-2 Household Heavy Duty Laundry Detergents[26]	December 2012
P&G Future Friendly	UK	No categories, only Procter & Gamble products can be awarded the label	Launched in the UK in 2007
Ecocert[27]	Global (founded	Natural detergents and Natural	Last revised May 2012

[20] Information on ecolabels on detergents, including laundry detergents can be found on the following website: http://www.globalecolabelling.net/categories_7_criteria/list_by_product_category/1301.htm?xhighlightwords=detergents

[21] Nordic Ecolabelling of Laundry detergents and stain removers, Version 7.6, 15 December 2011 – 31 December 2017. Available from: http://www.nordic-ecolabel.org/criteria/product-groups/?p=2

[22] Nordic Ecolabelling of Laundry detergents for professional use, Version 3.0, 19 March 2014 – 31 March 2019. Available from: http://www.nordic-ecolabel.org/criteria/product-groups/?p=2

[23] Technical Guidelines Detergents, V03, 2012, Ministry of Environment available from: http://www.cenia.cz/web/www/web-pub2.nsf/$pid/MZPMSFHMV9DV/$FILE/032012.pdf

[24] Technical Guidelines Detergents used in industry and institutions, V72, 2013, Ministry of Environment available from: http://www1.cenia.cz/www/sites/default/files/722013.pdf

[25] Good Environmental Choice criteria: Chemical products, Version 2006:4, Swedish Society for Nature Conservation, available from: http://www.naturskyddsforeningen.se/sites/default/files/dokument-media/bra-miljoval-engelska/bmv-kem-chemical-crit.pdf

[26] General principles for an environmental communication on mass market products: methodology for the environmental impacts assessment of household heavy duty laundry detergents, BP X£)-323-2, ADEME, December 2012. Available from: http://www.base-impacts.ademe.fr/documents/RG_detergents.pdf

[27] Ecocert is a certification body and not a program labelling. However, they have also expertise in developing standards, especially related to detergents that have no petrochemical ingredients. The standards is the result of a partnership between ECOCERT Greenlife, a certification body in the environmental field, and certain detergent professionals who have long expressed the need to find a solution to the detergent problems. http://www.ecocert.com/sites/default/files/u3/Natural-Detergents-made-with-Organic-Ecocert-Greenlife-11.05.2012.pdf

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Labelling programs	Region	Product category	Date of adoption/last revision
	in France)	detergents made with organic[28]	
Green Seal	USA	GS-48 Laundry Care Products for Household Use[29]	12 July 2013
		GS-51 Laundry Care Products for Industrial and Institutional Use[30]	12 July 2013
Environmental Choice	New Zealand	EC-02-14 Laundry Detergents[31]	January 2014
		EC-38-14 Commercial and Institutional Laundry Detergents[32]	January 2014
Korea Eco-Label	Korea	EL307 Liquid Laundry Detergents[33] EL 302 Powder laundry detergents[34]	2008 1998
		EL306 Fabric Softeners[35]	2008
Singapore Green Label	Singapore	Laundry Detergents[36]	Launched in 1992. Criteria last issued May 2013
Greenmark Program	Chinese Taipei	Laundry Detergents[37]	1995 (revised 2013)
Cradle to Cradle	USA	No product specific categories	Last revised January 2013
Good Environmental Choice Australia	Australia	Cleaning products[38]	Last revised November 2011

Nordic Swan[39]: The Nordic Swan became the official ecolabel for the Nordic countries in 1989. It is a voluntary scheme that uses a life cycle based approach to evaluate a product's impact on the environment. At present there are 63 product categories covered by the Nordic Swan; these include products and services. Each Nordic country has a national office which is responsible for licensing, auditing, marketing and criteria development. As per the EU Ecolabel, the Nordic Swan uses the same DID list for data on ingredient ecotoxicity and degradability.

Czech Ecolabelling[40]: The Czech Ecolabel was launched in 1994 and is administered by CENIA, the Czech Environmental Information Agency. The Czech Ecolabel covers a wide range of products and services; for many of these it employs the EU Ecolabel criteria. The criteria for product groups which exist in both labelling schemes are gradually being unified. At present the Czech Ecolabel has published its own criteria for LD and

[28] Ecocert Standard: Natural detergents and natural detergents made with organic, May 2012, Ecocert Greenlife SAS, available from: http://www.ecocert.com/sites/default/files/u3/Natural-Detergents-made-with-Organic-Ecocert-Greenlife-11.05.2012.pdf
[29] Green Seal GS-48 Standard for Laundry Care Products for Household Use, Edition 1.1, July 2013. Available from: http://www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=0&sid=35
[30] Green Seal GS-51 Standard for Laundry Care Products for Industrial and Institutional Use, Edition 1.2, March 2014. Available from: http://www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=0&sid=43
[31] The New Zealand Ecolabelling Trust Licence Criteria for Laundry Detergents, EC-02-14. Available from: http://www.environmentalchoice.org.nz/docs/publishedspecifications/ec0214_laundry_detergents.pdf
[32] The New Zealand Ecolabelling Trust Licence Criteria for Commercial and Institutional Laundry Detergents, EC-38-14. Available from: http://www.environmentalchoice.org.nz/docs/publishedspecifications/ec3814_commercial__institutional_laundry.pdf
[33] Korea Eco-Label: Liquid laundry detergents, EL307-2008. Available from: http://el.keiti.re.kr/enservice/enpage.do?mMenu=2&sMenu=1
[34] Korea Eco-Label: Powder laundry detergents, EL307-1998. Available from: http://el.keiti.re.kr/enservice/enpage.do?mMenu=2&sMenu=1
[35] Korea Eco-Label: Fabric softeners, EL307-2008. Available from: http://el.keiti.re.kr/enservice/enpage.do?mMenu=2&sMenu=1
[36] Singapore Green Labelling Scheme Certification Guide: Laundry Detergents, May 2013. Available from: http://www.sec.org.sg/sgls/standards-criteria.php
[37] Green Mark, Laundry Detergents, General No:24, Classified No: L-01, 1995. Available from: http://greenliving.epa.gov.tw/GreenLife/uploadfiles/Criteria/24/02caeed6-847c-411b-9209-0f5823989625.pdf
[38] Good Environmental Choice Australia, Environmental performance standard: Cleaning products, Standard no: CP V2.2-2012, issued November 2013. Available from: http://www.geca.org.au/media/medialibrary/2013/11/CPv2.2-2012_Cleaning_Products_Standard_Final.pdf
[39] More information available at: http://www.nordic-ecolabel.org/
[40] More information available at: http://www1.cenia.cz/www/ekoznaceni/ekologicky-setrne-vyrobky

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IILD; however, these will gradually become discontinued and the EU Ecolabel criteria for these product groups will be used instead.

Bra Miljöval (Good Environmental Choice)[41]: Good Environmental Choice (Bra Miljöval in Swedish), is the ecolabelling system established by the Swedish Society for Nature Conservation. A life-cycle analysis based approach is employed for the testing and award procedure. At present the system covers 11 product areas including chemical products. For detergents the criteria sets limits on aquatic toxicity and biodegradability. The scheme sets limits by ingredient type, for instance solvents or complexing agents. For biodegradability, OECD 301 or an equivalent test must be used; surfactants must be anaerobically in accordance with ISO 11734. The toxicity of chemical substances to aquatic organisms, where possible, should be specified in accordance with OECD 201-203.

AFNOR-ADEME[42]: In France the General Directorate for Sustainable Development manages the implementation of environmental impact labels for consumer goods. The labels aim to target all products and not only those with the best environmental characteristics; this is in order to make purchasing decisions easier for consumers.

P&G Future Friendly[43]: Future Friendly is a private label, in such that it can only be awarded to Procter & Gamble products. It was established in 2007 by a partnership between P&G and sustainability experts including Energy Saving Trust, Waste Watch and Waterwise.

Ecocert[44]: Ecocert is an inspection and certification body founded in France in 1991, their focus is on sustainable development and organic agricultural products. Ecocert develops internationally recognised standards for products, systems and services. The product categories include natural cleaning products, paintings and coatings from natural origins and inputs eligible for use in organic farming. The basic principle of the scheme is to protect our planet and its resources, to protect and inform the consumer and to reduce unnecessary waste and discharges. In France Ecocert is accredited by the French Accreditation Committee (Cofrac)

Green Seal[45]: Green Seal is an independent non-profit certification organisation that operates in the USA and was established in 1989. Green Seal uses a lifecycle approach to evaluate the environmental impacts of products, services and companies. It develops its label with input from industry, government, academia and the public.

Environmental Choice (New Zealand): The Environmental Choice ecolabel is operated by the New Zealand Ecolabelling Trust and is endorsed by the New Zealand government. The ecolabel was launched in 1992 and has standards based on life cycle considerations for a wide range of products, services and companies.

Korea Eco-Label [46]: The Korean Eco-Label was launched by the government of the Republic of Korea in 1992. The label uses a life cycle based approach and is verified by an independent organisation. The Korea Eco-Label covers a wide range of products and services.

Singapore Green Label: The Singapore Green Label Scheme was launched by the Ministry of the Environment in 1992. Since 1995 the scheme has been run by the Singapore Environment Council, which is an independently managed non-profit and non-governmental organisation. The green label considers overall product environmental impacts such as raw materials, manufacturing process, health impacts and disposal. The label

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[41] More information available at: http://www.naturskyddsforeningen.se/in-english
[42] More information available at: http://www2.ademe.fr/
[43] More information available at: http://www.pg.com/en_UK/sustainability/environmental-sustainability/pg-future-friendly.shtml
[44] More information available at: http://www.ecocert.com/
For the detergent standards check: http://www.ecocert.com/sites/default/files/u3/Natural-Detergents-made-with-Organic-Ecocert-Greenlife-11.05.2012.pdf
[45] More information available at: http://www.greenseal.org/Home.aspx
[46] More information available at: http://el.keiti.re.kr/enservice/enindex.do

covers a wide range of products, but does not cover services and processes. In addition there are five levels of certification: basic, bronze, silver, gold and platinum. Products are scored across all five criteria categories and the overall certification level is equal to the lowest score in any category.

Greenmark Program[47]: The Green Mark Program was founded in 1992 and is the official voluntary Ecolabel in Chinese Taipei. The program is run by the Environmental Protection Agency. It aims to promote recycling, pollution reduction and resource conservation. The Green Mark Ecolabel covers 117 product categories including cleaning products, office equipment and home appliances.

Good Environmental Choice Australia: The Australian Good Environmental Choice program was launched in November 2011 and is currently managed by a non-profit organisation. The program is compliant with ISO 14024 and provides standards for a wide range of products and services.[48] The scheme aims to enable consumers to choose certified products and standards and have confidence that they have a lower impact on the environment, human health and address important social considerations.

The Charter for Sustainable Cleaning: This charter is a voluntary initiative of A.I.S.E, the International Association for Soaps, Detergents and Maintenance Products.[49] Although it is not a national labelling scheme it is relevant for the revision of the The Charter aims to encourage both consumers and industry to adopt more sustainable approaches to cleaning. The Charter is based on a lifecycle analysis and covers initiatives and activities ranging from human and environmental safety of chemicals and products to eco-efficiency, occupational health and safety, resource use and consumer information. The Charter has advanced sustainability profiles (ASPs) for the following categories of laundry detergent products: household solid laundry detergents, household liquid laundry detergents and household fabric conditioners. The ASPs are sustainability criteria which have been created for each A.I.S.E. product category using a life cycle approach. However, there are no limits values set for environmental impacts such as aquatic toxicity and biodegradability. The ASP for a given product category describes the product group characteristics which the industry considers to represent a good sustainability profile. For laundry detergents the ASPs have criteria covering the product formulation, packaging, wash temperature, end user information and performance. Applicant companies are assessed by independent verification in order to certify that the company has the required Charter Sustainability Procedures (CSPs) in place, under control and adequately applied. In addition, all ordinary company members of the charter must report annually to A.I.S.E. on a set of key performance indicators (KPIs). The KPIs report on the use of poorly biodegradable organics, the packaging used, water consumed, waste and the percentage of production which is compliant with ASPs and other indicators.

In addition to taking on board feedback from the stakeholders, the current scope and definition of the different ecolabels in categories related to laundry detergents have been reviewed as shown in Table 4.

Table 4: Product group definitions and scope of alternative voluntary labelling schemes

Labelling programs	Product category	Definitions & scope
EU Ecolabel	Laundry detergents	Laundry detergents and pre-treatment stain removers whether in powder, liquid or any other form which are marketed and used for the washing of textiles principally in household machines but not excluding their use in laundrettes and common laundries. Pre-treatment stain removers include stain removers used for direct spot treatment of textiles (before washing in the machine) but do not include stain removers dosed in the washing machine and stain removers dedicated to other uses besides pre-treatment. This product group shall not comprise products that are dosed by carriers such as sheets, cloths or other materials nor washing auxiliaries used without subsequent washing such as stain removers for carpets and furniture upholstery.

[47] More information available at: http://greenliving.epa.gov.tw/GreenLife/eng/english.aspx
[48] ISO 14024:1999 Environmental labels and declarations – Type I environmental labelling – Principles and procedures. More information available at: http://www.iso.org/iso/catalogue_detail?csnumber=23145
[49] More information available at: http://www.sustainable-cleaning.com/en.home.orb

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Labelling programs	Product category	Definitions & scope
	Industrial and institutional laundry detergents	Laundry detergent products performed by professional users in the industrial and institutional sector. Included in this product group are multi-component-systems constituting of more than one component used to build up a complete detergent or a laundering program for automatic dosing system. This product group shall not comprise products for obtaining textile attributes such as water-repellent, waterproof or fire-proof, etc. Furthermore, the product group shall not comprise products that are dosed by carriers such as sheets, cloths or other materials, as well as washing auxiliaries used without subsequent washing, such as stain removers for carpets and furniture upholstery. Consumer laundry products are excluded from the scope of this product group.
The Nordic Swan	Laundry detergents and stain removers (domestic use)	The product group encompasses laundry detergents and stain removers in powder, tablets, liquids, gel or any other form. The products shall be used for washing of textiles, and are intended to be used in household machines, but not excluding the use in launderettes and common laundries. The ecolabel criteria distinguish between heavy-duty detergents and low-duty detergents. Heavy-duty detergents are defined as detergents used for regular washing of white and coloured textiles at any temperature. Low-duty detergents are defined as detergents promoting special fabric care: e.g. use for delicate fabrics such as viscose, wool, silk, microfiber or other fabric requiring special care. Special care could be e.g. no bleach, no enzymes and gentle wash in excess water. Liquid detergents for normal washing of white and coloured textiles are not considered low-duty detergents. The product group does not comprise products that are exclusively used for hand-washing and products that are dosed via carriers such as sheets, cloths or other materials. The product group does not comprise multiple function detergents such as "2 in 1" products with both detergent and fabric softening effects/claims.
	Laundry detergents for professional use	Products intended for laundering textiles in water, and that are intended for use by large-scale consumers and professional users. The criteria apply to both complete powders and complete liquid detergents, and multi-component systems (where rinsing agent and stain remover may also be included). Fabric softeners and stain removing agents may also be Nordic Ecolabelled when they are constituents of a multi-component system. Multi-component systems are detergent systems based on the use of various components to form a complete detergent, a stock solution, or a wash programme for automatic dosing. This type of system may include several products, such as pre-wash agent, main detergent, wash booster, bleaching agent, fabric conditioner, disinfectants, neutralizing agents and detergent for delicate fabrics. The criteria apply to all products that come into contact with the laundry during washing, but do not apply to special impregnating agents that have, for example, a water-repelling or flame-retardant function. Dyes for colouring textiles are not covered by this product group. Products with specifically added microorganisms are also not included in the product group definition.
AFNOR-ADEME[50]	BP X30-323-2 Household Heavy Duty LD	Household laundry detergents category includes concentrated and ultra-concentrated laundry washing liquid, regular laundry washing liquid and regular laundry washing powder. Hand wash is not covered.

[50] General principles for an environmental communication on mass market products: methodology for the environmental impacts assessment of household heavy duty laundry detergents, BP X£)-323-2, ADEME, December 2012.

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Labelling programs	Product category	Definitions & scope
Czech Ecolabelling[51]	Detergents	Refers to EU Ecolabel criteria (Commission Decision 2011/264/EU) for category definition.
	II Detergents	Refers to EU Ecolabel criteria (Commission Decision 2012/271/EU) for category definition.
Bra Miljöval (Good Env Choice)	Chemical products	Laundry detergents - products that are used for hand washing and machine washing of textiles. Fabric softeners: products that are added to textiles to make them softer and to reduce static. Stain removers: Products that remove stains or discolouration from textiles.
Green Seal (USA)	GS-48 Laundry Care Products for Household	Products that can be certified: laundry pre-wash, everyday laundry detergents (and combination products), fine washable laundry detergents, spot removers, stain removers, bleaches, antimicrobial pesticide products for home health care, laundry detergents sold in Laundromat dispensers, fabric softeners (liquids and single-use dryer sheets), anti-static products (liquids and single use sheets), anti-wrinkle products, fabric protectants, fabric refreshers, starch, sizing and fabric finish.
	GS-51 II Laundry Care Products for	Products that can be certified: laundry prewash, laundry detergents (complete/built detergent and multi-component systems), home-style detergents (used in a home-style machine in the industrial and institutional market), spot removers, stain removers, bleaches, antimicrobial pesticide products used in I&I laundries for health care and food service, builders (water conditioners), alkali boosters, laundry sours, antichlor products, fabric softeners (liquids & single-use dryer sheets), anti-static products, anti-wrinkle products, fabric protectants, fabric refreshers, starch, sizing, fabric finish.
Env Choice New Zealand	EC-02-14 Laundry Detergents	All laundry detergent, soaps, bleaches; in powder, liquid or any other form; for washing textiles; and which are intended to be used principally in household machines, but not excluding the use in laundrettes and common laundries.
	EC-38-14 Commercial and Institutional Laundry Detergents	Products intended for laundering textiles in water by professional or commercial users like institutional/industrial users and other large-scale consumers. The product group covers complete powders and complete liquid detergents as well as a multi-component system, Softeners, rinsing agents and stain removers are also covered by these criteria. A multi-component system is a detergent system based on components used to build up a complete detergent, stock solution or a laundering programme for automatic dosing. This system may incorporate a number of products such as pre-wash agents, basic detergents, washing strengtheners, bleaching agents, rinsing agents and special detergents for laundering delicates. Special impregnating agents with a water-repelling or flame-retarding function are not covered. Products which are intended to be used principally in household machines or those used by the general public in laundrettes and common laundries.

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[51] Technical Guidelines Detergents used in industry and institutions, V72, 2013, Ministry of Environment available from: http://www1.cenia.cz/www/sites/default/files/722013.pdf

Labelling programs	Product category	Definitions & scope
Singapore Green Label	Laundry Detergents	This category establishes criteria for all laundry detergents in powder and liquid/gel form, for washing textiles; and which are intended to be used principally in household machines, but not excluding the use in laundrettes and common laundries.
Korea Eco-Label[52]	EL302. Powder LD	Laundry detergents for household washers, which include powder type, small particle type and sheet type detergents.
	EL307 liquid LD	Liquid laundry detergent which is used in home washing machines.
	EL306 Fabric softeners	Fabric softeners used to soften fabric in the final phase of rinse and to prevent the generation of static electricity when fabric products, such as clothes are washed at general households.

The products included in the scope and definition of the different ecolabels varies considerably. The Green Seal Ecolabel covers all categories and types of laundry care products and so, in defining the scope, takes a different approach to the EU Ecolabel. A better comparison is the Nordic Swan Ecolabel. For LD the main difference in product scope is that the Nordic Swan covers stain removers in any form, whereas EU Ecolabel only covers pre-wash stain removers. The New Zealand Environmental Choice label for LD also has a wider product scope.
For IILD the EU Ecolabel has a similar product group definition to both the Nordic Swan and the Environmental Choice ecolabels. The definitions used in the other ecolabels are more detailed which is likely to help avoid confusion over which products are covered. For instance the Environmental Choice label defines a multi-component system as "… a detergent system based on components used to build up a complete detergent, stock solution or a laundering programme for automatic dosing. This system may incorporate a number of products such as pre-wash agents, basic detergents, washing strengtheners, bleaching agents, rinsing agents and special detergents for laundering delicates". In addition, like the EU Ecolabel these ecolabels exclude special impregnating agents from their scope.

An overview of the requirements of the criteria documents for different ecolabels for LD is given in Table 5 and Table 6, for DD and IILD respectively. The excluded substances for different ecolabels are compared in Table 7. All of the criteria documents for the ecolabels listed in Table 4 were examined, however, only those which have a similar scope to the EU Ecolabel were included. Please note that for ease of comparison, some details of environmental criteria for LDs have been excluded. The criteria for the Czech Ecolabel have been excluded based on their similarity to the EU Ecolabel.

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[52] http://el.keiti.re.kr/enservice/enpage.do?mMenu=2&sMenu=1

Table 5: Overview of the requirements of different ecolabels for consumer laundry detergents

<table>
<tr><th>EU Ecolabel
(laundry detergents)</th><th>Nordic Swan
(laundry detergents)</th><th>Environmental Choice New Zealand
(laundry detergents)</th><th>Bra Miljöval (Good Environmental Choice)</th><th>Singapore Green Label Scheme
(laundry detergents)</th></tr>
<tr><td colspan="5">Limited substances</td></tr>
<tr>
<td>Fragrances: any ingredients added to the product as a fragrance shall be manufactured and handled following the code of practice of the International Fragrance Association (IFRA).

Biocides: the product may only include biocides in order to preserve the product, and in the appropriate dosage for this purpose alone. This does not refer to surfactants which may also have biocidal properties.</td>
<td>Fragrances: Fragrances encompassed by the declaration requirement in the Detergents Regulation 648/2004/EEC and its subsequent amendments must not be present in quantities >100 ppm (0.010 %) per substance.

Fragrance substances classified with H317/R43 and/or H334/R42 can be included, the amounts have to be <0.010 % (100 ppm).

Any ingredients added to the product as a fragrance shall have been manufactured and/or handled following the IFRA code of practice.

Phosphorus: The total content of phosphorus in the product is limited to:

<table>
<tr><th>Product type</th><th>P (g/kg wash)</th></tr>
<tr><td>Heavy-duty LD (normally soiled)</td><td>0.030</td></tr>
<tr><td>Low-duty LD (lightly soiled)</td><td>0.030</td></tr>
<tr><td>Stain-removers (in-wash)</td><td>0.010</td></tr>
<tr><td>Stain-removers (pre-treatment)</td><td>0.0050</td></tr>
</table>

Colouring agents: Colouring agents may be added to liquid products provided that the colouring agent has been approved for use in foodstuffs or is not bioaccumulable.</td>
<td>Fragrances: Fragrances must be produced and used in accordance with the code of practice compiled by IFRA.

Biocides and preservatives: The product may only include biocides in order to preserve the product, and in the appropriate dosage for this purpose alone.

This criterion does not apply to ingredients (e.g. quaternary ammonium salts) added for other functions but which may also have biocidal properties.

Enzymes: The enzyme production micro-organism shall be absent from the final enzyme preparation.

In other products, enzymes must be present in liquid form or as a dust-free granulate.

Colorants: Colouring agents may be added to liquid products only, provided they have been approved a food additive or are not bio-accumulative.

Complexing agents: The maximum concentration of complexing agents in the product must not exceed 10 g/kg laundry (dry weight). Citrate shall not be included in this amount.</td>
<td>Fragrances: No more than 0.50 % by weight fragrance content is permitted in the product. This limit also applies to concentrated products that are diluted before use. Fragrances must be used in accordance with the recommendations drawn up by IFRA. Nitromusk compounds and polycyclic musk compounds are not permitted in fragrances.

Phosphorus: Ingredients that contain phosphorus must not be added to the product intentionally.

Enzymes are approved in products that bear the Bra Miljöval label.

Colouring agents are not permitted.

Complexing agents: Organic complexing agents must be readily biodegradable according to OECD or equivalent test. Product may contain a maximum of 2.0 % by weight of complexing agent that does not meet requirement 3.1, but is potentially biodegradable according to OECD 302.

Solvents: Solvents must be readily biodegradable according to OECD 301 or an equivalent test.

Solvents, preservatives, thickening agents/ dissolving agents, bleaching</td>
<td>Fragrances: all fragrances synthesised and included in the final product must comply with IFRA’s code of practice.

Phosphorus: phosphonates are prohibited from the product. The total amount of phosphorus shall be <0.5 %.

Enzymes: no micro-organism should be present in the concluding step of any enzyme production process. Enzymes used in the product must be in liquid state or anti-dust particulate state.

Colorants: only dyes accepted for use in food colouring and non-bioaccumulative dyes may be used in the product.

Heavy metals: specified substances</td>
</tr>
</table>

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<table>
<tr><th>EU Ecolabel
(laundry detergents)</th><th>Nordic Swan
(laundry detergents)</th><th>Environmental Choice New Zealand
(laundry detergents)</th><th>Bra Miljöval (Good Environmental Choice)</th><th>Singapore Green Label Scheme
(laundry detergents)</th></tr>
<tr><td></td><td>Sensitizing substances: Substances classified as respiratory sensitizers with H334/R42 and/or H317/R43 may not be used in products. The following are exempt to this requirement: enzymes (added as liquid or encapsulated granulates, bleach-catalysts and fragrance.</td><td>The product must not contain > 0.15 g phosphonates which are not readily biodegradable per kg laundry (dry weight)

Heavy metals: Laundry detergents shall not be formula-ted or manufactured with compounds or substances that contain toxic metals, including arsenic, cadmium, chromium, lead or mercury.

Palm oil and palm kernel oil: the licence applicant must have an effective purchasing policy for all palm oil, palm kernel oil (or derivatives) or raw materials that are manufactured from palm kernel oil to maximise the use of palm oil and palm kernel oil from sustainable sources.</td><td>agents must have a bioconcentration factor (BCF) < 100 according to OECD 305. If no BCF data is available, log K_{ow} < 3 according to OECD 107 or 117.

Bleaching agents: Hydrogen peroxide and percarbonate may be stabilised with no more than 0.2 % by weight of complexing agents that do not meet the requirements for bleaching agents.

Nitrogen: The nitrogen content of the product must not exceed 1.0 % by weight.

Fillers must meet the requirements for other additives. For laundry detergents filler content must not exceed 0.5 % by weight.</td><td>are prohibited: arsenic, cadmium, chromium, lead, mercury and zinc. Unless found in trace amounts (under 0.1 % by weight).

Chemical dyes: shall be within the specified limit of <0.05 %.

Optical brighteners: shall be within the specified limit of <0.05 %.

The pH value of the detergent shall be <11.</td></tr>
<tr><td colspan="5">Hazardous substances and mixtures</td></tr>
<tr><td>The product or any part of it thereof shall not contain substances or mixtures meeting the classification with the hazard class or categories listed below:

<table><tr><th>GHS Hazard statement</th><th>EU Risk Phrase</th></tr><tr><td>H300</td><td>R28</td></tr><tr><td>H301</td><td>R25</td></tr><tr><td>H304</td><td>R65</td></tr><tr><td>H310</td><td>R27</td></tr><tr><td>H311</td><td>R24</td></tr><tr><td>H330</td><td>R23/26</td></tr><tr><td>H331</td><td>R23</td></tr><tr><td>H340</td><td>R46</td></tr></table></td><td>Products must not be classified according to the classifications listed below:

<table><tr><th>Classifi-cation</th><th>Hazard statement (CLP Reg)</th><th>EU Risk Phrase</th></tr><tr><td>Hazardous to the aquatic environment</td><td>H400
H410
H411
H412
H413</td><td>N with R50
R50/53
R52,
R53 or
R52/53
without N</td></tr></table></td><td></td><td></td><td>The following substances shall not be incorporated into the manufacturing process or final product: carcinogens, mutagens, endocrine disruptors such as reproductive toxins and phthalates.</td></tr>
</table>

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)

H341	R68
H350	R45
H350i	R49
H351	R40
H360F	R60
H360D	R61
H360FD	R60/61/60-61
H360Fd	R60/63
H360Df	R61/62
H361f	R62
H361d	R63
H361fd	R62-63
H362	R64
H370	R39/23/24/25/26/27/28
H371	R68/20/21/22
H372	R48/25/24/23
H373	R48/20/21/22
H400	R50
H410	R50-53
H411	R51-53
H412	R52-53
H413	R53
EUH059	R59
EUH029	R29
EUH031	R31
EUH032	R32
EUH070	R39-41
H334	R42
H317	R43

Derogations: the following substances or mixtures are specifically exempted from this requirement:

Substance /mixture	(CLP Reg)	EU Risk Phrase

Acute toxicity	H300 H301 H302 H304 H310 H311 H312 H330 H331 H332	Xn with R20, R21, R22, R65 T with R23, R24, R25 T+ with R26, R27, R28
Skin corrosion	H314	C with R34 or R35
Skin or respiratory sensitisation	H317 H334	Xi with R43 Xn with R42
Specific target organ toxicity/ repeated exposure	H370 H371 H372 H373	Xn with R48/20 R48/21 R48/22 R68/20 T with R39/23 R39/24 R39/25 R48/23 R48/24 R48/25 T+ with R39/26 R39/27 R39/28

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<table>
<tr>
<th>EU Ecolabel
(laundry detergents)</th>
<th>Nordic Swan
(laundry detergents)</th>
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(laundry detergents)</th>
<th>Bra Miljöval (Good Environmental Choice)</th>
<th>Singapore Green Label Scheme
(laundry detergents)</th>
</tr>
<tr>
<td>
<table>
<tr><td>Surfactants (in conc < 25 % wt)</td><td>H400</td><td>R50</td></tr>
<tr><td rowspan="3">Biocides for preservation purposes</td><td>H401</td><td>R50-53</td></tr>
<tr><td>H411</td><td>R51-52</td></tr>
<tr><td>H412</td><td>R52-53</td></tr>
<tr><td>Fragrance</td><td>H412</td><td>R52-53</td></tr>
<tr><td rowspan="2">Enzymes</td><td>H334</td><td>R42</td></tr>
<tr><td>H317</td><td>R43</td></tr>
<tr><td>Nitrilo tri-acetic acid (NTA) as impurity in MGDA and GLDA</td><td>H351</td><td>R40</td></tr>
<tr><td>Bleach catalysts</td><td>H317</td><td>R43</td></tr>
<tr><td>Optical brighteners (only for heavy duty LD)</td><td>H413</td><td>R53</td></tr>
</table>
</td>
<td>
Substances in the product must not be classified according to the classifications in the table below:
<table>
<tr><th>Classifi-cation</th><th>Hazard statemt (CLP Reg)</th><th>EU Risk Phrase</th></tr>
<tr><td>Carcinogenic</td><td>H350
H350i
H351</td><td>Carc with R40, R45 and/or R49</td></tr>
<tr><td>Germ cell mutagen-icity</td><td>H340
H341</td><td>Mut with R46 and/or R68</td></tr>
<tr><td>Toxic for repro-duction</td><td>H360F
H360D
H361f
H361d
H362</td><td>Repr with R60, R61, R62, R63 and/or R64</td></tr>
</table>
The content of substances classified as environmentally hazardous (according to Regulation 1272/2008 and Directive 67/548/EEC), must not exceed the following values:

Dosage (g/kg wash)*(100*concH410 + 10*concH411 + concH412) ≤ 0.18 g/kg wash,

or

Dosage (g/kg wash)*(100*concR50/53 + 10*concR51/53 + concR52/53) ≤ 0.18 g/kg wash
</td>
<td></td>
<td></td>
<td></td>
</tr>
</table>

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)
Surfactants				
	All surfactants must be aerobically and anaerobically biodegradable.	All surfactants must be readily biodegradable and anaerobically degradable.	Surfactants must be readily biodegradable according to OECD 301 or an equivalent test. Surfactants must be 60 % anaerobically biodegradable in accordance with ISO 11734 or an equivalent test. Surfactants must have a very low residual content of organo-halogen compounds – below 100 mg/kg TOX Surfactants must not be very toxic to aquatic organisms (LC50, EC50 and IC50> 1mg/L). Surfactants must not be classified as R50, very toxic to aquatic organisms. If palm oil is used as a raw material in surfactant production, the surfactant manufacturer or the palm oil supplier must be a member of the Roundtable on Sustainable Palm Oil (RSPO) or be able to show that the palm oil used to produce the surfactants comes from a plantation that is certified in accordance with RSPO's sustainable cultivation rules.	A biodegradability test for anionic surface active agents/ surfactants is required: • If anionic surfactant content is more than 5 % by weight in the product, the biodegradability test needs to be performed on the surfactant and it must be > 90 % biodegradable. • If anionic surfactant content is below 5 % by weight in the product, it is not necessary to do the biodegradability test. • If cationic or non-ionic surfactants are used, it is not necessary to do the biodegradability test. Biodegradability of anionic surfactants should be measured according to ISO 7827, 9439, 10707, 10708, 9408,

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<table>
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(laundry detergents)</th></tr>
<tr><td></td><td></td><td></td><td></td><td>14593 or OECD methods 310A – F.</td></tr>
<tr><td colspan="5">Dosage and dosage instructions</td></tr>
<tr>
<td>The recommended maximum dosage amounts are:
<table>
<tr><th>Product type</th><th>Dosage /kg wash</th></tr>
<tr><td>Heavy-duty LD powder/tablet</td><td>17.0 g</td></tr>
<tr><td>Heavy-duty LD – liquid/gel</td><td>14.0 ml</td></tr>
<tr><td>Low-duty detergent</td><td>17.0 g or 17.0 ml</td></tr>
<tr><td>Stain-removers (pre-treatment)</td><td>2.7 ml</td></tr>
</table>
</td>
<td>The dosage of the product shall not exceed:
<table>
<tr><th>Product type</th><th>g/kg wash</th></tr>
<tr><td>Heavy-duty LD powder/tablet</td><td>14.0</td></tr>
<tr><td>Heavy-duty LD – liquid/gel</td><td>14.0</td></tr>
<tr><td>Low-duty detergent</td><td>4.5</td></tr>
<tr><td>Stain-removers (pre-treatment)</td><td>2.7</td></tr>
</table>
*reference water hardness: soft for detergents and all levels for stain-removers

The recommended dosage for middle-hard water must not exceed 130% of the recommended dosage for soft water. The recommended dosage for hard water must not exceed 160% of the recommended dosage for soft water.

If a specific dosage is recommended for lightly soiled textiles, this dosage must not exceed 70% of the recommended dosage for normally soiled textiles. If a specific dosage is recommended for heavily soiled textiles, this dosage must not exceed 130 % of the recommended dosage for normally soiled textiles.

If recommendations for both prewash and subsequent wash apply, the total recommended dosage (prewash + subsequent wash) has to comply with</td>
<td>Dosage instructions shall appear on the product packages. The recommended dosages shall be specified for ‘normally’ and ‘heavily’ soiled textiles, and for the ranges of water hardness appropriate to where the product is marketed.</td>
<td>The recommended dosage must be stated on the packaging. Products for bulk users may have the dosage information printed on a data sheet or the like. The dosage for consumer products must be stated in litres, decilitres, millilitres or other measurement units; a phrase of the type “try not to use more than needed” should be printed on the packaging.

Products must give good washing results at a dosage not exceeding:
<table>
<tr><th>Prod type</th><th>Dosage</th></tr>
<tr><td>Powder LD</td><td>40 g per wash (9 g/kg wash)</td></tr>
<tr><td>Liquid LD</td><td>50 ml/wash (11g/kg wash)</td></tr>
<tr><td>Stain removers and bleaching agents</td><td>40 ml/wash (9ml/kg wash)</td></tr>
<tr><td>Fabric softener prods</td><td>25 ml/wash (5.5ml/kg wash)</td></tr>
</table>
*Dosage is for soft water in a washing machine that takes a 4-5 kg load.

For powder laundry detergents the density must be at least 67 g/dL.

The recommended dosage for different water hardness levels must be clearly stated on the packaging.</td>
<td></td>
</tr>
</table>

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<table>
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(laundry detergents)</th></tr>
<tr><td></td><td>the maximum dosage level.

Water hardness for the recommended dosage must be stated in German degrees of hardness (°dH). Water hardness must be expressed in ranges that are relevant to the geographic areas in which the product is on sale.</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Toxicity to aquatic environments</td></tr>
<tr><td>The critical dilution volume of the product must not exceed the following limits ($CDV_{chronic}$):
<table><tr><th>Product type</th><th>$CDV_{chronic}$ (l/kg wash)</th></tr><tr><td>Heavy-duty LD</td><td>35,000</td></tr><tr><td>Low-duty LD</td><td>20,000</td></tr><tr><td>Stain-removers (pre-treatment)</td><td>3,500</td></tr></table></td><td>The $CDV_{chronic}$ and CDV_{acute} values must not exceed the following limits:
<table><tr><th>Product type</th><th>$CDV_{chronic}$ (l/kg wash)</th></tr><tr><td>Heavy-duty LD (normally soiled)</td><td>45,000</td></tr><tr><td>Low-duty LD (lightly soiled)</td><td>15,000</td></tr><tr><td>Stain-removers (in-wash)</td><td>7,500</td></tr><tr><td>Stain-removers (pre-treatment)</td><td>3,500</td></tr></table>
<table><tr><th>Product type</th><th>CDV_{acute} (l/kg wash)</th></tr><tr><td>Heavy-duty LD (normally soiled)</td><td>100,000</td></tr><tr><td>Low-duty LD (lightly soiled)</td><td>55,000</td></tr><tr><td>Stain-removers (in-wash)</td><td>30,000</td></tr><tr><td>Stain-removers (pre-treatment)</td><td>30,000</td></tr></table></td><td></td><td>The toxicity of chemical substances to aquatic organisms must be specified, giving results for fish, daphnia and algae (except for preservatives for which data is only required for fish and daphnia).

Complexing agents must not be very toxic to aquatic organisms (LC50, EC50 and IC50 > 1 mg/L).

Solvents must not be toxic to aquatic organisms (LC50, EC50 and IC50 > 10 mg/L).

Included solvents must not be harmful to aquatic organisms (LC50, EC50 and IC50 > 100 mg/L).

Preservatives must not be very toxic to aquatic organisms (LC50 and EC50 > 1 mg/L).

Thickening agents/ dissolving agents must not be toxic to aquatic organisms (LC50, EC50 and IC50 > 10 mg/L).

Bleaching agents must not be very toxic to aquatic organisms (LC50,</td><td></td></tr>
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<tr><td></td><td></td><td></td><td>EC50 and IC50 > 1 mg/L).

Acids must not be toxic to aquatic organisms (LC50, EC50 and IC50 > 10 mg/L).</td><td></td></tr>
<tr><td colspan="5">Biodegradability of organics</td></tr>
<tr><td>The content of organic substances in the product that are aerobically non-biodegradable (aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:
<table><tr><th>Product type</th><th>aNBO (g/kg wash)</th></tr><tr><td>Heavy-duty LD - Powder</td><td>1.00</td></tr><tr><td>Heavy-duty LD - Liquid</td><td>0.55</td></tr><tr><td>Low-duty LD - Powder</td><td>0.55</td></tr><tr><td>Low-duty LD - Liquid</td><td>0.30</td></tr><tr><td>Stain-remover pre-treatment - powder</td><td>0.10</td></tr><tr><td>Stain-remover pre-treatment - liquid</td><td>0.10</td></tr></table><table><tr><th>Product type</th><th>anNBO (g/kg wash)</th></tr><tr><td>Heavy-duty LD - Powder</td><td>1.30</td></tr><tr><td>Heavy-duty LD - Liquid</td><td>0.70</td></tr><tr><td>Low-duty LD - Powder</td><td>0.55</td></tr></table></td><td>The content of organic substances that are aerobically non-biodegradable(aNBO) and/or anaerobically non-biodegradable (anNBO) must not exceed the following limits:
<table><tr><th>Product type</th><th>aNBO (g/kg wash)</th></tr><tr><td>Heavy-duty LD (normally soiled)</td><td>1.00</td></tr><tr><td>Low-duty LD (lightly soiled)</td><td>0.50</td></tr><tr><td>Stain-removers (in-wash)</td><td>0.20</td></tr><tr><td>Stain-removers (pre-treatment)</td><td>0.10</td></tr></table><table><tr><th>Product type</th><th>anNBO (g/kg wash)</th></tr><tr><td>Heavy-duty LD (normally soiled)</td><td>1.00</td></tr><tr><td>Low-duty LD (lightly soiled)</td><td>0.50</td></tr><tr><td>Stain-removers (in-wash)</td><td>0.20</td></tr><tr><td>Stain-removers (pre-treatment)</td><td>0.10</td></tr></table></td><td></td><td>Organic ingredients must be readily bio-degradable in accordance with OECD 301 or an equivalent test.

Organic ingredients must be 60 % anaerobically biodegradable in accordance with ISO 11734 or an equivalent test.

Ingredients that are not fully biodegradable in accordance with OECD 302 must not exceed a total concentration of 2 % by weight. (additional requirement for laundry detergents)

Preservatives, thickening agents/ dissolving agents, bleaching agents and acids must be readily biodegradable according to OECD 301 or an equivalent test.</td><td></td></tr>
</table>

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)
Low-duty LD - Liquid: 0.30 Stain-remover pre-treatment - powder: 0.10 Stain-remover pre-treatment - liquid: 0.10				
Origin and traceability of vegetable raw materials				
	For fatty acids, soap and oils consisting of ≥ 75% vegetable based materials and which are present in the final product in concentrations > 1.0 % (by weight).The following should be fulfilled: • The name and geographical origin of the type of plant species used to extract the vegetable raw materials must be specified • The detergent manufacturer must furthermore have a written routine for purchasing of vegetable raw materials to ensure that it does not come from environments with a large need for protection for biological and/or social reasons and must have a written policy documenting this. The vegetable raw materials must not come from: a) Protected areas or areas that are under evaluation for protection b) Areas with uncertain ownership or user rights c) Illegally harvested vegetable raw materials			

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<tr><td></td><td>d) Genetically modified vegetable raw materials/plans (enzymes and other GMO use in closed systems are not included)</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Packaging</td></tr>
<tr><td>The weight/utility ratio (WUR) must not exceed the following values:
<table><tr><th>Product type</th><th>WUR (g/kg wash)</th></tr><tr><td>Powders</td><td>1.2</td></tr><tr><td>Others (liquids, gels, tablets, capsules)</td><td>1.5</td></tr></table>
Plastic/paper/cardboard packaging containing more than 80 % recycled material is exempt from this requirement.</td><td>The weight/utility ratio of the product and its packaging must not exceed the following values:
Powders: 1.2 g/kg wash
Others (liquids, tables, gels, etc.): 1.5 g/kg wash.
Halogenated plastic must not form part of the packaging including the label.
Primary packaging consisting of plastic must be labelled according to Commission Decision 97/129/EC of 28 January 1997 or ISO 11469:200 Plastics – Generic identification and marking of plastics products or similar.</td><td>For primary packaging the weight/utility ratio must be less than or equal to:
<table><tr><th>Prod type</th><th>WUR (g/kg wash)</th></tr><tr><td>Powders – soft water</td><td>1.50</td></tr><tr><td>Powders – medium water</td><td>2.0</td></tr><tr><td>Powders – hard water</td><td>2.5</td></tr><tr><td>Liquids – soft water</td><td>2.0</td></tr><tr><td>Liquids – medium water</td><td>2.5</td></tr><tr><td>Liquids – hard water</td><td>3.0</td></tr></table>
All plastic packaging must be made of plastics that are able to be recycled in the country where the product is sold.
Primary cardboard packaging shall consist of 80 % recycled content, 25 % of which must be post-consumer material.
Information shall be provided to the Trust on the following:</td><td>Packaging must be made of components that are easy to take apart, and each component must consist of a single type of material. Refill packaging that weighs no more than 30 % of the weight of the original packaging is exempted from this rule.
Plastic packaging must be made from polyethylene, polypropylene (PP), polyethylene terephthalate or an equivalent plastic. Polyvinyl chloride (PVC) is not permitted. Plastic packaging must be marked in accordance with DIN 6120 or American SPI. It is not necessary to mark small parts, such as stoppers, in this way.
At least 80 % of cardboard packaging must be manufactured from wood fibre obtained from recycled raw material. If new raw material is used for the rest of the cardboard, at least 30 % of this must be certified by the Forest Stewardship Council (FSC). If the product content prevents the use of recycled raw materials for packaging, it is acceptable to use cardboard that is 100 % FSC-certified. Only wholly chlorine-free bleaching</td><td></td></tr>
</table>

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)
		• The use of refillable containers • Use of PVC and/or phthalates in packaging	methods may be used. As far as possible, the packaging must comply with REPA's recommendations to facilitate recycling.[53] Products that are intended for sale to consumers must carry instructions on how the packaging should be sorted for recycling in accordance with the document *REPA's instructions*. If the packaging consists of different materials, information must also be given on how the different components should be recycled. No metal may be used in the packaging. Exceptions to this requirement may be allowed for large packaging that can be recycled. Metal may be used in the handles of buckets that hold 15 litres or more if the handle can easily be removed when the packaging is recycled. Nozzles on packaging such as pump bottles and trigger sprays are exempted from this requirement.	
Consumer information				
The following washing recommendations shall appear on the packaging: • Wash at the lowest possible	The label/packaging must clearly indicate the temperature at which the product has been performance tested, e.g. "Efficient at 40 °C"	The laundry detergents shall be accompanied by instructions for proper use so as to maximise product performance and minimise waste.		Instructions guiding the appropriate use of the product to enhance performance

[53] This criterion is only applicable to Sweden, REPA now FTI, for more information see http://www.ftiab.se/

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)
temperature. • Always wash with full load. • Dose according to soil and water hardness; follow the dosing instructions. • If you are allergic to house dust, always wash bedding at 60 °C. Increase wash temperature to 60 °C in case of infectious diseases. • Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution, waste production and energy consumption. Information appearing on the EU Ecolabel: The logo should be visible and legible. The use of the EU Ecolabel logo is protected in primary EU law. The EU Ecolabel registration/license number must appear on the product, it must be legible and clearly visible. The optional label with text box shall contain the following text: • Reduced impact on aquatic ecosystems. • Limited hazardous substances. • Performance tested.	The following washing advices (or equivalent) shall appear on the packaging of laundry detergents (not applicable for stain removers). The washing advices may be present either as text or symbols. • Preferably wash with full load • Dose correctly according to soil and water hardness. Overdosing does not make the laundry cleaner and is harmful for the environment • Reduce the temperature of your normal wash programmes to safeguard the environment • If you are allergic to house dust, always wash bedding at 60 °C or above • Run a 60 °C wash now and again with a bleach containing detergent (white wash powder detergent) and follow the machine manufacturer's recommendations regarding maintenance • Leave the machine open between washes	These instructions shall include information on reuse, recycling and/or correct disposal of packaging. The applicant shall take suitable steps to help the consumer respect the recommended dosage, for example by making available a dosage device (for powdered or liquid products), and/or by indicating the recommended dosage at least in ml (for powdered or liquid products). A recommendation shall appear on the packaging for the consumer to contact their water supplier or local authority in order to find out the degree of hardness of their tap water. All laundry detergents must display on the container a list of product ingredients that complies with the labelling requirements of Article 11 of Regulation (EC) No. 648/2004 of the European Parliament and of the Council of 31 March 2004 on Detergents, as amended by Regulation (EC) No 907/2006 of 20 June 2006. The following or equivalent words should be clearly displayed on the		and generate lesser waste (e.g. reuse/ recycle and disposal methods) should be available to consumers. Product ingredients must be clearly visible on the product packaging in accordance with the labelling criteria stated in Article 11 of 648/2004/EC and the amended version in 907/2006/EC.[54] [55]

[54] Detergents Regulation 648/2004/EC available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:104:0001:0035:en:PDF
[55] Amendment 907/2006/EC to Directive 648.2004 available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:168:0005:0010:en:PDF

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)
		packaging: *"All Laundry Detergents have an effect on the environment. Always use the correct dose for maximum efficiency and minimum environmental impact. Use the lowest recommended temperature"* Any proposed changes/ alterations to this wording must be submitted to and approved by The Trust. All labelling shall comply with the requirements of the HSNO legislation or the appropriate hazardous substance legislation for the country where the product is sold. All packaging shall include a website reference where a copy of the product data sheet can be obtained.		
Product claims				
Claims on the packaging: In general the claims on the packaging shall be documented through performance testing (e.g. claims of efficiency at low temperatures, of removal of certain stain types, of benefits for certain types or colours of textiles, or other claims of specific properties/benefits of the product)	Products marketed as cold water products should pass the performance test at the lowest indicated temperature where the effect of the product is stated - but maximum at 20 °C. Reference is still washed at 40 °C. A stain remover must always pass the performance requirements for any specific stain type for which the product claims to be effective. If claims are made regarding the content of certified raw materials (e.g. organically grown ingredients), the total content in weight % of these ingredients	No claim or suggestion, on the packaging or by any other means, shall be made that the product has an antimicrobial action. If the licence holder includes claims relating to the product being 'natural' or 'plant based' the licence holder shall provide evidence to support the claim, including but not limited to: • the definition used by the licence holder to support the 'natural' or 'plant based' claim; • the source of all ingredients including whether they are		

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)
	must be clearly stated on the pack.	synthetic versions of the chemicals; and • evidence of chain of custody where synthetic versions exist and the ingredients are non-synthetic versions		
Fitness for use				
The product shall comply with the performance requirements as specified in the EU Ecolabel laundry detergents performance test's latest version.	The fitness for use shall be documented by use of the Nordic Ecolabelling Performance Test for laundry detergents and stain removers. For detergents for white wash and for stain removers the performance of the products must by the recommended dosage on normally soiled clothing be satisfactory at 40 °C compared to the reference detergent tested at 40 °C. For detergents for delicates the performance must be satisfactory at the recommended dosage to lightly soiled. Further information on the performance test can be found in the criteria documents.	The product shall be fit for its intended use and conform as appropriate to relevant product performance standards. Performance of the product with respect to both cleaning ability (ability to remove soil) and cleaning performance (the total amount of soil removed per wash) must be assessed.		
Points scoring system				
The points scoring system (max=8, min=3) has the objective of (1) promoting cold water and low-temperature products and (2) promoting products with very low emissions of hazardous substances to the environment.				
Waste management				
		The licence applicant/ holder and product manufacturer must have		

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)
		effective waste management policies and procedures and/or a waste management programme. In addition licence holders must report annually to The Trust on waste management.		
Energy management				
		The licence applicant/holder and product manufacturer must have effective energy management policies and procedures and/or an energy management programme. In addition licence holders must report annually to The Trust on energy management.		Effective energy management policies and procedures and/or an energy management program must be in existence or proposed.
Bio-concentration factor (BCF)				
			Ingredients must have a BCF of <100 according to OECD 305. If no BCF data is available, log K_{ow} < 3 according to OECD 107 or 117. Exceptions may be made if any of the following requirements are met: a) the ingredient must not be harmful to aquatic organisms (LC50, EC50 and IC50 > 100 mg/L). b) it can be shown that the ingredient is quickly broken down into substances whose BCF or log K_{ow} satisfies the requirements. Acids must have a bioconcentration factor (BCF) of less than 100 according to OECD 305. If no BCF data is available, log K_{ow} < 3 according to OECD 107 or 117.	

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EU Ecolabel (laundry detergents)	Nordic Swan (laundry detergents)	Environmental Choice New Zealand (laundry detergents)	Bra Miljöval (Good Environmental Choice)	Singapore Green Label Scheme (laundry detergents)
Water content				
			For heavy-duty and liquid laundry detergents water content must not exceed 75 % by weight. For stain removers and bleach the water content must not exceed 81 % by weight. For fabric softeners the water content must not exceed 85 % by weight.	

A.I.S.E. Charter for Sustainable Cleaning

Beside the five national ecolabels listed above, the A.I.S.E. Charter for Sustainable Cleaning also contains a restrained number of criteria that are of interest for the revision of the EU Ecolabel:

- ***Limited substances:*** Product formulation must pass successfully Environmental Safety Check (ESC) on all ingredients.

- ***Dosage and dosage instructions:*** The maximum dosage limits are:

Product type	ml/ job
Powder detergent (and tablets)	≤ 75 g /job or ≤ 115
Liquid deter-gents	≤ 75
Fabric conditioners	≤ 35

Based on the standard washing machine load of 4.5 kg of dry fabric for heavy-duty detergents and 2.5 kg of dry fabric for low-duty detergents and medium water hardness and lightly soiled fabric.

- ***Packaging:*** Total (primary + secondary but excluding tertiary) packaging g/job:

Product type	WUR (g/ job)
Powders & tabs	≤6.5 g
Liquids	≤7.0 g
Fabric soften-ers	≤4 g

Board packaging – recycled content
Powder (and tablets) – minimum requirement of ≥ 60 % OR where 100 % of the board used is certified made from fibre sourced from sustainable forests under an endorsed certification standard such as FSC, SFU or PEFC: no minimum.
Packaging recycled content: Liquids and fabric softeners. Primary packaging: no minimum, but any recycled plastic content is excluded from calculation of packaging weight per job. Secondary packaging: Board ≥ 60 %.

- ***Consumer information:*** For powder (and tablets) and liquid products, ability to wash at≤ 30° C indicated on pack.
End user information on *Cleanright* and Safe Use tips must be displayed on pack.

- ***Fitness for use:*** Evidence has to be provided (in case of external verification organised by A.I.S.E.) that the product has been performance tested and reached a level acceptable to consumers consistent with claims made.

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Table 6: Overview of the requirements of different ecolabels for IILDs

EU Ecolabel Industrial and institutional laundry detergents	Nordic Swan **Laundry detergents for professional use**	Environmental Choice New Zealand **Commercial and Institutional Laundry Detergents**
Limited substances		
Fragrances: any ingredients added to the product as a fragrance shall be manufactured and handled following the code of practice of the IFRA. **Enzymes:** Enzymes must be in liquid form or dust-free granulate. Enzymes must be free from micro-organism remnants from manufacture. **Biocides:** the product may only include biocides in order to preserve the product, and in the appropriate dosage for this purpose alone. This does not refer to surfactants which may also have biocidal properties.	**Enzymes:** Must be liquid of take the form of non-dusting granules. **Preservatives:** may be added in liquid products if the preservatives are not bioaccumulable. **Dyes**: must either be approved for use in foodstuffs or not be bioaccumulative. **Complexing agents, phosphonates/phosphonic acids:** Phosphonates/phosphonic acids may, in total, be present in quantities of no more than 0.15 g/kg of articles to be washed. **Phosphorus:** The total content of phosphorus in the product is limited to: Light soiling: 0.50 g/kg laundry Medium soiling:1.00 g/kg laundry Heavy soiling: 1.50 g/kg laundry	**Fragrances:** Fragrances must be produced and used in accordance with the code of practice compiled by IFRA. **Enzymes:** The enzyme production micro-organism shall be absent from the final enzyme preparation. Enzymes must be present in liquid form or as a dust-free granulate. **Biocides and preservatives:** The product may only include biocides in order to preserve the product, and in the appropriate dosage for this purpose alone. This criterion does not apply to ingredients (e.g. quaternary ammonium salts) added for other functions but which may also have biocidal properties. **Colorants:** Colouring agents may be added to liquid products only, provided they have been approved a food additive or are not bioaccumulative. **Complexing agents:** The maximum concentration of complexing agents in the product must not exceed the following limits: Light soiling: 0.5 g/kg laundry (dry weight) Medium soiling: 1.0 g/kg laundry (dry weight) Heavy soiling: 1.5 g/kg laundry (dry weight). Citrate shall not be included in this amount. The product must not contain more than 0.50 g phosphonates which are not readily (aerobically) biodegradable per kg laundry (dry weight) **Heavy metals:** Laundry detergents shall not be formulated or manufactured with compounds or substances that contain toxic metals, including arsenic, cadmium, chromium, lead or mercury.

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<table>
<tr><th>EU Ecolabel Industrial and institutional laundry detergents</th><th>Nordic Swan Laundry detergents for professional use</th><th>Environmental Choice New Zealand Commercial and Institutional Laundry Detergents</th></tr>
<tr><td></td><td></td><td>Palm oil and palm kernel oil: the licence applicant must have an effective purchasing policy for all palm oil, palm kernel oil (or derivatives) or raw materials that are manufactured from palm kernel oil to maximise the use of palm oil and palm kernel oil from sustainable sources.

Sodium: the total sodium load per wash shall be less than 21 g/150 litre (0.14 g/L)</td></tr>
<tr><td colspan="3">Surfactants</td></tr>
<tr><td>All surfactants must be biodegradable under aerobic conditions. All non-ionic and cationic surfactants must also be biodegradable under anaerobic conditions.</td><td>All surfactants must be aerobically and anaerobically biodegradable.</td><td>All surfactants must be readily biodegradable and anaerobically degradable.</td></tr>
<tr><td colspan="3">Dosage and dosage instructions</td></tr>
<tr><td>The recommended total dosage for 1 kg of laundry according to the degree of soiling and water hardness shall be given in g/kg laundry of ml/kg laundry. All products in a multi-component system have to be included with the worst case dosage when assessments of the criteria are made.
The product name , or in case of a multi-component system, a list of all products part of that system, together with the recommended water hardness (soft, medium or hard) and the intended degree of soiling shall be provided.</td><td>The recommended dosage for 1 kg of articles to be washed for different levels of soiling and for different water hardness must be given in ml or g/ 1 kg laundry on the label or in a technical product data sheet. It must be clear for what type of wash the dosage is recommended.</td><td>Dosage instructions shall appear on the product packages. The recommended dosages shall be specified for ‘normally’ and ‘heavily’ soiled textiles, and for the ranges of water hardness appropriate to where the product is marketed.</td></tr>
<tr><td colspan="3">Hazardous substances and mixtures</td></tr>
<tr><td>The product or any part of it thereof shall not contain substances or mixtures meeting the classification with the hazard class or categories listed below:

<table><tr><th>GHS Hazard statement</th><th>EU Risk Phrase</th></tr><tr><td>H300</td><td>R28</td></tr><tr><td>H301</td><td>R25</td></tr><tr><td>H304</td><td>R65</td></tr><tr><td>H310</td><td>R27</td></tr><tr><td>H311</td><td>R24</td></tr><tr><td>H330</td><td>R23/26</td></tr><tr><td>H331</td><td>R23</td></tr><tr><td>H340</td><td>R46</td></tr></table></td><td>Products must not be classified according to the classifications listed below:<table><tr><th>Classification</th><th>Hazard statement (CLP)</th><th>EU Risk Phrase</th></tr><tr><td>Dangerous for aquatic environment</td><td>H400
H410
H411
H412
H413</td><td>N with R50
R50/53 R52,
R53 or
R52/53 without N</td></tr><tr><td>Acute toxicity specific target organ toxicity – single exposure</td><td>H330
H300
H370</td><td>T+ with R26, R27, R28 and/or R39</td></tr><tr><td>Acute toxicity specific</td><td>H301</td><td>T with R23, R24,</td></tr></table></td><td>Commercial and institutional cleaning products shall not be formulated or manufactured with substances (active content only) that are:
i. Classified as Category 1 or Category 2 under the European Commission priority list developed under the Community strategy for endocrine disruptors;
ii. Classified under the Hazardous Substances and New Organisms Act (HSNO) as: 6.6 (mutagens), 6.7 (carcinogens), 6.8 (reproductive/developmental toxins), 9.1B (aquatic ecotoxins).

Any raw ingredient that is classified as 9.1A (aquatic ecotoxin) must be readily biodegradable and not potentially bioaccumulative.</td></tr>
</table>

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EU Ecolabel Industrial and institutional laundry detergents	Nordic Swan Laundry detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Laundry Detergents

H341	R68
H350	R45
H350i	R49
H351	R40
H360F	R60
H360D	R61
H360FD	R60/61/60-61
H360Fd	R60/63
H360Df	R61/62
H361f	R62
H361d	R63
H361fd	R62-63
H362	R64
H370	R39/23/24/25/26/27/28
H371	R68/20/21/22
H372	R48/25/24/23
H373	R48/20/21/22
H400	R50
H410	R50-53
H411	R51-53
H412	R52-53
H413	R53
EUH059	R59
EUH029	R29
EUH031	R31
EUH032	R32
EUH070	R39-41
H334	R42
H317	R43

Derogations: the following substances or mixtures are specifically exempted from this requirement:

Sub-stance /mixture	GHS Hazard statement	EU Risk Phrase
Surfactants (in concentration < 25 % in	H400	R50

target organ toxicity – single and repeated	H330 H331 H370 H372	R25, R39 and/or R48
Harmful to health	H332 H312 H373 H371 H304	Xn with R20, R21, R48, R65 and/or R68
Carcinogenic properties	Carc. 1A, 1B, 2A, 2B, 2: H350, H350i, H351	T with R45 and/or R49 (Carc1 or Carc2) or Xn with R40 (Carc3)
Skin or respiratory sensitisation	H317 H334	Xi with R43 Xn with R42
Mutagenic	H340 H341	T with R46 (Mut1 or Mut2) or Xn with R68 (Mut3)
Toxic for reproduction	H360FD H361fd H373 H362	T with R60, R61, R64 and/or R33 (Rep1 or Rep2) or Xn with R62, R63, R64 and/or R33

Substances in the product must not be classified according to the classifications in the table below:

Classification	Hazard statement (CLP reg)	EU Risk Phrase
Carcinogenic	H350 H350i H351	Carc with R40, R45 and/or R49
Allergenic	H334 H317	Xn R42 or Xi R43
Mutagenic	H340 H341	Mut with R46 and/or R68
Toxic for	H360F	Repr with R60, R61,

The limits by weight of substances classified 6.5 (respiratory and contact sensitisers) shall not exceed 0.1 %.

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the product)		
Biocides used for preservation purposes	H331	R23
	H334	R42
	H317	R43
	H400	R50
Enzymes	H334	R42
	H317	R43
	H400	R50
Bleach catalysts	H400	R50
NTA as in impurity in MGDA and GLDA	H351	R40

reproduction	H360D H361f H361d H362	R62, R63 and/or R64

Toxicity to aquatic environments

The critical dilution volume of the product must not exceed the following limits ($CDV_{chronic}$):

Soft water (0-6 °dH)	**$CDV_{chronic}$ (L/kg laundry)**		
Product type/ Degree of soiling	Light	Medium	Heavy
Powder	30,000	40,000	50,000
Liquid	50,000	60,000	70,000
Multi-component-system (MCS)	50,000	70,000	90,000

Medium water (7-13 °dH)	**$CDV_{chronic}$ (L/kg laundry)**		
Product type/ Degree of soiling	Light	Medium	Heavy
Powder	40,000	60,000	80,000
Liquid	60,000	75,000	90,000
MCS	60,000	80,000	100,000

Hard water (>14 °dH)	**$CDV_{chronic}$ (l/kg laundry)**		
Product type/ Degree of soiling	Light	Medium	Heavy
Powder	50,000	75,000	90,000
Liquid	75,000	90,000	120,000

The $CDV_{chronic}$ and CDV_{acute} values must not exceed the following limits:

L/kg laundry	**Level of soiling**		
	Light	Medium	Heavy
$CDV_{chronic}$	140,000	200,000	300,000
CDV_{acute}	70,000	100,000	150,000

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EU Ecolabel Industrial and institutional laundry detergents	Nordic Swan Laundry detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Laundry Detergents

MCS	75,000	100,000	120,000

Biodegradability of organics

The content of organic substances in the product that are aerobically non-biodegradable (aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

aNBO:

Soft water (0-6 °dH)	aNBO (g/kg laundry)		
Product type/ Degree of soiling	Light	Medium	Heavy
Powder	0.70	1.10	1.40
Liquid	0.50	0.60	0.70
Multi-component system (MCS)	1.25	1.75	2.50

Medium water (7-13 °dH)
Product type/ Degree of soiling
Powder
Liquid
MCS

Hard water (>14 °dH)
Product type/ Degree of soiling
Powder
Liquid
MCS

anNBO:

Soft water (0-6 °dH)
Product type/ Degree of soiling
Powder
Liquid
MCS

The total quantity of substances that that are aerobically non-biodegradable (aNBO) and/or anaerobically non-biodegradable (anNBO) must not exceed the following limits:

g/kg laundry	Level of soiling		
	Light	Medium	Heavy
aNBO	0.50	0.85	1.50
anNBO	0.50	0.85	1.50

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<table>
<tr><th>EU Ecolabel Industrial and institutional laundry detergents</th><th>Nordic Swan Laundry detergents for professional use</th><th>Environmental Choice New Zealand Commercial and Institutional Laundry Detergents</th></tr>
<tr><td>

Medium water (7-13 °dH)	anNBO (g/kg laundry)		
Product type/ Degree of soiling	Light	Medium	Heavy
Powder	1.10	1.40	1.75
Liquid	0.60	0.70	0.90
MCS	1.75	2.50	3.75

Hard water (>14 °dH)	anNBO (g/kg laundry)		
Product type/ Degree of soiling	Light	Medium	Heavy
Powder	1.40	1.75	2.20
Liquid	0.70	0.90	1.20
MCS	2.50	3.75	4.80

</td><td></td><td></td></tr>
<tr><td colspan="3">Packaging</td></tr>
<tr><td>

The weight/utility ratio (WUR) must not exceed the following values:

Product type/ water hardness	WUR (g/kg laundry)		
	Soft	Medium	Hard
Powders	1.5	2.0	2.5
Liquids	2.0	2.5	3.0

Plastic/paper/cardboard packaging containing more than 80 % recycled material or more than 80 % plastic from renewable origin is exempt from this requirement.
Only phthalates that at the time of application have been risk assessed and have not been classified according to criterion 4(b) may be used in any plastic packaging. To allow for identification of different parts for recycling, the primary packaging must be market in accordance with DIN 6120, Part 2 or the equivalent. Caps and pumps are exempted from this requirement.

</td><td>Plastic material must be labelled in accordance with DIN 6120, Part 2 or equivalent.
PVC or other halogenated plastics must not be incorporated in either the packaging or the labelling</td><td>All plastic packaging must be made of plastics that are able to be recycled in the country where the product is sold.
Primary packaging must not be impregnated, labelled, coated or otherwise treated in a manner which would prevent recycling.
Primary cardboard packaging shall consist of 80 % recycled content, 25 % of which must be post-consumer material.
The primary packaging shall have a WUR less than or equal to:

Product type/ water hardness	WUR (g/kg laundry)		
	Soft	Medium	Hard
Powders	1.5	2.0	2.5
Liquids	2.0	2.5	3.0

Information shall be provided to the Trust on the use of refillable containers, PVC and/or phthalates used in the packaging.</td></tr>
<tr><td colspan="3">Washing performance</td></tr>
<tr><td>The primary laundering effects of the detergent, such as dirt and stain removal, must be documented by the</td><td>The primary laundering effects of the detergent such as dirt removal and stain removal capacity must be documented by the</td><td>The product must be fit for its intended use and conform, as appropriate, to relevant product</td></tr>
</table>

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EU Ecolabel Industrial and institutional laundry detergents	Nordic Swan Laundry detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Laundry Detergents
producer/applicant with the aid of artificially soiled test clothes which are washed in the process. The test may be conducted by an external or internal laboratory fulfilling the requirements in Appendix II(a). The test must be conducted with the recommended dosage and at the corresponding water hardness and the degree of soiling at the lowest recommend wash temperature. The measurements must be performed on unlaundered and laundered test clothes. The laboratory's evaluation of the test results shall be clearly stated in the report. The measurements of secondary effects such as bleaching, bleaching/damage factor, ash content, greying and fluidity increase can be made with multi wash test clothes and analysed according to ISO 4312.	manufacturer/applicant with the aid of artificially soiled test clothes which are washed in the process. The test must be conducted by a laboratory fulfilling the requirements in annex 4. The test must be conducted with soft water (0-6d°H). The measurements must be performed on unlaundered and laundered test clothes. Evaluation of the test results shall be made by the laboratory and it shall be clearly stated in the report. The measurements of the secondary effects such as bleaching effect, bleaching factor, ash content, greying and fluidity increase shall be made with multi wash test clothes and analysed according to ISO 4312.	performance standards. Performance of the product with respect to both cleaning ability (ability to remove soil) and cleaning performance (the total amount of soil removed per dish wash) must be assessed.
Automatic dosing systems		
The existing criteria state that multi-component systems shall be offered to the customer together with an automatic and controlled dosing system. This must incorporate customer visits which: ensure correct dosage; are performed at customers' premises; take place at least once a year during the license period; as a minimum must include calibration of dosage equipment; can be performed by a third party.	Customer visits to customers who use automatic dosing systems must be incorporated as a normal routine at manufacturers/suppliers. Customer visits must be performed during the term of the licence in accordance with the suppliers' routines and in accordance with agreements with the customer in question. Customer visits can also be made by a third party.	
User information		
Under the existing criteria, the following washing recommendations shall appear on the packaging: • Wash at the lowest possible temperature. • Always wash with full load. • Dose according to soil and water hardness; follow the dosing instructions. • If you are allergic to house dust, always wash bedding at 60 °C. Increase wash temperature to 60 °C in case of infectious diseases. • Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution, waste production and energy consumption.		The detergent must be accompanied by instructions for proper use so as to maximise product performance and minimise waste. These instructions shall include information on reuse, recycling and/or correct disposal of packaging. The label, or an accompanying technical product data sheet, must include details of the recommended dosage (in ml or g) for one kg of laundry to be washed for different levels of soiling and for different water hardness. The following or equivalent words should be clearly displayed on the packaging: *"All detergents have an effect on the environment. Always use the correct dose for maximum efficiency and minimum environmental impact."*

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EU Ecolabel Industrial and institutional laundry detergents	Nordic Swan Laundry detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Laundry Detergents
		Any proposed changes/ alterations to this wording must be submitted to and approved by The Trust.
Claims		
Claims on the packaging: In general the claims on the packaging shall be documented through performance testing (e.g. claims of efficiency at low temperatures, of removal of certain stain types, of benefits for certain types or colours of textiles, or other claims of specific properties/benefits of the product).		No claim or suggestion, on the packaging or by any other means, shall be made that the product has an antimicrobial action. If the licence holder includes claims relating to the product being 'natural' or 'plant based' the licence holder shall provide evidence to support the claim, including but not limited to: • the definition used by the licence holder to support the 'natural' or 'plant based' claim; • the source of all ingredients including whether they are synthetic versions of the chemicals; and • evidence of chain of custody where synthetic versions exist and the ingredients are non-synthetic versions.
Waste management		
		The licence applicant/holder and product manufacturer must have effective waste management policies and procedures and/or a waste management programme. In addition licence holders must report annually to The Trust on waste management.
Energy management		
		The licence applicant/holder and product manufacturer must have effective energy management policies and procedures and/or an energy management programme. In addition licence holders must report annually to The Trust on energy management.

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Table 7: Comparison of excluded substances

Substance	EU Ecolabel		Nordic Swan		Environmental Choice New Zealand		Singapore Green Label
	LD	IILD	LD	Professional LD	LD	Commercial and Institutional LD	LD
Phosphates	X	X	Separate criterion on phosphorus compounds	Separate criterion on phosphorus compounds	X		Separate criterion on phosphorus compounds
APEO and ADP derivatives		X	X	X	X	X	
Ethylenediaminetetracetic acid (EDTA)	X	X	X	X	X	X	X
Nitro-musks and polycyclic musks	X	X	X		X	X	X
Reactive chlorine compounds				X	X	X	
Chlorine-based bleach			X				X
Linear alkylbenzene sulphonate				X			
diallyl dimethyl ammonium chloride (DADMAC)				X			
Perfluorinated and polyfluorinated alkylated compounds (PFAS)				X			
Boric acid and borates				X			
Optical brighteners	Derogations apply		X	X	X	X	
Nitrilo tri-acetic acid (NTA)	Derogations apply	Derogations apply		X	X	X	
Fragrances	Special exemptions apply	Special exemptions apply	Special exemptions apply	X			
Triclosan				X			
Persistent, bio-accumulable and toxic (PBT) substances – Annex XIII of REACH			X	X			
Very persistent and very bio-accumulable (vPvB) – Annex XIII or REACH			X	X			
Substances on the EU's list of 118 substances documented to cause endocrine disruption			X	X	X	X	

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Substance	EU Ecolabel		Nordic Swan		Environmental Choice New Zealand		Singapore Green Label
	LD	IILD	LD	Professional LD	LD	Commercial and Institutional LD	LD
Halogenated flame retardants				X			
Nanoparticles compromising metal, carbon or fluorine compounds				X			
Quaternary ammonium salts that are not readily biodegradable					X	X	
Heavy metals (As, Cd, Cr, Pb, Hg)					X		X
Formaldehyde							
Benzophenone UV adsorbers							
Opacifiers						X	
Perborates							X

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2.6 The need for separate criteria for LD and IILD

2.6.1 *Stakeholder feedback*

In the initial stage of the study the potential for merging LD and IILD criteria was analysed. Nearly 80 % of respondents to the stakeholder questionnaire thought that they should remain as two separate sets of criteria. The following reasons for keeping the two separate were received as feedback from stakeholders:

- They are used in different ways and as a consequence need different performance tests.
- The products contain different ingredients and are two completely different approaches to washing textiles.
- It would be very difficult and confusing to merge the criteria.
- There are major differences in regulation, product dosage, formula, applications, conditions, washing procedure and device characteristics.

However, three of the respondents suggested that the criteria should be merged as, in their opinion, LD and IILD are actually the same products and have the same purpose and, instead, pre-wash detergents should have separate criteria.

A review of other national ecolabelling schemes has revealed that their criteria are separate for domestic/ household and industrial/professional laundry detergents (Section 2.5). For instance, the New Zealand Ecolabelling Trust quotes the following in its criteria document for commercial and institutional laundry detergents: "Commercial and institutional laundry products are likely to have tougher performance expectations than household products. Due to the performance expectations required of professional laundry products, it is appropriate to have different environmental criteria than for household products in order to ensure that the products can perform as required." The Nordic Swan label also has separate criteria for 'laundry detergents and stain removers' and 'laundry detergents for professional use'. In general LD and IILD are only merged in criteria documents when they are treated as wider product groups - for example, detergents or chemical products as a whole - which is the approach taken be by the Swedish Good Environmental Choice Label.

2.6.2 *Differences between LD and IILD products*

In order to form a balanced argument for and against merging LD and IILD criteria, it is important to fully understand the differences in the products which are covered by these categories and how they are used. IILD only account for around 4 % of the total laundry detergents market. In terms of market value, this is equivalent to €642 million (in 2012)56. Compared to household products they are used in a wide range of locations including hotels, restaurants, food production and processing, contract cleaners, professional laundries, hospitals and nursing homes.

The products and services provided by the IILD market cater for specialist cleaning and hygiene needs. Not only is the customer base vastly different but so are the needs required from the products, compared to the market for domestic laundry products. In contrast to the household sector, often IILD users do not simply purchase a detergent product; rather they buy a full service whereby the formulations are specific to their laundry needs. For IILD users, more care and attention is given to the dosage rates, and often automatic dosing systems are used. This not only cuts down on product wastage and therefore cost but also impacts on the environmental performance of textile washing. In contrast, users of household detergents are more likely to over-dose with laundry detergent. As a consequence, more stringent user information and dosage requirements are needed for the Ecolabel criteria for LD compared to IILD.

To further characterise the differences between LD and IILD, the typical users, wash performance requirements and washing processes and equipment are outlined below.

[56] Euromonitor International, cited on A.I.S.E website http://www.aise.eu/our-industry/market-and-economic-data.aspx

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2.6.2.1 Typical users and required wash performance

Typically, the IILD market is divided into the following segments[57]:

- large commercial laundries and textile leasing companies
- hospital laundries
- large on-premises laundries
- small on-premises laundries.

These classifications cover a wide range of industries and institutions including: hospitals, nursing homes, schools, hotels, prisons, restaurants, contract cleaners, health clubs, food production and processing and other industries which use textiles. These industries and institutions are likely to have specific requirements in terms of wash performance (e.g. spotless white linens for hotels) and types of soiling (e.g. mineral oil from the engineering industry).

Typical types of soiling and wash performance requirements of users of IILD are[56]:

- Specific hygiene requirements such as disinfection.
- Maintenance of whiteness, of particular importance for linens used in the hospitality industry.
- A minimum of ash (detergent and salt residue) left on the fibre.
- Minimal shrinkage and deformation of textiles.
- Fresh and 'clean' smell.
- Removal of dirt from engineering industry (e.g. mineral oil and heavy metals).
- Removal of soiling from hospital goods (e.g. blood, faeces, food and pus).
- Removal of soiling from kitchen and food factory wash-goods.
- Minimum colour fading or dye transfer.
- Optimal performance in calenders[58] and folding machines.
- Minimum mechanical and chemical damage.
- Optimal soil and stain removal.

Typical stains encountered for domestic and household laundry include:

- food stains such as mustard, chocolate, frying fat, baby food, tomato sauce
- drink stains such as tea, coffee, red wine, fruit juice
- grass
- mud
- blood
- motor oil
- make-up.

2.6.2.2 Differences in product formulation

Due to the confidentiality of manufacturer product formulations, limited information has been found regarding the key differences in product formulation between laundry products intended for household and commercial use. In general IILDs are more concentrated and highly alkaline compared to their household equivalents. Alkaline substances are used to improve the performance of detergents; commonly used alkalis include silicates and sodium hydroxide. Many of the same substances are used in IILDs and LDs but in varying concentrations. The use of optical brighteners is discouraged in household laundry detergents, by the existing ecolabels, for instance Nordic Swan and EU Ecolabel. However, reasons why they are required in professional laundry detergents include:[59]

- Improved degree of whiteness, leading to a longer life span – this is especially important for hotel linen.
- Demand by some institutions for a certain level of whiteness before certifying laundries.

[57] *Industrial and Institutional: Environmental dossier on professional laundry*, A.I.S.E., October 2000
[58] Calender: a machine used for pressing and ironing textiles used in industrial laundry operations
[59] *Ecolabel Criteria for Laundry Detergents for Professional Use – Technical report*, version 3. Ecolabelling Denmark, 2011

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- New textiles which already have optical brighteners embedded in them may require a wash process with optical brighteners to maintain their original whiteness level.

Most large industrial laundries have central water softening equipment, reducing the need for builders[60] in the detergent formulation. Thus, IILDs may contain substantially lower amounts of builders compared to household equivalents. Some laundries may also have wastewater treatment facilities which minimise the release of wastewater products. Due to better sorting, equipment and dosage optimisation systems, professional laundries use detergents more efficiently than households; they use an estimated 80-90 % less detergent per kg of washing.[61] Often modular systems are employed for professional laundry detergents, where the detergent system consists of an alkali booster, a sequestrant builder, a surfactant blend, an enzymatic additive and a per-oxy-bleach, mixed to achieve the optimal wash performance for a specific task.

2.6.2.3 Differences in washing processes and equipment

In general, professional laundering takes place at higher temperatures and uses more efficient washing machines than domestic laundering.[62] The washing machine used will depend on the type of industry or institution and the wash load volume. Washer extractors of various sizes, washer dryers and continuous batch tunnel machines are all used.

The differences in wash load volume, wash programme duration and wash temperature for different types of washing machine are summarised in Table 8.

Table 8: Summary of wash processes by washing machine type[63]

Type of appliance	Main customer segment	Wash load volume	Duration of typical wash programme	Typical temp of wash programme
Household washing machine	Household	6 kg	120 min	40 °C
Semi-professional washer extractor	Coin & card laundry and apartment household laundry	6 kg	35-55 min	40 °C
Professional washer extractor	Coin & card laundry and apartment household laundry	<15 kg	35-55 min	40 °C
Professional washer extractor	Hospitality laundry	15-40 kg	50 min	60 °C
Professional washer extractor	Commercial industrial laundry	>40 kg	30 min	60 °C
Professional washer dryer	Hospitality laundry	6 kg	50-70 min	60 °C
Professional barrier washer	Healthcare hospital laundry	30 kg	45 min	>60 °C
Washing tunnel machine	Commercial industrial laundry	1,000-2,000 kg per hour	30 min	Pre-rinse 40 °C, main wash 70-80 °C, rinse zone 40 °C

2.6.3 *Conclusions*

Compared to household users, professional users have different requirements and often higher expectations of laundry detergents. The evidence presented above suggests that the washing processes employed are different

[60] The function of builders in laundry detergents is to bind calcium in the water and in the soil on the clothing. Examples of builders include zeolite, citrate, polycarboxylates, silicates and carbonates.
[61] *Environmental assessment of laundry detergents, European Textiles Services Association*, 2013; from http://www.eco-forum.dk/detergents/index.htm
[62] *Nordic Ecolabelling of Laundry detergents for professional use*, proposal for consultation, version 3, Nordic Ecolabelling, June 2013
[63] *Preparatory Studies for Eco-design Requirements of Energy-using Products*: Lot24: Professional Washing Machines, Dryers and Dishwashers, Oeko Institute and BIO Intelligence Service, May 2011

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for professional and household laundry. Almost 80 % of stakeholders were in agreement with the proposal for the LD and IILD criteria to remain as two separate criteria. This proposal is in line with the separate criteria for LD and IILD undertaken by, for example Nordic Swan and New Zealand's Environmental Choice.

2.7 Summary of the findings

Very few formal definitions or scope documents for laundry detergents (both domestic and industrial) or related products have been developed. However, the few which have been developed (Nordic Swan, Environmental Choice) define the product groups separately. Based on the evidence gathered in this report (cf. Section 2.6), the EU Ecolabel should keep the criteria for LD and IILD separate. The stakeholder survey and review of other ecolabels and voluntary agreements for laundry detergents have been taken into account when considering the proposed scope and definitions which, for the LD and IILD product groups, are as follows:

- For LD, we propose that the product group definition shall remain largely the same. However, the inclusion of fabric softeners and a wider range of stain removers should be considered as it was viewed favourably by the stakeholders. Further LCA analysis is proposed to be used to support the inclusion of additional products.
- For IILD, we propose that the product scope shall remain the same and a definition of multi-component systems should be added for clarity.

Laundry detergents: *The product group 'Laundry Detergents' shall comprise: laundry detergents, fabric softeners and stain removers whether in powder, liquid or any other form which are marketed and used for the washing or textiles principally in household machines but not excluding their use in laundrettes and common laundries.*

This product group shall not comprise products that are dosed by carriers such as sheets, cloths or other materials nor washing auxiliaries used without subsequent washing such as stain removers for carpets and furniture upholstery.

Industrial and Institutional laundry detergents: *The product group 'Industrial and Institutional Laundry Detergents' shall comprise: laundry detergent products performed by professional users in the industrial and institutional sector.*

Included in this product group are multi-component-systems constituting of more than one component used to build up a complete detergent or a laundering program for automatic dosing system. Multi-component systems may incorporate a number of products including fabric softeners, stain removers and rinsing agents.

This product group shall not comprise products for obtaining textile attributes such as water-repellent, waterproof or fire-proof, etc. Furthermore, the product group shall not comprise products that are dosed by carriers such as sheets, cloths or other materials, as well as washing auxiliaries used without subsequent washing, such as stain removers for carpets and furniture upholstery.

Consumer laundry products are excluded from the scope of this product group.

2.8 Recommendations for revision of existing criteria from the stakeholders' survey

In the following section, the initial recommendations for revision of the current criteria - based on feedback received from the stakeholder survey - are presented. The issues presented have been identified following stakeholder consultation and, where applicable, from reviews of other ecolabelling schemes for laundry detergents. An initial discussion on the feasibility and motivations behind each recommendation is also provided.

This examination process will be used to help direct the revision of the criteria and to highlight areas where further investigation and stakeholder input are required. These changes have been suggested by stakeholders,

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and further assessment may be required. This will be undertaken during the next stage of the revision process and presented in the technical report. In the technical report the proposals for criteria revision will be assessed and verified by the results of the technical analysis and/or another applicable method.

2.8.1 *Comparison between LD, IILD and GPP criteria*

The characteristics covered by the three different criteria documents - LD, IILD and Green Public Procurement (GPP) (core and comprehensive criteria) - are summarised in Table 9. The EU Ecolabel product category for LD has the widest set of criteria. The most significant difference for the LD product category is the point criterion, describing a series of other environmental attributes for which a minimum number of points must be met in order for the product to qualify for the award of an Ecolabel.

Table 9: Comparison of LD, IILD and GPP criteria

Criterion description	LD	IILD	GPP (core)	GPP (comprehensive)
Dosage	X	X	X	X
Aquatic toxicity (CDV)	X	X		X
Biodegradability of organics	X	X		
Excluded or limited substances	X	X	X	X
Washing performance	X	X	X	
Points	X			
Packaging	X	X	X	X
Consumer/user information	X	X	X	X
Info on the EU Ecolabel	X			
Automatic dosing systems		X		

For consistency between the product categories, further harmonisation should be considered within each individual criterion. For instance, where the criterion for dosage for IILD is specified by water hardness, the same should be true for LD. Several of the stakeholders suggested that, where possible, the list of excluded or limited substances should be harmonised between the criteria. This will be assessed on a case-by-case basis during the review process. It has also been noted that the criteria for LD and IILD use different definitions of water hardness: for the sake of simplification these should be harmonised where possible.

2.8.2 *Assessment and verification of measurement thresholds for constituents*

In this instance the measurement threshold is defined as the concentration of ingredients in the product for which there is a requirement for documentation of compliance with the ecological criteria. During the previous LD criteria revision, the measurement thresholds imposed on ingredient concentration for ecological requirements were reviewed.64 In the 2003 criteria, the measurement threshold imposed on ingredient concentration for ecological requirements was set at ≥ 0.1 % by weight of the preparation; this was changed to ≥ 0.01 % weight of the preparation for all ingoing substances in 2011. Moreover, in the current criteria, compliance is required for preservatives, colouring agents and fragrances regardless of their concentration.

As part of the questionnaire, stakeholders were asked for their views on this threshold and to comment on whether or not they thought it should remain at 0.01 % or change. The opinion of the stakeholders was split on this matter, with just under 50 % of the respondents suggesting a reversion to 0.1 % and just over 50 % of the respondents calling for the thresholds to remain at 0.01 %. The stakeholders gave a variety of opinions for and against the 0.01 % measurement threshold, such as:

In favour of 0.1 % requirement:

[64] *Revision of Ecolabel Criteria for Laundry Detergents: Background Report*, Ecolabelling Denmark, 2009.

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- "*Should be 0.1 % unless toxicity of the ingredient requires a lower limit".*
- *"These limits are also used by REACH and CLP".*
- *"0.1 % is enough for general ingredients and lower limits should be set for substances that have special toxicity scale or limits".*

In favour of 0.01 % requirement:

- *"Remain at 0.01 % because impurities can be present in the product up to 100ppm".*
- *"In the criteria for all purpose cleaners all the substances, even if the concentration is lower than 0.01 %, should be taken into account for the CDV calculation. This has to be changed for laundry detergents too".*
- *"The threshold should be 0.01 % except for biocides, fragrances and colorants where it should be stricter.*

To uphold the environmental credentials of the EU Ecolabel, it is proposed that the threshold should remain at 0.01 %. No issues have been raised by the stakeholders with regard to the technical feasibility of this requirement. However, there is an argument for a variable threshold, whereby stricter limits are applied when necessary. Employing a variable threshold would further complicate the criteria and application process, which may deter and hinder applicants. Moreover, other national ecolabelling schemes use the 0.01 % threshold and it would be detrimental for the EU Ecolabel to appear less strict on ecological criteria. At this stage we recommend that the measurement threshold imposed on ingredient concentrations for ecological requirements is not changed.

2.8.3 *Criteria for LD product category*

2.8.3.1 Criterion 1: Dosage requirements

Current criteria:
The recommended maximum dosage amounts in the current criteria are:

Product type	Dosage, powder/tablet	Dosage, liquid/gel
Heavy-duty laundry detergent, colour-safe detergent	17.0 g/kg wash	17.0 ml/kg wash
Low-duty detergent	17.0 g/kg wash	17.0 ml/kg wash
Stain remover (pre-treatment only)	2.7 g/kg wash	2.7 ml/kg wash

Dosage corresponds to grams or millimetres of product used per kilogram wash. Heavy-duty detergents are defined as detergents used for ordinary washing of white and coloured textiles at any temperature. Low-duty detergents are defined as detergents promoting special fabric care, e.g. delicate fabrics such as wool and silk or for delicate colours.

Proposed changes from stakeholder feedback	Further information from feedback
1) For Nordic Swan the maximum dosage is 14.0 g/kg wash; the criteria could be lowered to be in line with the Nordic Swan	Three respondents out of 17 responses did not consider that the dosage criterion is strict enough. It was commented that the dosage requirements could be lowered to 14 g/kg (as per the Nordic Swan). The dosage requirements criteria for the Nordic Swan ecolabel appear to be stricter than the current EU Ecolabel criteria. The maximum dosage limits for the Nordic Swan are shown below[65]. For both heavy-duty and low-duty LD the headline figure for maximum dosage is 14.0 g/kg wash, compared to 17.0 g/kg wash for the EU Ecolabel. However, the value for the Nordic Swan corresponds to soft water. In addition, the Nordic Swan criteria state that for middle-hard and hard water the maximum dosage must not exceed 130 % and 160 % of the

[65] Maximum dosage criterion for Nordic Swan

Product type	Water hardness	Dosage
Heavy-duty laundry detergent (normally soiled)	Soft	14.0 g/kg wash
Low-duty laundry detergent	Soft	14.0 g/kg
Stain-removers (pre-treatment)	All	2.7 g/kg

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	recommended dosage for soft water respectively. This would imply a maximum dosage of 18.2 g/kg wash for middle-hard water and 22.4 g/kg wash for hard water. The current EU Ecolabel criteria are for a water hardness of 2.5 mmol of $CaCO_3$/l, which corresponds to medium water hardness. Thus, when water hardness level is taken into account, it shows that the current EU Ecolabel criteria are stricter than the Nordic Swan criteria. However, this is not obvious from the criteria documents. For comparison the dosage limits of the A.I.S.E. Charter for Sustainable Cleaning are of similar magnitude. For instance, for powder detergents the maximum dosage is 75 g/job (for a 4.5 kg load) for medium water hardness, which corresponds to 16.7 g/kg wash. *Instead of changing the dosage requirements, further clarification in the criteria documents is required. This could be achieved by simplifying the wording or including a table of water hardness*.
2) Criteria could be stricter for liquids and hydro-soluble capsules	One respondent pointed out that liquids and hydro-soluble liquids are different products to powder detergents and have different requirements. Stricter dosage requirements could be proposed for these products types, to keep pace with the current trend for product compaction. The following limits have been suggested by one of the EU Ecolabel competent bodies: 10 ml/kg wash for liquids and 7 ml/kg wash for capsules. None of the other ecolabels examined in this report have specific dosage limits for hydro-soluble capsules. Potentially different dosage requirements could also be implemented for concentrated liquids. *Further investigation and stakeholder input is required.*
3) Dosage requirements should be dependent on water hardness	The criteria for maximum dosage should take into account water hardness as the amount of product required will depend on the level of water hardness which varies significantly by country and region. Clarification is first required over what level of water hardness is implied by the current criteria; at present it is stated as "for a water hardness of 2.5 mmol $CaCO_3$/l", however, it would be simpler to state soft/medium/hard water. The A.I.S.E. requirements state that dosage limits must be set according to the level of water hardness. *This criterion should be revised so that different levels of water hardness are taken into consideration. For the maximum dosage criteria it will be simpler to set the criteria at a specified level of water hardness, for example medium hard water. The dosage information on the packaging should also be described according to water hardness, and this should be addressed in the criteria for consumer information.*

2.8.3.2 Criterion 2: Toxicity to aquatic organisms: Critical Dilution Volume (CDV)

Current criteria:
The critical dilution volume of the product must not exceed the following limits (CDV chronic):

Product type	$CDV_{chronic}$
Heavy-duty laundry detergent, colour-safe detergent	35,000 l/kg wash
Low-duty detergent	20,000 l/kg wash
Stain remover (pre-treatment only)	3,500 l/kg wash

Proposed changes from stakeholder feedback	Further information from feedback
1) CDV limits need to be recalculated according to the 2014 Detergent	The method of calculating the CDV limits should use the latest version of the DID list, which has recently been enlarged and updated. The DID list is regularly updated and includes as many detergent ingredients as possible. When

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	Ingredient Database list (DID list)[66]	ingredients are not on the DID list, it is more difficult for manufacturers to validate the data which they have received from their suppliers. *Following an examination of the new DID list the CDV limits will be revised accordingly; this will form part of the technical report. This will be done in parallel to the analysis of CDV values of EU Ecolabel products (to be obtained from competent bodies).*
2)	**Consider taking an environmental risk approach**	Two of the stakeholders commented that CDV takes a purely hazard based approach and uses the sum of these hazards. It would be more logical to use an environmental risk based approach, such as that employed by REACH[67] where a risk assessment of the consumer's / environment's exposure is required, taking into account the way the chemicals (and products) are actually used.[68] *As little information was provided on this approach, further investigation and stakeholder input are required*
3)	**Consider different CDV levels for different product types/forms**	Fewer than 40% of the respondents consider that different CDV levels should be set for different product types/forms. It was pointed out that the release of active ingredients is different and ingredients are different for each form or product. The CDV limits for the current criteria do not depend on the form of the product (e.g. the limit for liquids and powders is the same). This may not be the most realistic approach; for example, water soluble films contribute significantly to CDV levels and therefore should have stricter limits. The IILD criteria set CDV limits by product type and form as well as by water hardness. Further harmonisation can be achieved by taking the same approach with LD. Other ecolabels examined in this report, when considering aquatic toxicity, do not employ CDV limits set by product form. *To assess this requirement it may be necessary to acquire anonymised product formulations from existing licence holders via CBs. In order to propose new values for the revised EU Ecolabel criteria competent bodies and other stakeholders will be contacted and asked for information on CDV values of EU Ecolabel laundry detergents. The results of this investigation will be presented in the technical report.*
4)	**Consider using USEtox for assessing toxicity to aquatic environment**	USEtox[69] is a model which can be used to calculate characterisation factors for human and ecotoxicity impact categories for life cycle assessment. The French environmental labelling standard, under development by ADEME-AFNOR, has chosen to employ USEtox instead of CDV.[70] Studies have been conducted to compare the environmental scores from USEtox and CDV. [71] [72] They have found that the scores obtained from both for the same detergent may give different ingredient rankings. However, the general conclusion from the studies is that both methods are relevant for calculating product environmental impact scores related to their hazard. Switching from CDV to USEtox for assessing the environmental scores of detergent products for the EU Ecolabel would be far from trivial. For instance, it will not be possible to calculate the USEtox of a detergent using the DID list,

[66] http://joutsenmerkki.fi/wp-content/uploads/2013/07/DID-list-Final-report-english.pdf
[67] For further information on REACH see http://ec.europa.eu/enterprise/sectors/chemicals/reach/index_en.htm
[68] Position of the European Chemical Industry Council (Cefic) on the Communication from the commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions. Public procurement for a better environment, Brussels, August 2013. From http://www.cefic.org/Documents/PolicyCentre/CEFIC-POSITION_on_GPP_final.pdf
[69] USEtox DOI: http://dx.doi.org/10.1007/s11367-008-0038-4
[70] *General Principles for an Environmental Communication on Mass Market Products*, Methodology for the Environmental Impacts Assessment of Household Heavy Duty Laundry Detergents, Ademe, 2012
[71] *Comparing chemical environmental scores using USEtox and CDV from the European Ecolabel*, E.G. Saouter, C. Perazzolo, L.D. Steiner, Int.J.Life Cycle Assess., p795-802, 2011
[72] Ecotoxicity impact assessment of laundry products: a comparison of USEtox and critical dilution volume approaches, Van Hoof, G., Schowanek, D., Franceschini, H., Munoz, I., Int. J. Life Cycle Assess., p803-818, 2011.

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	instead a USEtox database is required. *The criterion on toxicity to the aquatic environment is very important for laundry detergents as they are released into water during use and after use, any changes to this criterion require careful consideration and thorough investigation.*

2.8.3.3 Criterion 3: Biodegradability of organics

Current criteria:
The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

For aerobically non-biodegradable organics (aNBO):

Product type	aNBO, powder	aNBO, liquid
Heavy-duty laundry detergent, colour-safe detergent	1.0 g/kg wash	0.55 g/kg wash
Low-duty detergent	0.55 g/kg wash	0.30 g/kg wash
Stain remover (pre-treatment only)	0.10 g/kg wash	0.10 g/kg wash

For anaerobically non-biodegradable organics (anNBO):

Product type	anNBO, powder	anNBO, liquid
Heavy-duty laundry detergent, colour-safe detergent	1.3 g/kg wash	0.70 g/kg wash
Low-duty detergent	0.55 g/kg wash	0.30 g/kg wash
Stain remover (pre-treatment only)	0.10 g/kg wash	0.10 g/kg wash

Proposed changes from stakeholder feedback	Further information from feedback
1) Criteria should be less strict for anaerobic biodegradability of organics	Around 20 % of the stakeholders have commented that the current criteria for anaerobic biodegradability of organics are too strict. The (non-surfactant) organic aNBO or anNBO substances found in laundry detergents and stain removers are: polycarboxylates, carboxymethylcellulose, silicone, poly-4-vinylpyridine-n-oxide/polyvinylpyrrolidone-iodine, phosphonates, polymers, fragrances and colorants. Organic substances which are readily biodegradable are removed quickly from the environment. Conversely, substances which are not biodegradable can accumulate in the environment and potentially cause harm. Limiting the amount of non-biodegradable substances ensures that EU Ecolabel products contribute minimally to accumulation of organic substances in wastewater sludge.[63] *As no suggestions were given for what a more suitable limit would be, further investigation and stakeholder input is required if this criterion is to be revised. If possible this will include an analysis of anNBO levels of EU Ecolabel laundry detergents, information on which is to be collected from the CBs.*
2) Biodegradability of surfactants should be consistent with other Ecolabel criteria	Opinions were split on this matter. Ecolabel criteria for other product groups, including IILD, have a requirement for all surfactants to be biodegradable. Such a requirement could also be applied to the LD category. In addition, the Nordic Swan and Environmental Choice (New Zealand) criteria state that *"all surfactants must be aerobically and anaerobically biodegradable"*. According to the Detergents Regulation, ultimate aerobic biodegradability of surfactants is already required for products sold on the European market.[73] However, this Regulation does not define requirements for anaerobic biodegradability. *Further discussion is required on whether or not the criteria should state that all surfactants must be readily aerobically and anaerobically biodegradable. For further information, and to strengthen the scientific argument, on degradation*

[73] Guidelines on the implementation of the Detergents Regulation v2, A.I.S.E., June 2013.

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	of surfactants the work of SCHER will be drawn upon, in addition to stakeholder feedback. This investigation will be presented in the technical report.

2.8.3.4 Criterion 4: Excluded of limited substances and mixtures

Current criteria:
Under the existing criteria, the following ingredients must not be included in the product:

- phosphates
- EDTA (ethylenediaminetetraacetic acid)
- nitro-musks and polycyclic musks.

According to Article 6(6) of Regulation (EC) No 66/2010 on the EU Ecolabel, the product or any component of it shall not contain substances meeting criteria for classification with the hazard statements or risk phrases specified in the criteria document.

Derogations and exemptions apply for the following substances:

- surfactants (in concentrations <25 % in the product)(for H400 and H410)
- fragrances
- biocides used for preservation
- enzymes
- bleach catalysts
- NTA as in impurity in methylglycin di-acetic acid (MGDA) and glutamic acid di-acetic acid (GLDA)
- Optical brighteners (only for heavy duty domestic laundry detergents).

Proposed changes from stakeholder feedback	Further information from feedback
1) Harmonise with list for IILD (as far as possible)	Harmonisation would allow for synergies between the two product groups, however, there are some substances which will be acceptable in IILD and not LD and vice versa. The Commission Statement following the development of the IILD criteria called for closer alignment between LD and IILD.[74]
2) Add derogation for surfactants with H412 classification[75]	Five of the stakeholders requested that a derogation should be added for surfactants classified under H412 as almost all ethoxylated alcohols, commonly used surfactants, are now classified under H412. Stakeholders from trade associations, manufacturers and competent bodies all raised this issue. Preventing their use makes the formulation stage problematic. *An amendment to the Commission Decision (2011/263)[76], included a derogation for surfactants classified under H412. In order to ensure that, this derogation is necessary, given that substances classified with H412 are harmful to aquatic life with long-lasting effects, an assessment of its validity will be included in the technical report.*
3) Restrict substances considered persistent, bio-accumulable and toxic (PBT), very persistent and very bio-accumulable (vPvB) and/or those	Stakeholders have suggested that the use of these substances in the ingredients of the product should be restricted, but further discussion on the best approach for excluding such substances is needed. The Nordic Swan has a larger list of excluded substances, but EU Ecolabel also excludes a large number of substances by default through Art 6.6 of the Ecolabel Regulation.[78] Overall, APEOs (alkylphenol ethoxylates), APDs (alkylphenol derivatives) and linear alkylbenzene sulphonates are excluded by the Nordic Swan but not the

[74] Summary of the meeting of the Regulatory Committee established under Article 16 of Regulation (EC)66/2010 of November 2009 of the European Parliament and of the Council on the EU Ecolabel. Brussels, 29 June 2012.
[75] Derogation for surfactants with H412 classification has been introduced through a posterior amendment. The comment is kept because it was the stakeholder feedback.
[76] Commission Decision 2014/313/EU, available from: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0313&from=EN

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having endocrine disrupting properties[77]	EU Ecolabel. A comparison of the substances excluded by the criteria of different ecolabels is provided in Table 7. *Further research is required on each substance for which an exclusion is proposed, with the exception of those already banned by Article 6.6. This will be presented in the technical report.*
4) Exclude phosphonates from EU Ecolabel laundry detergents	One of the stakeholders from industry suggested that phosphonates should be excluded from both LD and IILD products. Phosphonates are chelating agents and limescale inhibitors which are used as alternatives to phosphates in laundry detergents. Phosphonates are not readily biodegradable and concerns have been raised over their use in laundry detergents. Phosphonates do not release phosphorus to aquatic systems as readily as phosphates do as they are only photo-degradable and so release phosphorus to aquatic systems under certain conditions only. According to the European Association of Craft, Small and Medium-Sized Enterprises (UEAPME), the use of phosphonates is fundamental to laundry detergents to achieve good washing performance and therefore their use should not be reduced.[79] The HERA report on phosphonates concluded that the use of the phosphonates aminotris (methylene phosphonic acid, ATMP), 1-hydroxy-ethylidene diphosphonic acid (HEDP) and diethylene-triamine-penta-methylene-phosphonic-acid (DTPMP) in household laundry and cleaning detergents is safe and does not cause concern with regard to consumer use.[80] Other national ecolabels take a different approach to phosphorus and, instead of exclusions, limits are set for the total content of phosphorus in the product. *Given all evidence gathered, total exclusion for phosphonates would seem inappropriate. A more considered approach would be to set a maximum limit for phosphorus substances in the product formulation. A criterion on the maximum limit of phosphorus will be proposed for consideration.*
5) Additional derogation for peracetic acid (classified H400)	Stakeholders requested that a derogation should be added for peracetic acid classified as H400. The reasoning provided by industry stakeholders is that bleaching agents such as peracetic acid are necessary for both domestic and I&I laundry detergent formulation. However, substances classified with H400 are very toxic with long-lasting effects. Further work is required to establish whether or not such substances are essential to the formulation of laundry detergents and whether or not suitable alternatives exist. *Further investigation into the use of bleaching agents and peracetic acid classified with H400 will be presented in the technical report.*
6) Exclude specific nanomaterials of concern	An exclusion of specific nanomaterials was not suggested by stakeholders during the survey but instead the review of national ecolabels found that the Nordic Swan has banned nanoparticles compromising metal, carbon or fluorine compounds from professional laundry detergents. Some nanomaterials, for example nanosilver, are already used in laundry detergents and their use is forecast to rise. Nanomaterials represent a significant problem with regard to testing as current available analytical test methods require modification in order to deal with nanoparticles. *Further investigation is required; this will include a literature search on specific nanomaterials used in laundry detergents and their environmental impacts.*

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[78] Regulation (EC) No 66/2010 of The European Parliament and of The Council 0f 25 November 2009 on the EU Ecolabel. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:027:0001:0019:en:PDF

[77] These chemicals are already restricted though the Hazardous Chemical substances criterion. The text is kept as it is feedback from the stakeholders.

[79] UEAPME's opinion on the revision of Eco-label criteria for laundry and dishwashing detergents, August 2008. Available from http://www.ueapme.com/docs/pos_papers/2008/0808_pp_ecolabel_laundry_and_dishwashing.pdf

[80] HERA *Human & Environmental Risk Assessment on ingredients of European household cleaning products*: Phosphonates, 2009

2.8.3.5 Criterion 5: Packaging requirements

Current criteria:
For laundry products, the weight/utility ratio (WUR) must not exceed the following values:

Product type	WUR
Powders	1.2 g/kg wash
Others (e.g. liquids, gels, tablets, capsules)	1.5 g/kg wash

Plastic/paper/cardboard packaging containing more than 80 % recycled material is exempt from this requirement.

Proposed changes from stakeholder feedback	Further information from feedback
1) Criteria which further promote the use of recycled materials in packaging are required	Four of the stakeholders (out of the 15 responses) agreed that additional criteria should be set to further promote the use of recycled materials in packaging. The motivation for using recycled materials is that the environmental impact of packaging is further reduced, as long as no market distortions are created. *In comparison to other environmental impacts associated with laundry detergents, the impacts caused by packaging are negligible. The use of recycled materials is already encouraged in the existing criteria. There is little motivation to add further requirements on the use of recycled materials.*
2) Encourage ease of disassembly of packaging	The recyclability of packaging is important and should be carefully considered when setting the criteria for packaging. Three stakeholders agreed that there should be restrictions on combinations of materials used for packaging, for instance to encourage ease of disassembly for recycling. Stakeholders commented that 'non-compatible materials are the major barrier to improve the recyclability of packaging'; 'encourage ease of disassembly for recycling'; and 'materials that are not recycled and cannot be separated from the primary packaging must not be used'. By adding a requirement for ease of disassembly, recycling can be facilitated. *To facilitate effective recycling a criterion for disassembly of primary packaging should be included. A requirement for this will be proposed in the technical report.*
3) Promote use of sustainably sourced wood fibres	The current criteria do not promote the use of sustainably sourced wood fibres, only the use of recycled cardboard and paper. One stakeholder commented that 'sustainably sourced wood fibres should be regarded as an alternative to recycled paper/board' as, for example, A.I.S.E. Charter for Sustainable Cleaning and Sweden's Good Environmental Choice do. *A criterion can be proposed for board and paper packaging to ensure that the virgin material comes from sustainably managed forestry. A requirement for sustainably sourced wood fibres will be drafted and presented in the technical report.*
4) To avoid over-dosing, the primary packaging should be designed in order to make correct dosing easy	The LCA study (Section 4) shows that incorrect dosing of detergent products has a significant effect on the overall environmental impact. Therefore, it is crucial that the product is correctly dosed. To ensure that the product is correctly dosed, the primary packaging should be designed in such a way to make the dosing easier. The new criteria for rinse off cosmetics have included a criterion on the design of primary packaging. *The feasibility, advantages and disadvantages of this approach need to be further assessed, and this will be presented in the technical report.*

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2.8.3.6 Criterion 6: Washing performance (fitness for use)

Current criteria:
The product shall comply with the performance requirements as specified in the EU Ecolabel laundry detergents performance test's latest version which can be found here:
http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html

The following feedback was given by stakeholders regarding the washing performance test:

- *"Performance requirements are too easy to fulfil."*
- *"Each chosen stain must have interest about the laundry performance. Some stains don't have significant results with the laundry detergent; therefore they don't have significant results."*
- *"With the IEC A reference detergent, there are no optical brighteners in the formulation stated in the commission decision, but in reality some manufacturers use optical brighteners in their IEC A reference detergent."*
- *"Please update the reference to the latest A.I.S.E. protocol."*
- *"Must the performance be checked on two different levels of water hardness?"*
- *"Dye transfer test for concentrated liquid CSD is unattainable and should be reviewed. PVI-VI is not soluble in concentrated liquid CSD. So the benchmark has to be with a soluble PVP."*

If revision of this criterion is required then further stakeholder input will be needed.

2.8.3.7 Criterion 7: Points

Current criteria:
The points scoring system (max=8, min=3) has the objective of 1) promoting cold water and low-temperature products and 2) promoting products with very low emissions of hazardous substances to the environment. The points available for heavy-duty and low-duty laundry detergents are:

For heavy-duty laundry detergents:

Criteria	Description	Points
Climate profile	Coldwater product (washing performance documents at ≤20 °C	2P
	Low-temperature product (washing performance documented at >20 °C to <30 °C)	1P
Maximum dosage	Max dosage ≤14 g/kg wash (powder/tablet) or ≤ 14 ml/kg wash (liquid/gel)	2P
	Max dosage ≤16 g/kg wash (powder/tablet) or ≤ 16 ml/kg wash (liquid/gel)	1P
CDV	$CDV_{chronic}$ <25,000 l/kg wash	2P
	$CDV_{chronic}$ between 25,000 to 30,000 l/kg wash	1P
aNBO	aNBO ≤75 % of limit value	1P
anNBO	anNBO ≤75 % of limit value	1P

For low-duty laundry detergents:

Criteria	Description	Points
Climate profile	Coldwater product (washing performance documented at ≤20 °C)	2P
	Low-temperature product (washing performance documented at >20 °C to <30 °C)	1P
Maximum dosage	Max dosage ≤14 g/kg wash (powder/tablet) or ≤ 14 ml/kg wash (liquid/gel)	2P
	Max dosage ≤16 g/kg wash (powder/tablet) or ≤ 16 ml/kg wash (liquid/gel)	1P
CDV	$CDV_{chronic}$ <15,000 l/kg wash	2P
	$CDV_{chronic}$ between 15,000 to 18,000 l/kg wash	1P
aNBO	aNBO ≤75 % of limit value	1P
anNBO	anNBO ≤75 % of limit value	1P

Proposed changes from stakeholder feedback	Further information from feedback
1) Review points criterion	Two stakeholders commented that the points system should be removed as it only adds complexity. Other comments added that there was no distinction between whether a product has been awarded 3 or 6 points, and points could

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	be more easily obtained on aspects other than low temperature washing. *Further discussion is required on the necessity of and the reasoning behind the points criterion.* The points scoring system was introduced during the previous revision process with the aim of promoting products which perform well at low temperatures. Overall, stakeholders did think that the points criteria was effective for promoting cold water and low-temperature products, with 11 respondents (mostly from industry) agreeing to this statement. *Further stakeholder input would be beneficial in determining the necessity of this criterion. As LCA studies have shown wash temperature to have the largest environmental impact, criteria for promoting products which perform well at low-temperatures are essential. However, feedback from stakeholders has revealed that the points criterion may not be the best strategy for this. The efficacy of the points criterion requires further assessment, this will be addressed in the technical report.*

2.8.3.8 Criterion 8: Consumer information

Current criteria:

Dosage instructions

Under the existing criteria, dosage instructions shall be specified for 'normally' and 'heavily' soiled textiles as well as various water hardness ranges relevant to the countries concerned. The difference between the dosage recommendations for the lowest water hardness range for normally soiled textiles and the highest water range for heavily soiled textiles may not differ by more than a factor of 2.

Information on the packaging

Under the existing criteria, the following washing recommendations shall appear on the packaging:

- Wash at the lowest possible temperature.
- Always wash with full load.
- Dose according to soil and water hardness, follow the dosing instructions.
- If you are allergic to house dust, always wash bedding at 60 °C. Increase wash temperature to 60 °C in case of infectious diseases.
- Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution, waste production and energy consumption.

There is an additional requirement for stain removers: the removal of stains for which no performance test has been conducted, shall not be claimed on the product.

Claims on the packaging

The current criteria state that any claims on the packaging shall be documented through either performance testing or other relevant documentation (e.g. claims of efficiency at low temperatures).

Proposed changes from stakeholder feedback	Further information from feedback
1) Further recommendations on correct dosage	Overdosing is a common problem with laundry detergents; information on the label can be used to make consumers aware of this issue. A statement such as "Do not overdose" could be added to washing recommendations appearing on the packaging bringing it in line with other labels. *Dosage instructions must be specified under existing criteria, but further consumer awareness could be raised be adding an additional phrase on the importance of correct dosage.*
2) Refer to A.I.S.E. campaign 'I Prefer 30'	The campaign aims to raise awareness of the benefits of low temperature washing. Similarly, the EU Ecolabel tries to do better, also being inspired by AISE work on low temperature washing. *EU Ecolabel should not promote separate campaigns; the existing criteria already require that 'washing at the lowest possible temperature' must appear*

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	on the packaging.

2.8.3.9 Criterion 9: Information appearing on the EU Ecolabel

Current criteria:
There is an optional requirement for a text box containing the following text:

- Reduced impact on aquatic ecosystems
- Limited hazardous substances
- Performance tested

There have been no suggested changes to this criterion.

2.8.4 *Criteria for IILD product category*

2.8.4.1 Criterion 1: Product and dosage information

Current criteria:
The recommended total dosage for 1 kg of laundry according to the degree of soiling and water hardness shall be given in g/kg laundry or ml/kg laundry. For multi-component systems all products have to be included with the worst-case dosage for assessments of the criteria.

Proposed changes from stakeholder feedback	Further information from feedback
1) Further requirements depending on level of water hardness	To remain consistent with the criteria for LD, dosage requirements by level of water hardness should be considered. The existing criteria require that the degree of soiling and water hardness shall be given. A review of other ecolabels has shown that dosage limits are not employed and a similar approach to the EU Ecolabel is taken. *Further discussion with stakeholders is required on product and dosage information for IILD as the level of feedback obtained from stakeholders during the questionnaire was low. This will be addressed in the technical report.*

2.8.4.2 Criterion 2: Toxicity to aquatic organisms: Critical Dilution Volume (CDV)

Current criteria:
The critical dilution volume of the product must not exceed the following limits ($CDV_{chronic}$):

Soft water (0-6 °dH)	**$CDV_{chronic}$ (L/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	30,000	40,000	50,000
Liquid	50,000	60,000	70,000
Multi-component-system	50,000	70,000	90,000

Medium water (7-13 °dH)	**$CDV_{chronic}$ (L/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	40,000	60,000	80,000
Liquid	60,000	75,000	90,000
Multi-component-system	60,000	80,000	100,000

Hard water (>14 °dH)	**$CDV_{chronic}$ (L/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	50,000	75,000	90,000
Liquid	75,000	90,000	120,000
Multi-component-system	75,000	100,000	120,000

The full formula for calculating the CDV value is given in the criteria document

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Biocides, colouring agents and fragrances present in the product must also be included in the CDV calculation even if the concentration is lower than 0.01 % (100 ppm). Because of degradation in the wash process, separate rules apply to the following substances:

1. Hydrogen peroxide (H_2O_2) – not to be included in the calculation of CDV.
2. Peracetic acid – to be included in the calculation as acetic acid.

Proposed changes from stakeholder feedback	Further information from feedback
1) CDV limits need to be recalculated according to the 2014 DID list	*See section on LD.*
2) Water hardness should be explained in a more international way, for example in mmol/l	The current criteria for LD and IILD use different units for describing water hardness, and this should be harmonised where possible. *A further investigation into the units used for describing water hardness will be provided in the technical report. A clarification will be drafted and presented in the technical report.*

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2.8.4.3 Criterion 3: Biodegradability

Current criteria:

Under the current criteria, all surfactants must be biodegradable under aerobic conditions. All non-ionic and cationic surfactants must also be biodegradable under anaerobic conditions.

The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable aNBO) and/or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

For aerobically non-biodegradable organic substances:

Soft water (0-6 °dH)	**aNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	0.70	1.10	1.40
Liquid	0.50	0.60	0.70
Multi-component system	1.25	1.75	2.50

Medium water (7-13 °dH)	**aNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	1.10	1.40	1.75
Liquid	0.60	0.70	0.90
Multi-component system	1.75	2.50	3.75

Hard water (>14 °dH)	**aNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	1.40	1.75	2.20
Liquid	0.70	0.90	1.20
Multi-component system	2.50	3.75	4.80

For anaerobically non-biodegradable organic substances:

Soft water (0-6 °dH)	**anNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	0.70	1.10	1.40
Liquid	0.50	0.60	0.70
Multi-component system	1.25	1.75	2.50

Medium water (7-13 °dH)	**anNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	1.10	1.40	1.75

Liquid	0.60	0.70	0.90
Multi-component system	1.75	2.50	3.75

Hard water (>14 °dH)	**anNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	1.40	1.75	2.20
Liquid	0.70	0.90	1.20
Multi-component system	2.50	3.75	4.80

Proposed changes from stakeholder feedback	**Further information from feedback**
1) Criteria should be more strict for multi-component and powder products	Most stakeholders agreed with the level of strictness for multi-component products, although one respondent called for stricter limits. Strict requirements on the amount of non-biodegradable organics in EU Ecolabel detergents would minimise the accumulation of non-biodegradable organics in wastewater sludge and contribute to a reduced overall environmental impact of these products. *As only one stakeholder responded that the criteria should be stricter, it is proposed to keep the current valid criterion.*

2.8.4.4 Criterion 4: Excluded or limited substances and mixtures

Current criteria:
Under the existing criteria, the following ingredients must not be included in the product:

- phosphates
- APEO (alkyl phenol ethoxylates) and ADP (alkylphenols and derivatives thereof)
- EDTA (ethylenediaminetetraacetic acid)
- nitro-musk or polycyclic musk.

According to Article 6(6) of Regulation (EC) No 66/2010 on the EU Ecolabel, the product or any component of it shall not contain substances meeting criteria for classification with the hazard statements or risk phrases specified in the criteria document.

Derogations and exemptions apply for the following substances:

- surfactants (in concentrations <20 % in the product)
- biocides used for preservation
- enzymes
- bleach catalysts
- NTA as in impurity in MGDA and GLDA
- fragrances
- optical brighteners (only for heavy duty domestic laundry detergents).

Proposed changes from stakeholder feedback	**Further information from feedback**
1) The same exemptions should exist for LD and IILD	Where possible the criteria for the two product groups should be harmonised. However, there are some substances such as fragrances and optical brighteners which should be allowed in IILD products. *Further input and discussion with stakeholders is required on this topic.*
2) Add derogation for surfactants with H412 classification	*See section on LD for further details*
3) Restrict substances considered PBT, vPvB and/or those having endocrine disrupting properties	*See section on LD for further details*

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4) Exclude phosphonates from EU Ecolabel laundry detergents	*See section on LD for further details*
5) Additional derogation for peracetic acid (classified H400)	*See section on LD for further details*
6) Exclude specific nanomaterials of concern	*See section on LD for further details*

2.8.4.5 Criterion 5: Packaging requirements

Current criteria:
The weight/utility ratio (WUR) must not exceed the following values:

Product type/water hardness	WUR (g/kg laundry)		
	Soft water	Medium water	Hard water
Powders	1.5	2.0	2.5
Liquids	2.0	2.5	3.0

Plastic/paper/cardboard packaging containing more than 80 % recycled material or more than 80 % plastic from renewable origin is exempt from this requirement.

Only phthalates that at the time of application have been risk assessed and have not been classified according to criterion 4(b) may be used in any plastic packaging. To allow for identification of different parts for recycling, the primary packaging must be market in accordance with DIN 6120, Part 2 or the equivalent. Caps and pumps are exempted from this requirement.

Proposed changes from stakeholder feedback	Further information from feedback
See proposed changes for LD criteria (Section 2.8.3.5).	A similar approach to encourage recycling and use of recycled materials should be taken for IILD. However, dosage requirements are different for IILD products and this should be taken into account when setting the packaging requirements. As automatic dosing systems are commonly used by I&I users, it does not make sense to encourage the use of packaging which has been designed to make dosing easier. *Additional investigation is needed on the packaging requirements of IILD. This will be presented in the technical report.*

2.8.4.6 Criterion 6: Washing performance (fitness for use)

Current criteria:
The primary laundering effects of the detergent, such as dirt and stain removal, must be documented by the producer/applicant with the aid of artificially soiled test clothes which are washed in the process. The test may be conducted by an external or internal laboratory fulfilling the requirements in Appendix II(a). The test must be conducted with the recommended dosage and at the corresponding water hardness and the degree of soiling at the lowest recommend wash temperature. The measurements must be performed on unlaundered and laundered test clothes. The laboratory's evaluation of the test results shall be clearly stated in the report.

The measurements of secondary effects such as bleaching, bleaching/damage factor, ash content, greying and fluidity increase can be made with multi wash test clothes and analysed according to standard ISO 4312.

Examples of what may be used as wash-test clothes include the following:

- WFK-PCMs-55 for industrial laundering processes, consisting of 13 different small dirt patches (WFK-Cleaning Technology Institute, Germany).
- EMPA 102, consisting of 15 different fresh spots (Swiss EMPA-Test materials).
- Wash clothes of Danish Technology Institute for industrial washing processes or equivalent.

As an alternative to the above laboratory test, a user test may be used to document efficiency. The user test should then meet the requirements stated in Appendix II(b) of the Commission Decision (2012/721/EU).

For both laboratory test and user test the following apply:
The test product must be tested against a reference product. The reference product may be a well-established product on the market or – in the case of a user test – the product normally used by the user. The test product must show efficiency equal to or better than the reference product

Most respondents agreed with the current criterion. However, it was commented that the 'fitness for use' test is hardly applicable to products for the I&I market because of the wide range of washing parameters in Europe (water hardness, types of soil, customer habits, and different types of machines).

The following comments were received from stakeholders:

- "How many wash cycles can be investigated? The required test material for measuring the washing performance is very different and can lead to different results."
- "It is very difficult and expensive to prove efficacy for the nine levels of water hardness and soils in external or internal tests."
- "The criterion on fitness for use is hardly applicable on the I&I market because of the wide range of washing parameters in Europe: water hardness, type of soils, customer habits, and different types of machine. This has to be fully described and organised."
- "In the consumer test the user has to answer a question on how satisfied he is with customer visiting arrangements. But how can they do this if it is a new product and the applicant starts with this?"

2.8.4.7 Criterion 7: Automatic dosing systems

Current criteria:
With regard to automatic dosing systems, the existing criteria state that multi-component systems shall be offered to the customer together with an automatic and controlled dosing system. This must incorporate customer visits which: ensure correct dosage; are performed at customers premises; take place at least once a year during the license period; as a minimum must include calibration of dosage equipment; can be performed by a third party.

There have been no suggested changes to this criterion.

2.8.4.8 Criterion 8: User information – information appearing on the EU Ecolabel

Current criteria:
Under the existing criteria, the following washing recommendations shall appear on the packaging:

- Wash at the lowest possible temperature.
- Always wash with full load.
- Dose according to soil and water hardness; follow the dosing instructions.
- If you are allergic to house dust, always wash bedding at 60 °C. Increase wash temperature to 60 °C in case of infectious diseases.
- Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution, waste production and energy consumption.

Claims on the packaging:
In general the claims on the packaging shall be documented through performance testing (e.g. claims of efficiency at low temperatures, of removal of certain stain types, of benefits for certain types or colours of textiles, or other claims of specific properties/benefits of the product)

Information appearing on the EU Ecolabel:
The logo should be visible and legible. The use of the EU Ecolabel logo is protected in primary EU law. The EU Ecolabel registration/license number must appear on the product, it must be legible and clearly visible. The optional label with text box shall contain the following text:

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- Reduced impact on aquatic ecosystems.
- Limited hazardous substances.
- Performance tested.

There have been no suggested changes to this criterion.

2.8.5 ***Additional hot spots***

As part of the survey, stakeholders were asked whether they thought further criteria should be developed to cover issues which are not already covered or because of recent developments which affect the environmental performance of laundry detergents.

The following suggestions were made:

- Promote the use of surfactants from vegetable origin.
- Promote the use of formulas without allergens.
- Provide further guidance on the use of optical brighteners.
- Introduce a criterion on the use of sustainably sourced ingredients.
- Promote the use of products containing a certain % of renewable carbon in formulations (bioproducts).

The impact of these suggestions for new criteria should be further investigated before deciding whether or not they are suitable for inclusion in the EU Ecolabel.

The review of alternative ecolabels and voluntary schemes for laundry detergents found that the following issues which are not currently covered by the EU Ecolabel:

- Different approaches to limiting phosphonates and phosphates. Nordic Swan has limits on the total amounts of phosphorus in the product. New Zealand Environmental Choice has states that the product must not contain more than 0.15 g/kg laundry of phosphonates.
- Requirement that all surfactants must be readily aerobically and anaerobically biodegradable. This is the approach taken by Nordic Swan and New Zealand Environmental Choice for LD.
- Ingredients from palm oil derivatives must be from sustainable palm oil sources. This is a requirement in Sweden's Good Environmental Choice and New Zealand Environmental Choice.
- The Nordic Swan Ecolabel for laundry detergents and stain removers has a criterion for 'origin and traceability of vegetable raw materials', which is described in the box below.

Origin and traceability of vegetable raw materials
This requirement includes fatty acids, soap and oils consisting of ≥75 % vegetable based materials and which are present in the final product in concentrations >1.0 % (by weight).
The following should be fulfilled:

1) The name and geographical origin of the type of plant species used to extract the vegetable raw materials must be specified.
2) The detergent manufacturer must furthermore have a written routine for purchasing of vegetable raw materials to ensure that it does not come from environments with a large need for protection for biological and/or social reasons and must have a written policy documenting this. The vegetable raw materials must not come from:
    - Protected areas of areas that are under evaluation for protection.
    - Areas with uncertain ownership or user rights.
    - Illegally harvested vegetable raw materials.
    - Genetically modified vegetable raw materials/plants (enzymes and other GMO used in closed systems are not included).

At this point the environmental benefits of such criteria are unclear but, as many surfactants are derived from palm oil and palm kernel oil, a requirement for the sustainability of these ingredients should be considered. The market analysis (see Section 3.5.1.1) conducted in this report has shown that the use of plant-derived

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chemicals in cleaning products including laundry detergents is set to increase as many chemicals companies have pledged to increase their use.

2.8.6 *Summary of suggested criteria changes to be further examined*

Following the review of stakeholder feedback and alternative ecolabels and voluntary agreements, suggested changes for the existing criteria have been collected. A summary of the possible amendments and further actions to be taken is given in Table 10 and Table 11, for LD and IILD respectively.

Table 10: Summary of suggested criteria changes for household laundry detergents

Criterion	Suggested Change	Further Action
Dosage requirements	Clarification on water hardness level for maximum dosage limits	Draft a clarification for the water hardness level at which this requirement is assessed.
	Set dosage limits for concentrated detergents	Further investigation and stakeholder input is required in order to determine sensible limits for concentrated detergents.
Toxicity to aquatic organisms	Recalculate the CDV limits according to new DID list	Examination of new DID list and revision of CDV limits accordingly.
	CDV limits for different product types/forms	Further input is required to propose new values.
	USEtox instead of CDV	Further investigation is ongoing. Input from CBs and stakeholders required.
Biodegradability of organics	Requirement for all surfactants to be readily biodegradable and anaerobically biodegradable.	Further information on scientific argument needs to be gathered. Results for LCA will also be taken into account.
	Criteria for anNBO should be less strict	Further investigation and stakeholder input is required. If possible an analysis of aNBO and anNBO values of EU Ecolabel products will be conducted.
Excluded or limited substances	Harmonise with IILD excluded substance list	The lists of excluded or limited substances for LD and IILD will be updated in parallel.
	Consider derogations for surfactants with H412 and peracetic acid with H400[81]	Further assessment is required into the uses of these substances in detergents and their environmental effects.
	Exclude specific nanomaterials of concern	Further investigation on the use of specific nanomaterials and their environmental relevance in laundry detergents is required.
	Consider excluding phosphonates or limit amount of phosphorus in formulations	Further scientific evidence is required on the environmental impacts of using phosphonates in laundry detergents.
Packaging requirements	Encourage disassembly and design for recycling	Aligning disassembly and design for recycling with other existing EU Ecolabel criteria.
	Promote use of sustainably sourced wood fibres	Further evidence is needed to assess a requirement on the percentage of virgin wood fibres used in packaging to be from sustainable sources.
Points	Remove points criterion and try to substitute it with another criterion on effectiveness of the product at low temperature	Efficacy of points criterion needs further assessment. Stakeholder input is required.
Consumer information	Additional phrase on importance of correct dosage	Prepare proposals for wording to include statement on dosing.
Additional criteria	Sustainable sourcing of palm oil derivatives	Further information to assess the relevance of a criterion for sustainable sourcing of palm oil derivatives

[81] See previous comments

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Criterion	Suggested Change	Further Action
		is needed.

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Table 11: Summary of suggested criteria changes for industrial and institutional laundry detergents

Criterion	Suggested Change	Further Action
Product and dosage inf.	Further requirements depending on level of water hardness	Proposal of new requirements and further discussion with stakeholders is required.
Toxicity to aquatic organisms	Update CDV limits	Examination of new DID list and revision of CDV limits accordingly. If possible an analysis of CDV values from EU Ecolabel products will be conducted.
	USEtox instead of CDV	Further investigation is ongoing. Input from CBs and stakeholders required.
Biodegradability of organics	No suggested changes	
Excluded or limited substances	Harmonise with LD excluded list	The lists of excluded or limited substances for DD and IIDD will be updated in parallel.
	Consider derogations for surfactants with H412 and peracetic acid with H400	*See LD for further information*
	Exclude nanomaterials	*See LD for further information*
	Consider excluding phosphonates or limit amount of phosphorus in formulations	*See LD for further information*
Packaging requirements	Encourage disassembly and design for recycling	*See LD for further information*
	Promote use of sustainably sourced wood fibres	*See LD for further information*
Additional criteria	Sustainable sourcing of palm oil derivatives	*See LD for further information*

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3. MARKET ANALYSIS

3.1 Introduction

In order to characterise the relevant European market for the product group under study, a market analysis has been conducted. The objective of the market analysis is to identify significant changes in the market for laundry detergents since the last revision of the EU Ecolabel criteria and investigate whether any such changes need to be reflected in the criteria so that the 10-20 % best environmentally performing products will be selected in accordance with Annex 1 of the EU Ecolabel Regulation.

The research in this section consists of a desktop study using a variety of available literature and statistical databases such as Datamonitor, Mintel and Euromonitor data and reports. The market analysis covers the period 2010-14 and includes a market forecast to 2015-16, data permitting.

Data and information have also been collated on market structure, public procurement, innovation, supply of raw materials and environmental labelling.

3.1.1 *Economic indicators*

Analysis of PRODCOM data categories compared with the current EU Ecolabel criteria definition and scope indicates that the classifications are irreconcilable. The PRODCOM 'cleaning product' categories are not broken down in a way that could be useful for analysis of current EU Ecolabel 'laundry detergent' criteria (Table 12).

Furthermore, the composition of the various 'cleaning product' categories is not clearly outlined, and it is therefore not possible to break these down to the category of 'laundry detergent' in order to provide data which are wholly applicable to the requirements of EU Ecolabel (see Table 13).

EUROSTAT data will therefore be used to provide cumulative data to analyse the overall laundry detergent market in Europe, broken down by Member State. This analysis will include all laundry detergent types as well as other detergent and cleaning products included in the PRODCOM category outlined in the above table Although this will not allow for specific analysis of laundry detergents that fit within EU Ecolabel criteria, it will nevertheless allow for a comprehensive analysis of the European laundry detergent market.

Table 12: PRODCOM cleaning product categories, code and description

Code(s)	Description
20.41.20.20	Anionic surface-active agents (excluding soap)
20.41.20.30	Cationic surface-active agents (excluding soap)
20.41.20.50	Non-ionic surface-active agents (excluding soap)
20.41.20.90	Organic surface-active agents (excluding soap, anionic, cationic, non-ionic)
20.41.31.20	Soap and organic surface-active products in bars, etc., n.e.c.
20.41.31.50	Soap in the form of flakes, wafers, granules or powders
20.41.31.80	Soap in forms excluding bars, cakes or moulded shapes, paper, wadding, felt and non-wovens impregnated or coated with soap/detergent, flakes, granules or powders
20.41.32.40	Surface-active preparations, whether or not containing soap, p.r.s. (excluding those for use as soap)
20.41.32.50	Washing preparations and cleaning preparations, with or without soap, p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations
20.41.32.60	Surface-active preparations, whether or not containing soap, n.p.r.s. (excluding those for use as soap)
20.41.32.70	Washing preparations and cleaning preparations, with or without soap, n.p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations

Source: Eurostat PRODCOM

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Table 13: Comparison of the categorisation criteria for PRODCOM categories (cleaning product-type) and EU Ecolabel for laundry detergents

PRODCOM categories (cleaning product-type)	EU Ecolabel for laundry detergents product classification (application)
• Anionic surface-active agents (excluding soap) • Cationic surface-active agents (excluding soap) • Non-ionic surface-active agents (excluding soap) • Organic surface-active agents (excluding soap, anionic, cationic, non-ionic) • Soap and organic surface-active products in bars, etc., n.e.c. • Soap in the form of flakes, wafers, granules or powders • Soap in forms excluding bars, cakes or moulded shapes, paper, wadding, felt and non-wovens impregnated or coated with soap/detergent, flakes, granules or powders • Surface-active preparations, whether or not containing soap, p.r.s. (excluding those for use as soap) • Washing preparations and cleaning preparations, with or without soap, p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations • Surface-active preparations, whether or not containing soap, n.p.r.s. (excluding those for use as soap) • Washing preparations and cleaning preparations, with or without soap, n.p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations	• This product group includes laundry detergents and pre-treatment stain removers whether in powder, liquid or any other form which are marketed and used for the washing of textiles principally in household machines but not excluding their use in launderettes and common laundries. • Pre-treatment stain removers include stain removers used for direct spot treatment of textiles (before washing in the machine) but do not include stain removers dosed in the washing machine and stain removers dedicated to other uses besides pre-treatment. • This product group shall not comprise products that are dosed by carriers such as sheets, cloths or other materials nor washing auxiliaries used without subsequent washing, such as stain removers for carpets and furniture upholstery.

3.1.1.1 Trade and production data, detergents market

The table below provides the PRODCOM production data (value and volume) for detergents in 2013. The total value of EU-28 detergent production in 2013 is €17 billion with 16 million tonnes produced.

- Germany has the highest production value (€4 billion) and the second highest production volume (3.01 million tonnes),
- Italy has the highest production volume (3.04 million tonnes) and the second highest value (€3 billion).

Note, countries marked with an asterisk (*) exclude some data which is anonymous, figures may therefore be higher than indicated in Table 14.

Table 14: Production of manufactured detergent products, EU-28, value and tonnes, 2013

Country	Value (€000s)	Sold volume (t)
Austria*	98,581	94,169
Belgium*	494,614	536,875
Bulgaria*	51,232	65,347
Cyprus	0	0
Czech Republic*	77,513	102,036
Denmark	204,735	174,200
Estonia	13,560	40,615
Finland	43,652	30,232
France*	1,300,489	1,701,172
Germany*	4,164,537	3,010,155
Greece*	108,892	84,428
Hungary*	213,368	212,220

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Country	Value (€000s)	Sold volume (t)
Ireland*	15,338	18,657
Italy	2,738,689	3,038,504
Latvia*	0	0
Lithuania	7,338	10,451
Luxemburg	0	0
Malta	0	0
Poland*	800,855	862,263
Portugal*	163,083	242,051
Romania*	150,122	229,815
Slovakia*	6,104	6,811
Slovenia*	6,357	5,503
Spain	2,020,008	2,341,911
Sweden*	52,148	31,463
The Netherlands*	711,337	307,391
UK	1,856,748	486,743
Croatia	97,529	104,690
Value EU 27	**17,099,313**	**16,090,515**
Total EU 28	**17,196,842**	**16,195,204**

* Estimates only – excludes some data which is anonymous. 'Value EU27' includes all data.
Source: PRODCOM

In the same way that PRODCOM data is not reconcilable with current EU Ecolabel definitions for laundry detergents, COMEXT data (international trade data) also consists of different categories which do not clearly match. Table 15 shows the COMEXT codes and description for categories which include detergents. It can also be seen that these do not directly relate to the PRODCOM categories indicated above. Even so, this data can be used to give an overall indication of both intra and extra- EU trade for detergent products.[82]

Table 15: COMEXT detergent code and description

Product Code	Description
34012090	Soap in paste form "soft soap" or in aqueous solution "liquid soap"
34012010	Soap in the form of flakes, granules or powders
34011100	Soap and organic surface-active products and preparations, in the form of bars, cakes, moulded pieces or shapes, and paper, wadding, felt and nonwovens, impregnated, coated or covered with soap or detergent, for toilet use, incl. medicated products
34011900	Soap and organic surface-active products and preparations, in the form of bars, cakes, moulded pieces or shapes, and paper, wadding, felt and nonwovens, impregnated, coated or covered with soap or detergent (excl. those for toilet use, incl. medicated products)

Table 16 shows the value and volume of intra-EU trade of detergents for 2013. Overall, this totals:

- an import value of €1,090 million
- an export value of €1,150 million
- imports of 623,793 tonnes
- exports of 690,659 tonnes.

Table 17 shows the value and volume of extra-EU trade of detergents for 2013. Overall, this totals:

- an import value of €302 million
- an export value of €487 million
- imports of 215,796 tonnes
- exports of 219,224 tonnes.

[82] Intra-EU trade refers to the trade between the Member States of the European Union, while extra-EU trade refers to the trade between Member States and partner countries that are not members of the European Union.

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Table 16: Intra-EU trade of detergents, import and exports, 2013

Intra EU trade	Import		Export	
Country	**Value (€million)**	**Quantity (100kg)**	**Value (€million)**	**Quantity (100kg)**
Austria*	43	194,848	8	17,343
Belgium*	71	348,454	65	440,996
Bulgaria*	9	42,852	4	29,439
Croatia	8	47,416	0	692
Cyprus	3	14,960	0	633
Czech Republic*	32	178,434	26	146,934
Denmark	21	139,862	16	79,277
Estonia	4	14,542	1	2,248
Finland	21	80,538	1	2,107
France*	167	966,219	66	274,158
Germany*	133	758,634	304	1,899,952
Greece*	17	94,548	9	49,206
Hungary*	28	168,663	10	43,066
Ireland*	54	211,946	8	24,810
Italy	49	299,228	205	1,377,243
Latvia*	5	23,092	1	3,753
Lithuania	6	29,207	2	8,094
Luxemburg	7	23,359	1	4,391
Malta	2	9,415	0	0
The Netherlands*	72	420,593	77	362,389
Poland*	56	385,558	120	805,672
Portugal*	49	382,657	9	41,269
Romania*	24	158,425	3	12,126
Slovakia*	13	83,864	4	27,713
Slovenia*	10	49,120	4	14,808
Spain	52	323,535	47	340,615
Sweden*	33	195,601	24	132,164
UK	100	592,369	136	765,500
Total EU 28	**1,090**	**6,237,939**	**1,150**	**6,906,598**

* Estimates only – excludes some data which is anonymous.
Source: COMEXT trade data. See Annex III for original data

Table 17: Extra-EU trade of detergents, import and exports, 2013

Extra EU trade	Import		Export	
Country	**Value (€million)**	**Quantity (100kg)**	**Value (€million)**	**Quantity (100kg)**
Austria*	6	25,106	2	6,326
Belgium*	22	157,013	7	20,365
Bulgaria*	10	100,764	4	29,543
Croatia	2	15,546	2	8,804
Cyprus	1	3,805	0	126
Czech Republic*	9	66,150	6	30,143
Denmark	4	22,912	11	42,636
Estonia	0	1,835	0	858
Finland	0	1,166	1	3,434
France*	32	276,851	52	153,958
Germany*	44	350,637	117	587,966
Greece*	2	17,530	2	12,174
Hungary*	2	13,344	3	17,159
Ireland*	0	2,457	0	118
Italy	13	113,920	37	189,006
Latvia*	1	5,787	3	10,013

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Extra EU trade	Import		Export	
Country	Value (€million)	Quantity (100kg)	Value (€million)	Quantity (100kg)
Lithuania	1	6,756	5	26,754
Luxemburg	0	1	0	1
Malta	0	2,141	0	768
The Netherlands*	29	186,073	44	178,489
Poland*	19	141,489	30	140,824
Portugal*	2	19,172	12	97,462
Romania*	9	73,520	3	11,029
Slovakia*	2	11,646	0	1,766
Slovenia*	1	3,913	2	11,956
Spain	12	82,408	19	108,681
Sweden*	5	33,695	20	75,432
UK	**73**	**422,331**	**104**	**426,456**
Total EU 28	**302**	**2,157,968**	**487**	**2,192,247**

* Estimates only – excludes some data which is anonymous.
Source: COMEXT trade data. See Annex III for original data

3.1.2 *Global market overview, textile washing products*[83]

According to a 2010 Datamonitor study[84], the Western European market for textile washing products grew at a compound annual growth rate (CAGR)[85] of 1.6 % between 2005 and 2009. It was projected to continue growing until the end of 2014, with a CAGR of 1.4 % for 2009-14. The Eastern European market for textile washing products grew at a CAGR of 2.8 % between 2005 and 2009, and was projected to continue growing until the end of 2014, with a CAGR of 2.6 % for 2009-14. As a whole, the EU-28 market for textile washing products grew by a CAGR of 2.2 % between 2005 and 2009, and was projected to grow by 2 % between 2009 and 2014.

Whilst the EU-28 market for textile washing products has seen low, steady growth for the 2005-09 period, and was expected to continue on this low, steady growth trajectory until the end of 2014, the global household detergents market was expected to grow by 3.4 % per annum between 2014 and 2017. Current and future global growth rates can be partly explained by a large increase in consumer demand for household detergents in the Asia-Pacific region, with growth being predominantly underpinned by China, whose market for household detergents is projected to grow by 6 % per annum between 2014 and 2017.[86]

High growth emerging markets, such as Brazil, Russia, India and China (BRIC), have also seen large investments from laundry detergent manufacturers in recent years.[87] However, as the BRIC countries' growth rates start to decelerate from recent peaks, detergent manufacturers are expected to see longer-term growth rates stabilise in these markets.[82]

In mature markets, such as Western Europe, Japan and North America, higher quality, cost-effective laundry detergent products (including more environmentally-friendly detergents) are in greatest demand.[88] Laundry detergent consumption in these countries is linked to standard of living and lower quality laundry detergents

[83] Includes: laundry detergents (powder, liquid and tablets), stain removers and additives, fabric conditioners, laundry bleach and carpet cleaners.
[84] Datamonitor Consumer, *Household Products Market in Western Europe to 2014 - Market Databook*, 24 January 2011 and Datamonitor Consumer, *Household Products Market in Eastern Europe to 2014 - Market Databook*, November 2010.
[85] CAGR = Compound Annual Growth Rate - average growth rate over a period of several years, taking into account the effect of annual compounding.
[86] Chemical Week, Soaps and Detergents: *Consumers Remain Cautious*, 17 January 2014, http://www.chemweek.com/sections/cover_story/Soaps-and-detergents-Consumers-remain-cautious_58079.html
[87] e.g. in 2012, Procter & Gamble (a multinational detergents manufacturer) announced that it planned to add around 20 manufacturing plants between 2010 and 2015 in countries such as Brazil and China. Source: *P&G to Build Huge Plant in China*, Zacks Equity Research, 19 March 2012, http://www.zacks.com/stock/news/71529/P&G+to+Build+Huge+Plant+in+China
[88] Key Note Ltd - *Household Detergents and Cleaners – Market Definition* - 2012

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see higher demand in areas with lower quality of life. The state of the laundry detergent market in these areas generally correlates positively with the health of the economy.

Currently, consumer incomes within the EU-28, which provide much of the impetus behind consumer laundry detergent sales in the EU, are stagnating. In some Member States, average consumer income has declined, both in absolute and in real terms.[89] This explains the current low to stagnant growth rate in laundry detergent sales across the EU.

Other drivers affecting the EU laundry detergents market include a broad range of factors: while general economic drivers such as gross domestic product (GDP) growth and changes in consumer income have an important impact on the market, there are other factors such as general changes in consumer habits and preferences to consider.[84] An example may be consumers switching towards buying more cost-effective or more environmentally-friendly laundry products, in place of traditional laundry detergents. These changes in consumer habit and consumer demand will also have a direct effect on the type of laundry detergent products that are produced and sold within the EU (both by multinational companies, and by smaller, private-label companies).

3.2 Market structure

3.2.1 *Product overview*

The laundry detergent products on the European market can be broadly categorised into four different products:

1. Powder detergents.
2. Liquid detergents.
3. Detergent tablets (powder or liquid/gels).
4. Other detergents (such as hand wash or fine fabric detergents).

There are also a number of laundry products used in conjunction with these detergents, including:

1. Fabric conditioner.
2. Fabric freshener.
3. Stain removers and other additives.

Figure 1 below shows the value and volume of these products in Western Europe. By value, laundry detergents represent 69 % of the total market for laundry care in Western Europe with other laundry products accounting for the remaining 31 %. Of the laundry detergents, powder detergents are the most popular (38 % of the market by value), followed by liquid detergents (23 % by value). Detergent tablets make up a relatively small proportion of the market in comparison (5 % by value) with other detergents accounting for 3 % of the total market for laundry care products.

Other laundry care products include fabric conditioner (18 % of the market by value), stain removers and other additives (11 % by value) and fabric fresheners (1 % by value).

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[89] According to Eurostat, 'Real adjusted gross disposable income of households per capita' has remained stagnant across the EU-28 in recent years, and had even declined in Greece, Spain and Cyprus. Source: Eurostat : http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tec00113

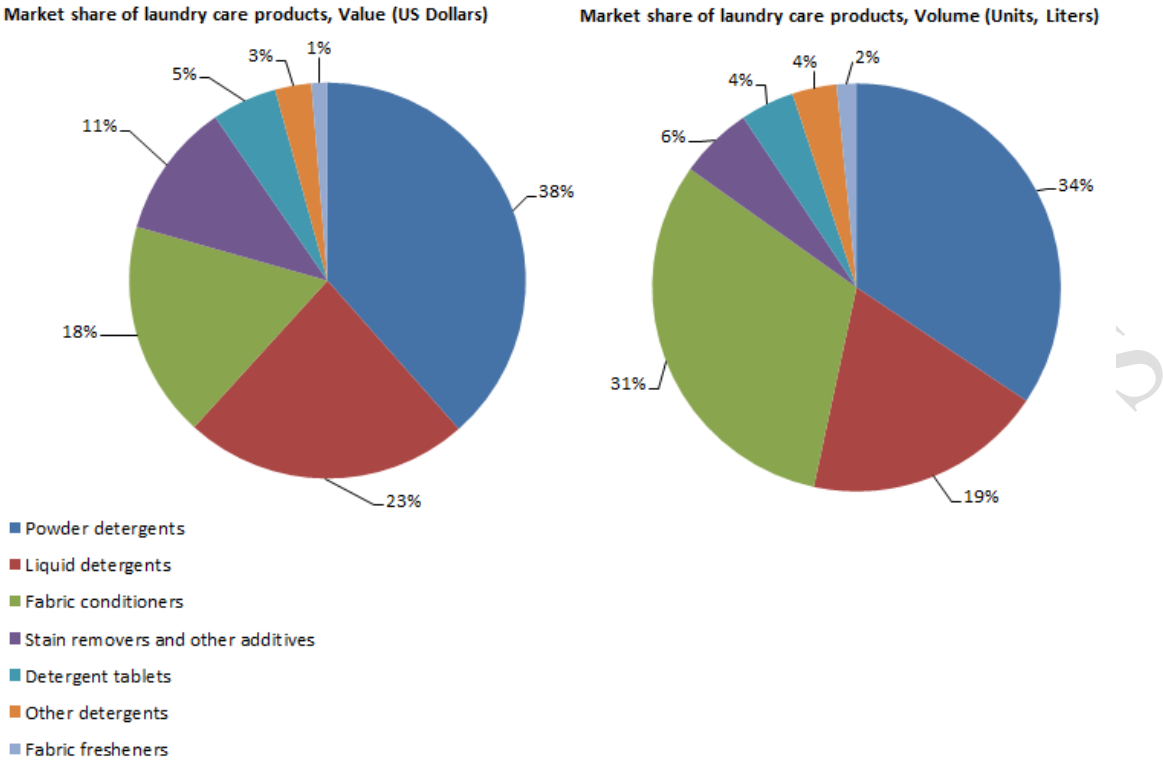

Figure 1: Value and volume of Western Europe laundry care products, 2012

3.2.2 *Market segmentation*

The laundry detergents market can be broken down into two main segments: household laundry and I&I laundry detergents:

HOUSEHOLD laundry care products include:	I&I laundry care products include:
• laundry detergents (in powder or liquid) • fabric conditioner and fresheners • laundry aids including stain removers • on-premise laundry detergents • fully formulated detergents • powder/liquid detergents • pre-wash additives • boosters	• pH-adjustment • water hardness regulators • bleach additives • disinfectant detergents/additives for hygienic laundry (hospital, food industry • fabric softeners • starch finishing • ironing aid • fragrance rinse

The value of the total laundry care market across Europe in 2012 (EU-27 + CH + NO) was €14.4 billion. Of this, household laundry care represents 96 % or €13.8 billion. Table 18 shows how this is broken down by product. Of the household products, liquid and powder detergents represent the products with the highest market value, followed by laundry aids and fabric conditioners.

Table 18: Market value of laundry care, 2012 (EU-27 + CH + NO)

Type of laundry care	€ million	% of total laundry care market value
Household:		
Powder detergents	€ 3,548	25 %
Liquid detergents	€ 4,054	28 %
Unit doses	€ 946	7 %
Fabric conditioners	€ 2,284	16 %
Laundry aids & others	€ 2,923	20 %
Total household	**€ 13,755**	**96 %**
Total I&I	**€ 642**	**4 %**

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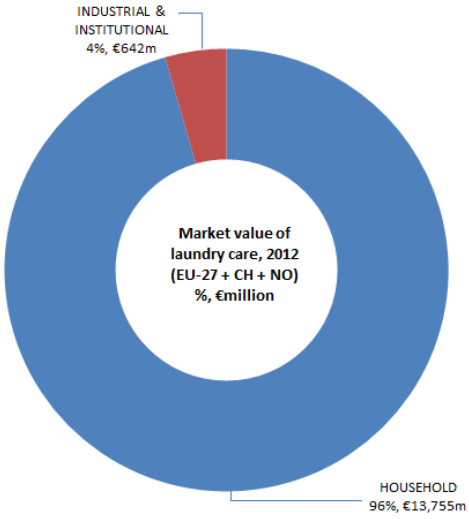
Type of laundry care	€ million	% of total laundry care market value
Total laundry care market value	**€ 14,397**	

Source: Euromonitor International, cited on A.I.S.E website http://www.aise.eu/our-industry/market-and-economic-data.aspx

In comparison to household laundry products, the value of the I&I market is a relatively small, €642 million (4 % of the total market), as shown in Figure 2 below.



Source: Euromonitor International, cited on A.I.S.E website http://www.aise.eu/our-industry/market-and-economic-data.aspx

Figure 2: Market value and % share of laundry care market, household and I&I, 2012

3.2.2.1 All laundry care products, by category, EU-28[90]

Figure 3 shows the retail value of the laundry care market by product category in five different European countries. Assuming the total retail value of the EU-28 market in 2013 is an estimated €13.3 billion[91], these five countries represent approximately 50 % of this market.

Sales of total laundry care products, by value, are highest in the UK. By product type, laundry detergent sales and fabric softener sales are also highest in the UK, compared to the other countries analysed.. Italy has the highest sales of laundry aid products.

This information has been further broken down in Figure 4, which shows the percentage split of laundry care sales in each country. Fabric softener represents the greatest proportion of laundry care sales in Poland (22 %), followed by the UK (20%). Laundry aids, however, are comparatively more popular in Italy (18 % of total laundry care sales) and Germany (15% of laundry care sales).

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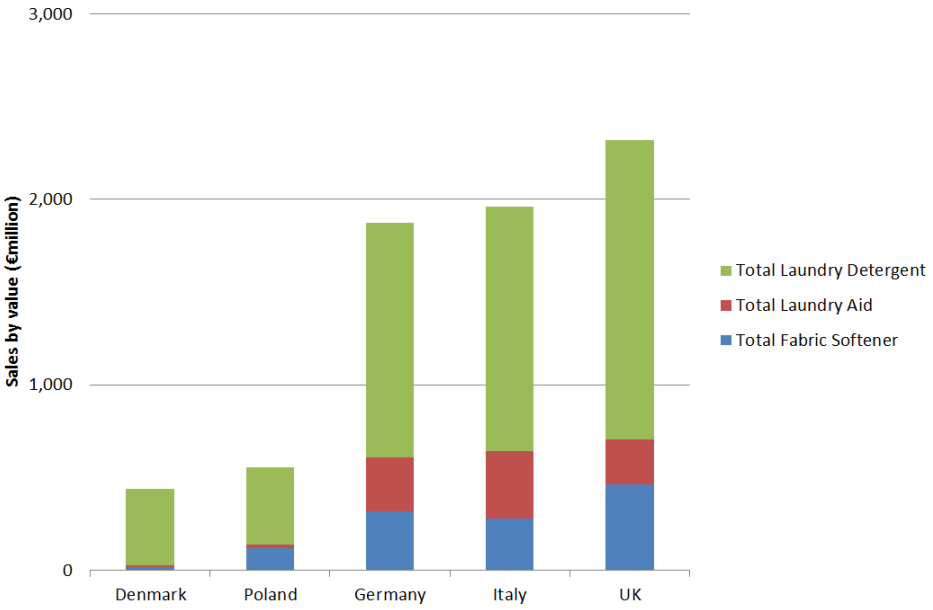
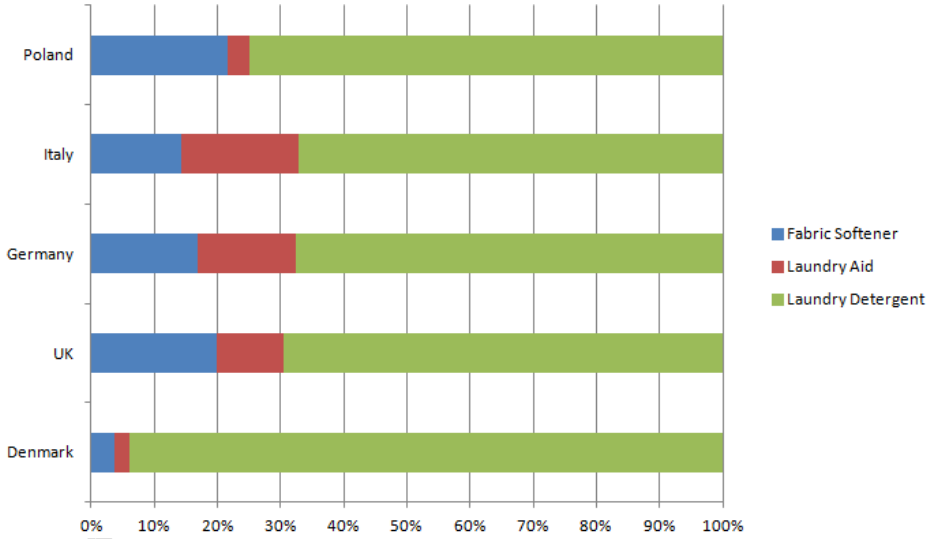
[90] N.B. Data on the total value of the laundry market are not readily available, but throughout this analysis the most recent figure for market size has been used; a 2013 figure of €13,203 million. This figure includes the EU-28 minus Cyprus, Luxembourg and Malta, for which there is no data. This figure is also assumed to include the total laundry care market, both household and I&I products.

[91] Passport data, *Market Sizes (2008-2018)* N.B. this excludes Cyprus, Luxembourg and Malta as no data is available.



Source: Euromonitor, summarised from 2013 Passport reports for *Laundry Care in: Denmark, Italy, Germany, UK, Poland*

Figure 3: Sales of laundry care products by category, value (€m) 2012



Source: Euromonitor, summarised from 2013 Passport reports for *Laundry Care in: Denmark, Italy, Germany, UK, Poland*

Figure 4: Split of laundry care products by category, (%) 2012

3.2.2.2 Laundry detergents by category, EU-28

Alongside the variety of laundry aids and fabric softeners on sale across Europe, there is also a variety of types of laundry detergents available. Figure 5 shows the sales of laundry detergents by type (tablets, liquid and powder detergents) across the same five European countries. Figure 6 shows this as a percentage of sales in each country. To summarise:

- Powder detergents represent a high (if not the highest) proportion of sales, by value, in each of the countries analysed. Poland in particular has the highest sales value of powder detergents, representing 92% of the sales value of all detergents. Italy is the exception to this: across all detergent types, sales value of powder detergents in Italy only represents 27% of total sales and the highest proportion (60%) is represented by liquid detergents. Liquid detergents are also popular (in terms of sales value) across the European countries analysed. Italy and Germany in particular favour liquid detergents (60% of the total detergent sales value in Italy and 52% in Germany). In Poland, however, liquid detergents only represent 7% of the total detergent sales value.
- Detergent tablets show a variable sales value across the five countries analysed. Notably, there are no sales of detergent tablets in Denmark. In Poland, detergent tablets represent only 0.4% of the total sales value of all detergents and in Germany only 2%. Italy and the UK do, however, show a higher

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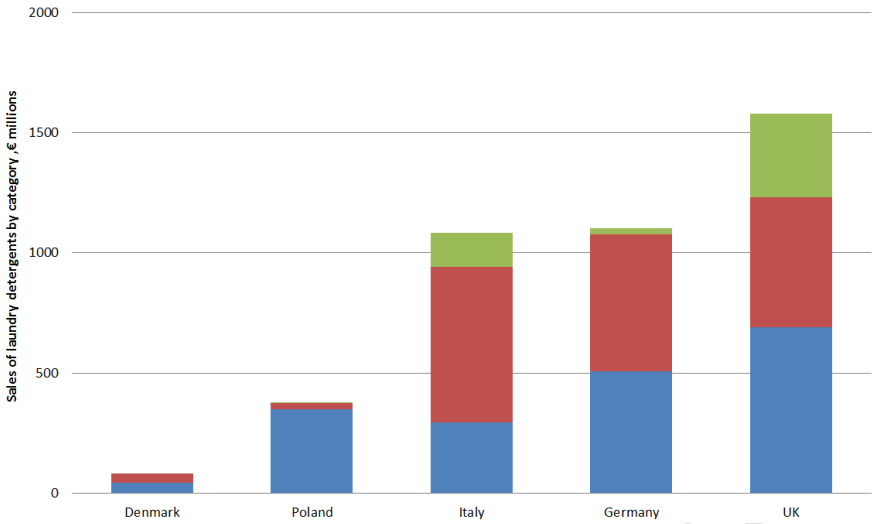
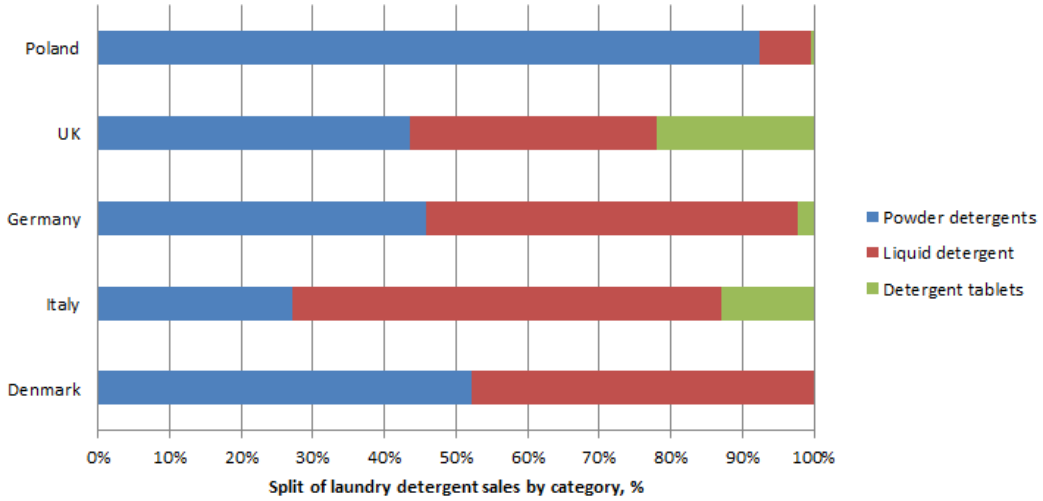
sales value for this product type with detergent tables representing 13% of the total sales value in Italy and 22% in the UK.



Source: Euromonitor, summarised from 2013 Passport reports for *Laundry Care in: Denmark, Italy, Germany, UK, Poland*

Figure 5: Sales of laundry detergents by category, value (€m) 2012



Source: Euromonitor, summarised from 2013 Passport reports for *Laundry Care in: Denmark, Italy, Germany, UK, Poland*

Figure 6: Split of laundry detergents by category, (%) 2012

3.2.2.3 Split of concentrated and standard products, EU-28, 2012

The laundry detergent market can also be characterised by standard and concentrated products, each of which can be either liquid or powder. Italy and France are the only two countries where sales of standard detergents outweigh sales of concentrated products.

Poland has the highest percentage of concentrated detergent sales (95 %), followed by the UK and Germany (91 % and 90 %, respectively). Sales of concentrated detergents make up 73 % of detergent sales in Denmark, but only 46 % in France and 26 % in Italy (see Figure 7).

(Further analysis of detergents by concentrated and standard formulation can be found in Section 3.4.2.)

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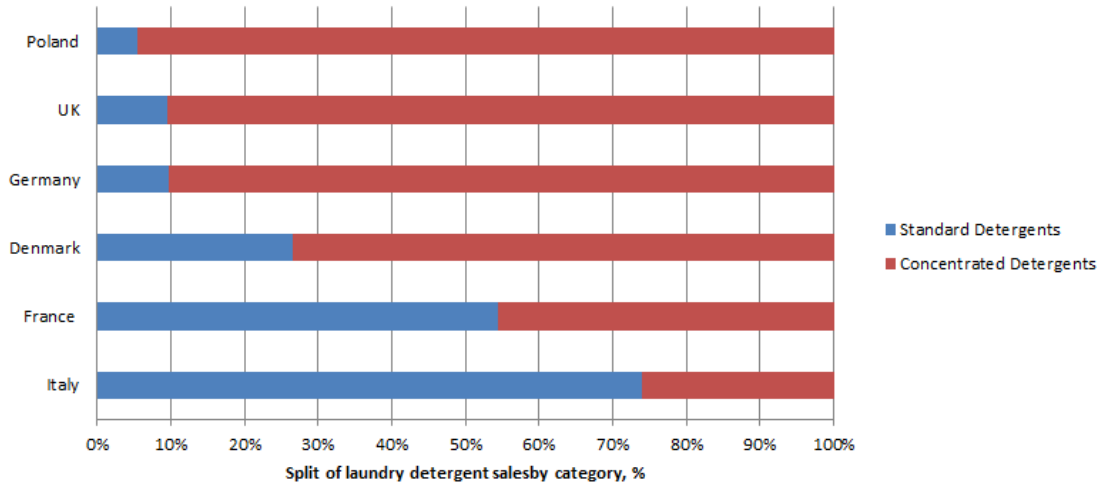

Source: Euromonitor, summarised from 2013 Passport reports for *Laundry Care in: Denmark, Italy, Germany, UK, Poland*

Figure 7: Split of laundry detergents, standard vs concentrated, (%) 2012

3.2.3 *Manufacturers and market shares*

The laundry market across Europe (as with the detergents and cleaning market in general) is heavily dominated by a few well-known and globally recognised organisations and brands (see Table 19). The top five organisations in the European market for laundry care have 69 % of the market share. In this market there are also an estimated 120 other organisation operating, each with less than 1 % of the market. Procter & Gamble (P&G) has the largest market share (26 %).

Table 19: Largest organisations in laundry care market, % breakdown by retail value, Europe*, 2013

Manufacturers name	% share of Eastern Europe laundry care market, by retail value
Procter & Gamble Co	26 %
Henkel AG & Co KGaA	19 %
Unilever Group	14 %
Reckitt Benckiser Plc	8 %
Colgate-Palmolive Co	2 %
Other organisations (est. 120 in total)	17%
Private labels	14 %

* Includes EU-28 excluding Malta, Luxembourg and Cyprus as no data is available
Source: Euromonitor International, Data used in Passport report, Brand share by global brand name (2013)

There is a high presence of big private labels manufacturers (14 % of market share); these typically produce products for retail chains and supermarkets under their own brand names. Supermarkets, which sell most laundry care products in Western Europe, are able to control the amount of product on shelves and often price promotions in store, and are therefore an important part of the supply chain for laundry detergent manufacturers (see Table 20).

Table 20: Laundry care products, value by distribution channel (€m), Western Europe, 2009

Channel	€m*	%
Supermarket	8,941	63
Independent retailers	2,939	21
Pharmacies	843	6
Convenience stores	763	5
Cash & Carry	106	1
Department stores	43	0.3
Others	591	4
Total	**14,226**	**100 %**

* Converted from US Dollars ($) at a rate of €0.74 to the Dollar (conversion rate as of 11/06/14)
Source: Datamonitor (2011) *Household products market in Western Europe*

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The laundry care market is dominated by a small number of large manufacturers and has changed little over the past five years. For example, between 2008 and 2013, P&G has consistently held the greatest share of the retail market with between 25 % and 26 % of the market.

Table 21 shows the breakdown of each of the largest organisations, by common brands. The largest brand is Tide/Ariel (owned by P&G) which represents 11 % of the total retail market for laundry care across Europe. The next largest brands are Dash/Daz (P&G) and Persil (Henkel AG) both with 5 % of the market. This shows that not only are a small number of organisations dominating the market, but a very small number of brands within these organisations hold the greatest market share.

Table 21: Common brand name laundry care products, Europe, 2013

	Procter & Gamble Co		**Henkel AG**		**Unilever Group**		**Reckitt Benckiser Plc**	
% of the EU retail market	**26 %**		**18 %**		**14 %**		**8 %**	
Common brands	Name	share*	Name	share*	Name	share*	Name	share*
	Tide/Ariel	11 %	Persil	5 %	Skip	3 %	Vanish	3 %
	Dash/Daz	5 %	Dixan	3 %	Persil	3 %	Calgon	2 %
	Lenor	4 %	Vernel	1 %	Comfort	2 %	Sole	1 %
	Bold	2 %	Le Chat	1 %	Surf	2 %		2 %
	Fairy	1 %			Omo	1 %		
	Others	4 %	*Others*	8 %	*Others*	3 %	*Others*	

Source: Euromonitor International, Data used in Passport report, *Brand share by global brand name (2013)*
* figure rounded to the nearest 1 %

3.2.4 *Structure of supply chain*

3.2.4.1 Raw materials

Any market is sensitive to changes in availability, and the impact this can have on price, of the raw materials used in products. The laundry detergent market relies on a number of ingredients, including:

- surfactants
- builders
- biocides/preservatives
- bleaches
- optical brighteners
- fragrances
- dyes
- enzymes
- solvents.

See Annex II for further details on each ingredient.

The market for laundry detergent ingredients is in a mature stage, with most opportunities for growth in the development of 'green' or 'natural' chemicals and multifunctional products. There is also scope for market expansion in Eastern Europe. There are 40-50 companies in the home and fabric care speciality ingredient market[92], with the dominant players mainly being specialty surfactants companies. However, the market is also characterised by an increasing degree of consolidation, altering the number of competing organisations.

Table 22 shows the percentage revenues for each of the key ingredients in the home and fabric care speciality ingredients market. In 2009 the largest market share in terms of revenue was speciality surfactants with 34.4 % of the market, followed by fabric enhancing chemicals (23.2 %), functional polymers (22.6 %) and rheology modifiers (14.1 %). Active ingredients - comprising disinfectants, bactericides and preservatives - held the smallest market share amongst the speciality chemicals with only 6.1 % of the market.[93]

[92] This includes: fabric washing and care; hard surface cleaners; car interior and upholstery cleaners; furniture, shoe and leather polishes; and dishwashing products.
[93] Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe.*

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Table 22: Home and fabric care speciality ingredients market: % of revenues by chemical type, Europe, 2009

Speciality surfactants	Functional polymers	Fabric enhancing chemicals	Active ingredients	Rheology modifiers
33.9 %	22.6 %	23.2 %	6.1 %	14.1 %

Source: Adapted from Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe*

The specialist chemical market for home and fabric care is facing a number of challenges over the next decade which may alter current business practises. Table 23 ranks the top eight challenges which the industry is expected to face, along with an indication of the impact that this may have on organisations. According to the literature, the top challenge ('volatility in oil prices') relates directly to the manufacture of raw materials. This is something which many organisations are now adapting to, and has helped to drive the increasing innovation and research in the use of plant-based chemicals. The use of 'green chemicals' is also a trend driven which had been driven supported by consumers who are focusing on the use of more natural products.

Table 23: Impact of industry challenges on European home and fabric care speciality ingredients market

Rank	Challenge	Expected impact 5-7 years
1	Volatility in crude oil prices affects the costs across the supply chain	High
2	REACH creates scepticism in the home and fabric care speciality chemicals market	High
3	The trend for ultra-concentrates lowers substantially the amount of carriers and other chemicals used	High
4	The super-buyers exert pressure backwards in the supply chain	High
5	Consolidation in the industry alters the market dynamics	High
6	Product switching due to price shortens the life cycle of products	High
7	Increase in multifunctional products that cater for more than one 'job'	Medium
8	Increase in the use of natural proteins as fabric enhancers	Medium

Source: Adapted from Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe*
Note: this table was produced in 2009

A number of other chemical manufacturers have adapted their offers as a result of these trends, in particular the increased demand for plant-based chemicals and shift toward liquid based detergents:

- **Dow Chemical** has reported that it has had to adapt to meet the needs of its customers who are launching detergent capsules, the use of which has led to a number of technical challenges for chemical providers. One example of this is Dow offering dispersant polymers in granulated and spray-dried forms, as those sold as water-based solutions are not compatible with the water-soluble films used in detergent 'pods'. The company reports that, in general, those ingredients that provide multiple benefits are in high demand, as these can be used widely by manufacturers of single-dose detergents[94].
- The **Arkema Group** has also recognised the challenge of responding to environmental concerns, and the shift away from the use of non-renewable fossil fuels, by focusing on innovations in plant chemistry and specifically developing raw materials of plant origin. To emphasise this, the Arkema Renewable label is awarded to those products from the company which are made from raw materials of renewable origin (over 20 % non-fossil based carbon). These products currently account for an estimated 12 % of Arkema's sales, with a predicted rise to 15 % by 2016.[95]
- **BASF** is also showing its commitment to reducing the use of fossil fuels as raw materials and is using renewable materials where possible. The organisation estimates that of total chemical production, approximately 10 % currently, uses renewable raw materials.[96]

[94] Chemical & Engineering news (2012) *Selling detergents one load at a time.* Available at: http://cen.acs.org/articles/90/i4/Selling-Detergents-One-Load-Time.html [Accessed 7 April 2014]
[95] Arkema, *Products made from renewable raw materials.* Available at: http://www.arkema.com/en/innovation/responses-to-global-trends/renewable-raw-materials/ [Accessed 7 April 2014]
[96] BASF, *Renewable raw materials.* Available at: http://www.basf.com/group/corporate/en/sustainability/dialogue/in-dialogue-with-politics/renewable-raw-materials/index [Accessed 7 April 2014]

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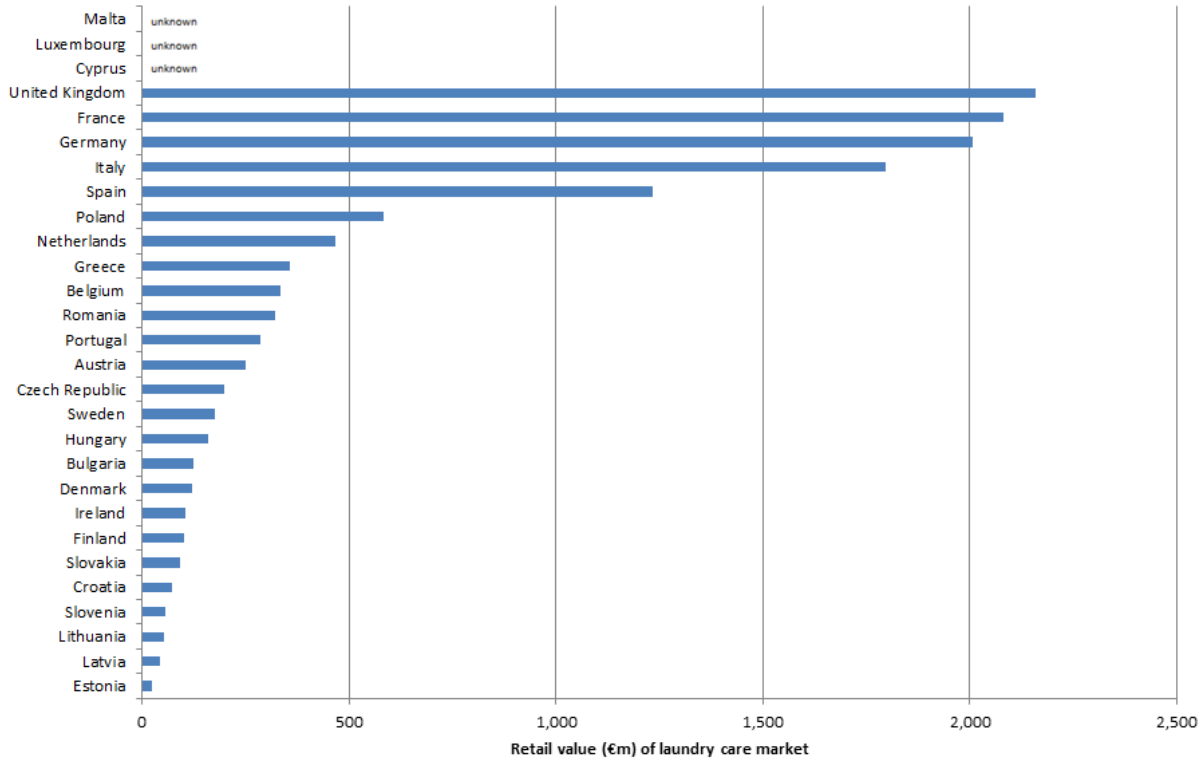
As an output of these commitments we should expect to see a wider range of detergent products with ingredients derived from plant-based sources appearing on the market in the near future.

3.3 Production and sales

3.3.1 *EU-28 sales*

Figure 8 shows the retail value of the laundry care market in Europe, by country. The total retail value of the EU-28 market in 2013 is an estimated €13 billion[97].



Source: Adapted from Passport data, *Market Sizes (2008-2018)*

Figure 8: Retail value (€m) of laundry care market, Europe (EU-28), 2013

As shown in Figure 8, there are five countries with a retail value over €1 billion (combined, these account for 70 % of the market, or €9.3 billion). These countries include the United Kingdom (16 %), France (16 %), Germany (15 %), Italy (14 %) and Spain (9 %). The remainder of the market accounts for just 29 %, or €3.9 billion.

3.3.2 *Market trends and projections*

Figure 9 outlines the current trends and projections for laundry care products (by retail value, average across EU) to 2018. Continuing with the current trends in the EU-28 market, average retail value is expected to increase to €590 million by 2018 – this equates to a total market value across Europe of €14.7 billion.

A clear dip can be seen in 2009, as a result of the European financial crisis – the past few years have, however, seen an increase in retail values which now exceed 2008 values.

[97] N.B. this excludes Cyprus, Luxembourg and Malta as no data is available.

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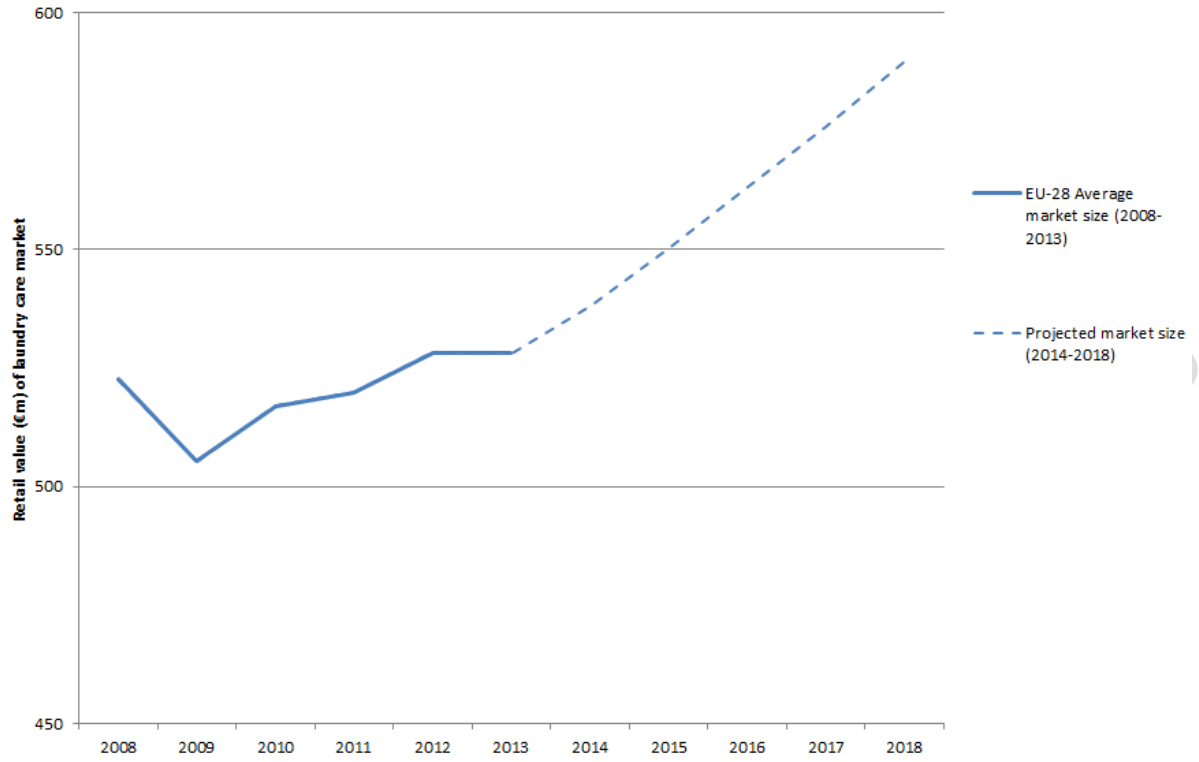
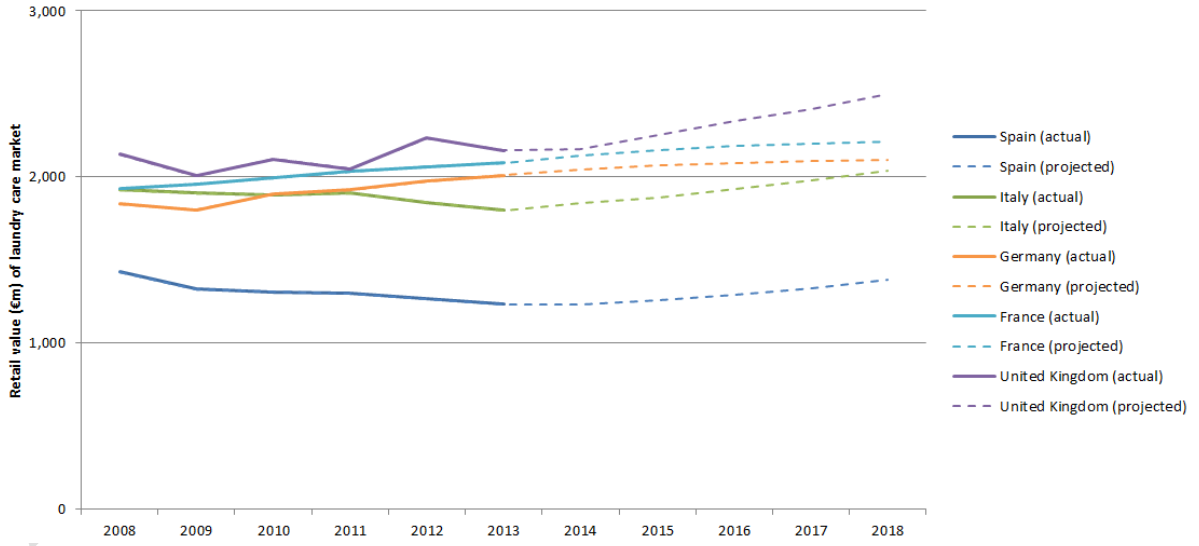


Source: Adapted from Passport data, *Market Sizes (2008-2018)*

Figure 9: Market trends, actual and projected retail value (€m), Europe (EU-28 average), 2008-18

Within Europe, five countries account for a large percentage of the total market size, and so changes to retail values in these countries will have a large impact on overall European trends. Figure 10 shows the trends for these countries.



Source: Adapted from Passport data, *Market Sizes (2008-2018)*

Figure 10: Actual and projected retail value (€m) for countries with top 5 market share (% share, by retail value) across Europe, 2008-18

Overall, each country shows an upward trend in terms of retail value for laundry care products. The UK - currently the largest market for detergents - is expected to see the steepest increase, reflecting the importance for manufacturers to continue trying to develop brand loyalty in this mature market.

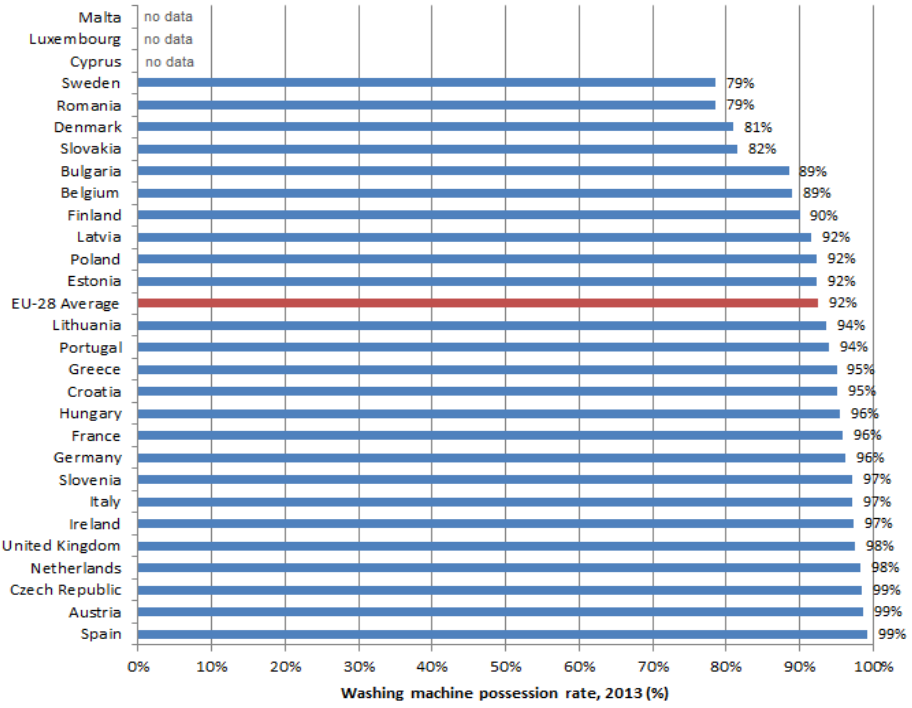
3.4 Market trends

3.4.1 *Washing machine ownership*

The use of automatic laundry detergents is driven by the possession of household washing machines. 92% of households in Europe have a washing machine, in 19 countries the possession rate is 90 % or over (Figure 11).

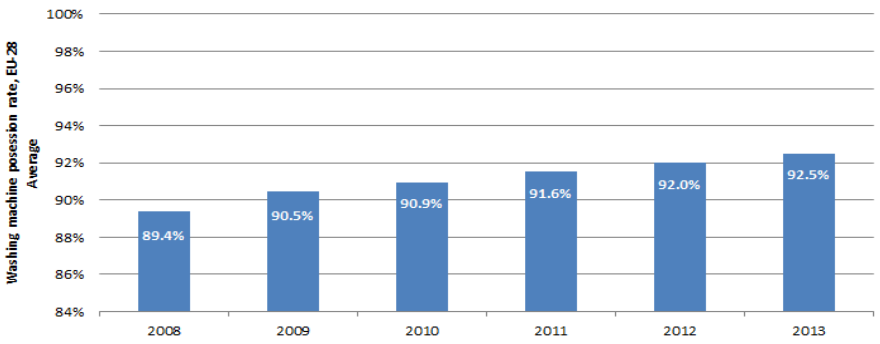
Sweden (79 %) and Denmark (81 %) have the lowest known washing machine possession rates due to the way laundry is typically carried out in the region. In apartment buildings, student residences, etc. there are typically communal laundry rooms available for use by residents which limits the need for household washing machines. There may be scope for an increase in ownership in other countries with below EU-average ownership rate. As shown in Figure 12, possession of washing machines across Europe is continuing to increase.

However, many countries are nearing (or may have already reached) saturation in terms of washing machine ownership. In countries such as Spain, Austria and the Czech Republic, possession of washing machines is 99 % and so laundry detergent sales will not be driven by an increase in washing machine purchases, In these countries, product innovation and understanding market sensitivities (e.g. price) and trends (e.g. sustainability) will be important for organisations in gaining market share.



Source: Euromonitor International, Data used in Passport report, *Possession rates (2013)*

Figure 11: Washing machine possession rates (%), EU-28, 2013 by country



Source: Euromonitor International, Data used in Passport report, *Possession rates (2013)*

Figure 12: Washing machine possession rates (%) EU-28 Average, by year (2008-13)

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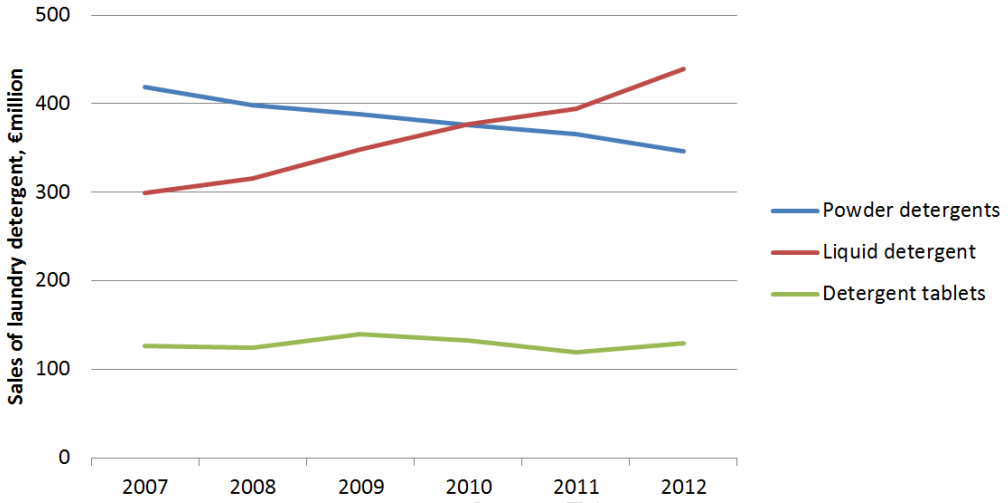
3.4.2 *Trade-offs in the laundry detergent market – product trends*

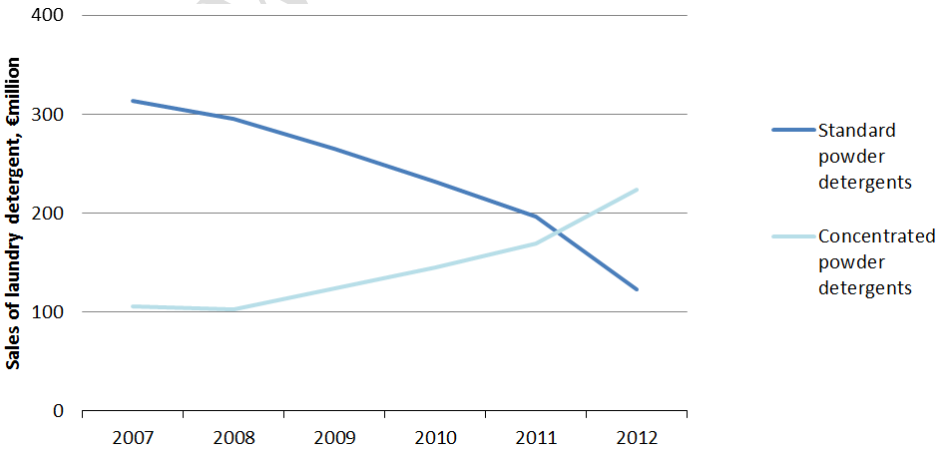
Figure 13 shows the average sales of laundry detergents by category (powder, liquid and tablet detergents) in Europe between 2007 and 2012. This average has been calculated from the sales of five European countries from different regions (UK - Northern Europe, Italy – Southern Europe, Germany – Central Europe, Poland – Eastern Europe and Denmark – Scandinavia), which combined account for an estimated 50 % of the total market for laundry detergents by retail value.[98] An average across these countries is assumed to be representative of Europe. A decrease in sales of powder detergents (17 % decrease 2007-12, CAGR -8.46 %) has been offset by an increase in liquid detergent sales (47 % increase 2007-12, CAGR 6.61 %). Detergent tablet sales overall remain significantly lower than sales of powder or liquid detergents across Europe and they have also been more volatile. Nevertheless they have seen a slight (2 %) increase 2007-12 (CAGR 0.35 %).



* EU Average calculated from data from Denmark, Italy, Germany, UK, Poland
Source: Euromonitor, summarised from 2013 Passport reports for *Laundry Care in: Denmark, Italy, Germany, UK, Poland*

Figure 13: Sales of laundry detergent by category, EU average*, 2007-12

Although trends can be seen in overall detergent categories (i.e. liquid, powder and tablet), it is important to understand sales of different product types within each category. The figures below outline the sales split between standard and concentrated products for both powder and liquid detergents.



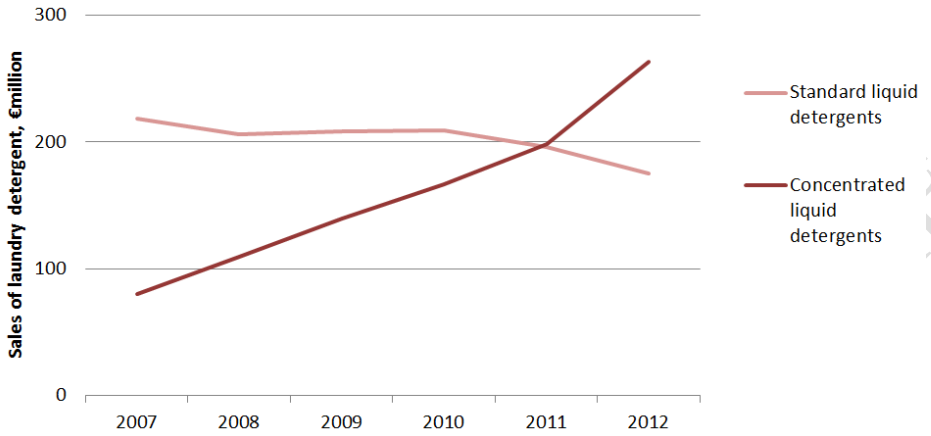
* EU Average calculated from data from Denmark, Italy, Germany, UK, Poland
Source: Euromonitor, summarised from 2013 Passport reports for *Laundry Care in: Denmark, Italy, Germany, UK, Poland.*

Figure 14: Sales of powder laundry detergent by category, EU average*, 2007-12

[98] These 5 countries account for a combined retail value of €6,669 million = 50 % of the total retail value of €13,203 (see Figure 8).

For powder detergents:

- Sales of standard powder detergents have decreased by €190 million between 2007 and 2012, a decrease of 61 % or a CAGR of -14.43 %.
- Sales of concentrated powder detergents increased by €118 million between 2007 and 2012, an increase of 111 % or a CAGR of 13.28 %. The majority of this increase has been seen between 2011 and 2012 where sales increased by over 50% in this one year period. This is also reflected in a significant decrease in sales of standard powder detergents between 2010 and 2012.



* EU Average calculated from data from Denmark, Italy, Germany, UK, Poland
Source: Euromonitor, summarised from 2013 Passport reports for *Laundry Care in: Denmark, Italy, Germany, UK, Poland*

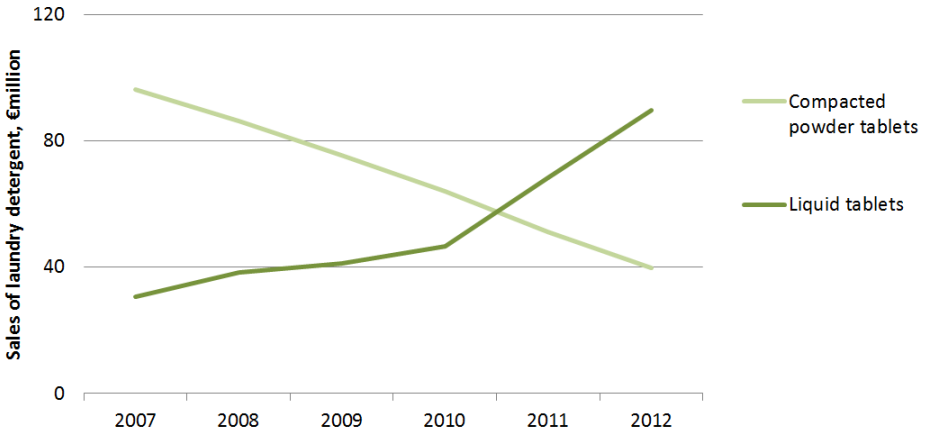
Figure 15: Sales of liquid laundry detergent by category, EU average*, 2007-12

For liquid detergents:

- Sales of standard liquid detergents decreased by € 42 million between 2007 and 2012, a decrease of 20 % or a CAGR of -3.58 %.
- Sales of concentrated liquid detergents increased by €183 million between 2007 and 2012, an increase of 228 % or a CAGR of 21.94 %.

Both the powder and liquid detergents categories have shown a similar trend in product sales. Sales of concentrated products have shown a steady increase with sales of standard detergents subsequently falling. This shows a direct trade-off between product types and also highlights the increasing popularity of concentrated products (see Section 3.5.1 for more information).

Alongside liquid and powder detergents, the availability of laundry detergent tablets is also increasing across Europe. As with the other laundry detergent categories, there is a clear trade-off between product types: an increase in sales of liquid tablets (193 % increase 2007-2012, CAGR 20.09 %) is mirrored by a decrease in sales of compacted powder tablets (59 % decrease 2007-2012, CAGR -13.58 %).



* EU Average calculated from data from Denmark, Italy, Germany, UK, Poland
Source: *Euromonitor, summarised from 2013 Passport reports for Laundry Care in: Denmark, Italy, Germany, UK, Poland*

Figure 16: Sales of tablet laundry detergent by category, EU average*, 2007-12

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Trends in the laundry detergent market can therefore be summarised as:

- A significant overall increase in liquid detergents (+47 % 2007-2012, CAGR 6.61 %).
- An overall decrease in the use of powder detergents (-17 % 2007-2012, CAGR -8.46 %).
- An increase in the use of concentrated products, most significantly concentrated liquid detergent (228 % increase in sales of concentrated liquid detergents 2007-2012, CAGR 21.94 %).
- An increase in liquid tablet detergents (193 % increase 2007-2012, CAGR 20.09 %).

3.4.3 *Sales trends*

In the laundry care market, consumers are typically very price sensitive. In the UK (the country with the largest share of the market, 17 % of the total retail value across Europe) consumers will typically switch between brands (albeit between the small number of well established brands) depending on price or promotional offers, demonstrating very low levels of brand loyalty. In Europe these price promotions are common. It is estimated that about 80 % of all laundry detergents are sold on offer as loss leaders in supermarkets.[99] The UK is also categorised by the increasing use of detergent tablets, specifically liquid tablets which are often more expensive per wash than alternative detergent types.

In Europe, the long term trend in the laundry detergent market is a move towards concentrated liquid (including gel) detergents both in liquid and tablet form. However, this trend is highly sensitive to price – in 2011 there was an increase in powder detergent use in Europe as consumers went for lower priced options.

Many of the recent developments and innovations in the detergent market have centred on the production of laundry tablets (also marketed as 'pods') and unit dose products (see Section 3.5.1 for more detail). The convenience factor is a significant driver for the sales of laundry tablets, which provide an easy way to dose detergents. Sales of liquid tablets in particular have seen significant growth since 2007 (with a CAGR of 20.09%) but still make up a very minor part of the market. As shown in Figure 6 (Page 83), this trend appears to be driven by a select few European countries – primarily Italy and the UK – where take-up of these laundry tablets has grown significantly since 2007.

3.4.4 *Labelling*

Table 24 provides an estimate of the number of EU Ecolabel LD products manufactured and sold in Europe. The first column (country) indicates the country which awarded the EU Ecolabel to various manufacturers and products; this is also the country in which the product is manufactured. 24 manufacturers have been awarded the EU Ecolabel for a total of 180 products.

Table 24: EU Ecolabel consumer LD products manufactured and sold, by country (EU-28)

Country	No. of manu-facturers awarded the EU Ecolabel	No. of products awarded the EU Ecolabel	Countries where products are sold (Europe only)
Belgium	2	44	Belgium, France, Italy, Netherlands, Portugal, Spain, UK
Denmark	4	24	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, UK
Spain	3	6	Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK
France	9	63	France
Italy	2	30	Italy

[99] Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe.*

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Country	No. of manu-facturers awarded the EU Ecolabel	No. of products awarded the EU Ecolabel	Countries where products are sold (Europe only)
Netherlands	3	11	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK
Sweden	1	2	Sweden
TOTAL	**24**	**180**	

Source: EU Ecolabel E-Cat (last viewed on 26/02/2014) - *http://ec.europa.eu/ecat/*

Availability of these products across Europe is varied – 63 EU Ecolabel products are both manufactured and sold in France suggesting high availability. However, only 7 of 28 European countries manufacture any products which have been awarded the EU Ecolabel and all other countries rely on import of EU Ecolabel products. Table 25 indicates how many EU Ecolabel products are available in each EU country. Again, France has the highest number of products available (106), followed by Italy (40).

Table 25: EU Ecolabel consumer LD products on the EU-28 market

EU Member State	No. of EU Ecolabel consumer laundry detergent products on the market	EU Member State	No. of EU Ecolabel consumer laundry detergent products on the market
Austria	3	Italy	40
Belgium	10	Latvia	3
Bulgaria	2	Lithuania	3
Croatia	3	Luxembourg	2
Cyprus	1	Malta	2
Czech Republic	3	Netherlands	15
Denmark	21	Poland	3
Estonia	2	Portugal	8
Finland	3	Romania	3
France	106	Slovakia	3
Germany	9	Slovenia	3
Greece	2	Spain	13
Hungary	3	Sweden	5
Ireland	3	United Kingdom	7

Source: EU Ecolabel E-Cat (last viewed on 26/02/2014) - *http://ec.europa.eu/ecat/*

There are significantly fewer EU Ecolabel IILDs on the EU market. As shown in Table 26, only one manufacturer in Spain has been awarded the EU Ecolabel for this product category, for a total of three products. The respective criteria are in force since 2012.

Table 26: EU Ecolabel IILD manufactured and sold, by country (EU-28)

Country	No. of manufacturers awarded the EU Ecolabel	No. of products awarded the EU Ecolabel	Countries where products are sold (Europe only)
Spain	1	3	France, Portugal, Spain
TOTAL	**1**	**3**	

Source: EU Ecolabel E-Cat (last viewed on 26/02/2014) - *http://ec.europa.eu/ecat/*

Across Europe, these products are available in France, Portugal and Spain only, with all three products available on each market. It is important to note, however, that some laundry detergents used for I&I purposes may have been awarded the EU Ecolabel under the 'consumer laundry detergent' category. Therefore, although there is a limited number of EU Ecolabel IILD, this does not mean there is a limited supply of, or demand for, EU Ecolabel products for I&I purposes.

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In addition to the EU Ecolabel, which operates across the EU-28, the Nordic Council has a Nordic Swan ecolabel that is also used on laundry detergents which are produced and marketed in its five Member States, i.e. Sweden, Denmark, Finland (also EU Member States), Norway and Iceland (EEA States) (see Table 27).

Table 27: Nordic Swan consumer laundry detergent products & stain removers on the EU-28 market

Nordic Swan Country	No. of Nordic Swan-labelled consumer laundry detergent products on market	No. of manufacturers/ brands	No. of Nordic Swan-labelled stain removers on market	No. of manufacturers/ brands
Denmark	238	49	30	7
Norway	40	6	13	1
Sweden	88	7	18	1
Finland	N/A[100]	N/A	N/A	N/A
Iceland	N/A	N/A	N/A	N/A
Total	366		61	

Source: Danish Ecolabelling website/product catalogue[101], Norwegian Ecolabelling website/product catalogue[102], Swedish Ecolabelling website/product catalogue[103] - last viewed on 26/02/2014

For many small Scandinavian producers of laundry detergents (private labels), it may be that the local market is more vital than the European market, and so the Nordic Swan label may be more familiar and accepted by producers and consumers alike. This may result in a lack of incentive for smaller producers to acquire both a regional label (Nordic Swan) and an EU Ecolabel.

Even though Nordic Swan products are more prevalent there is, nonetheless, a high uptake for EU Ecolabel LD products. The rate of producer uptake of the EU Ecolabel is particularly high in France (106 products), with quite a good uptake in Italy (31 products), Denmark (21 products), the Netherlands (15 products) and Spain (13 products). However, the number of Nordic Swan labelled I&I, or "professional laundry detergents", is significantly higher than the number of EU Ecolabel I&I LD products (Table 28).

Table 28: Number of Nordic Swan I&I laundry detergent products on the EU-28 market

Country	No. of Nordic Swan-labelled IILD products on market	No. of manufacturers/brands
Denmark	360	46
Norway	35	11
Sweden	16	2
Finland	N/A[96]	N/A
Iceland	N/A	N/A
Total	**411**	

Source: Danish Ecolabelling website/product catalogue, Norwegian Ecolabelling website/product catalogue[98], Swedish Ecolabelling website/product catalogue - last viewed on 26/02/2014

A number of labels are also used elsewhere in the world, including the 'Green Seal' (USA) labels for "laundry care products for household use" and "laundry care products for industrial and institutional use", as well as the 'Environmental Choice' (New Zealand) labels for "laundry detergents" and "commercial and institutional laundry detergents."

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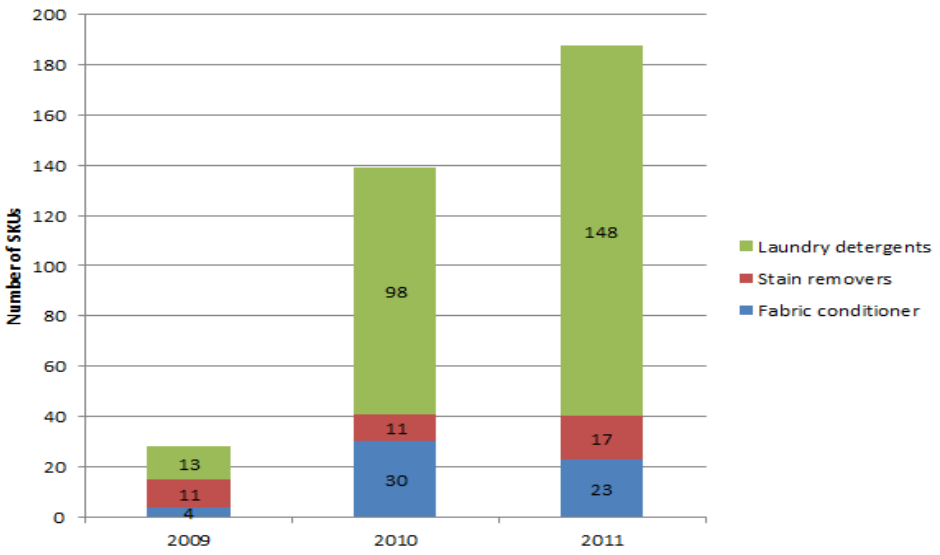
[100] Data not available on relevant websites (Ecolabelling Finland and Ecolabelling Iceland)
[101] http://www.ecolabel.dk/da/produkter/rengoering-og-vask/midler-til-husholdning
[102] http://www.svanemerket.no/produkter/producttype/?m1=300005&m2=310053&pt=299109#prodList
[103] http://www.svanen.se/en/Buy-Svanenmarkt/Ecolabelled_products/?categoryID=347&p=5

3.5 Product and process innovation

3.5.1 *Sustainability trends*

Innovation for sustainability is a concept that has gained significant ground with the detergents industry. A recent report on consumer and innovation trends in laundry care noted that manufacturers are continually increasing their efforts to provide greener solutions and are developing more formulas and packages based on sustainable ingredients.[104] Figure 17 shows the rapid increase in laundry products launched with environmentally friendly or fair trade claims between 2009 and 2011.



Source: Datamonitor, *Consumer and innovation trends*

Figure 17: Laundry products (SKUs) launched with environmentally friendly or fair trade claims, Europe

The key sustainability trends for laundry detergent product innovation include:

- the increased use of plant-based or 'green' ingredients,
- an increase in availability of compacted or concentrated versions of products,
- a focus on minimising packaging,
- the introduction of reusable bottles,
- an increase in the availability of unit dose products.

Each of these trends is outlined in more detail below.

3.5.1.1 Plant-based 'green' ingredients

A focus on sustainability of cleaning products has led to a number of manufacturers substituting commonly used chemicals for plant-based ingredients. P&G, for example, has set a goal to replace 25 % of petroleum-based raw materials with sustainably sourced renewable materials for all products and packaging by 2020[105], alongside the eradication of phosphate use in its leading detergent brands.[106] Henkel also states that it uses natural materials where possible in laundry detergents – specifically, using a mixture of different surfactants, many of which are based on renewable raw materials. Henkel states that the proportion of renewable raw materials in surfactants for detergent is currently about 30 %.[107]

[104] Consumer and Innovation Trends in Laundry Care, Datamonitor Consumer, December 2012
[105] P&G, *Working to reduce environmental impacts.* Available at: http://www.pg.com/en_US/sustainability/environmental_sustainability/renewable_resources/renewable_resources.shtml
[106] GreenBiz (2014) *P&G is washing phosphate out of tide.* Available at: http://www.greenbiz.com/blog/2014/01/28/pg-aims-remove-phosphates-leading-detergent-brands
[107] Henkel sustainability report; responsible use of raw materials. Available at: http://sustainabilityreport2012.henkel.com/sustainability-stewardship/raw-materials.html?print=1

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This trend can also be seen by the emergence of new laundry detergent manufacturers, such as Ecover, that only produce plant-based cleaners under a 'green laundry' brand.

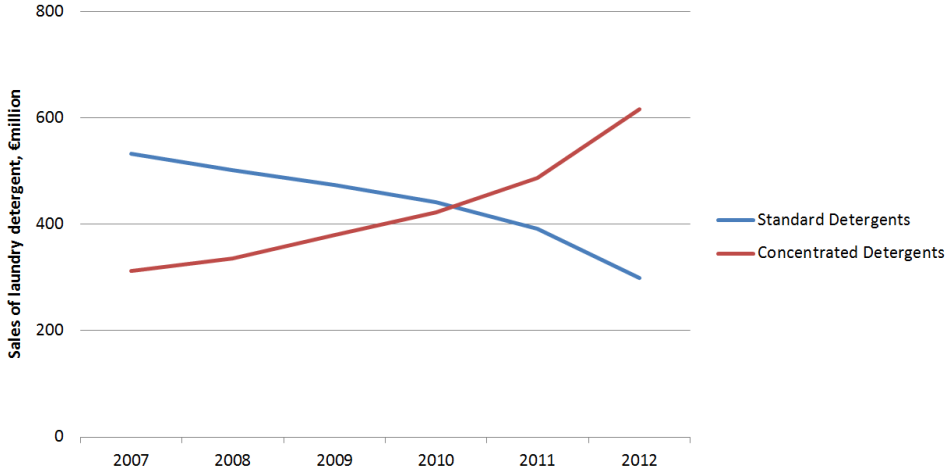
3.5.1.2 Compacted and concentrated version of products

The availability of concentrated detergent products in Europe has increased dramatically over the past five years, driven by an increase in sales (see Figure 18). This is a trend which is expected to continue, especially for concentrated liquid detergents which have seen the most significant increase.

This increase is mainly due to on-going developments of ultra-concentrated laundry detergents (in liquid and powder formats) made by key market players such as P&G. These new products are pushing standard detergent formats off the market. Overall, even concentrated powder detergents are likely to see sales being eroded by consumers switching from powder to concentrated liquid detergents.

Concentrated detergents reduce the impact on the environment in a number of ways, compared to standard detergents:

- Detergent for the same number of washes can be concentrated into a smaller bottle, reducing packaging sizes.
- In turn, this minimises the amount of space needed to transport detergents and so reduces transport related impacts.
- The amount of water used per dose of detergent is greatly reduced.



* Average taken from Denmark, Italy, Germany, UK, Poland – represent 51 % of the market

Figure 18: Sales of laundry detergents (concentrated vs standard), €m, EU average* 2007-12

Consumers are increasingly becoming aware of the environmental benefits of concentrated products and are paying more attention to information about the number of washes being offered per package. Manufacturers of concentrated products are increasingly providing information on packaging to outline environmental and potential cost saving benefit to consumers.

In France (the second biggest market in Europe by retail value) the move to concentrated detergents has been boosted by recommendation from AFISE, the main French trade association for household care. AFISE has encouraged a move from 3 litre bottles to 2 litre bottles for laundry detergents, which has been followed by most of the key players in the market.[108] Many manufacturers have taken this further by offering double concentrated formats instead of standard concentrated products. The increase in these 'super-concentrated' products can be seen across Europe.

However, the move towards more concentrated products needs to be accompanied by a greater amount of information on packaging aimed at consumers. Without proper information, consumers continue to dose as

[108] Passport (2013) *Laundry care in France*

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with non-concentrated products and therefore overdose these concentrated detergents. For example, a 2 litre bottle of concentrated detergent may provide the same number of 'washes' as a 3 litre bottle, but consumers are measuring out the same amount regardless of bottle size. Manufacturers are benefiting from this added value as a result of over-dosing.[104]

3.5.1.3 Minimisation of product packaging

The increase in concentrated products has led to a direct decrease in the amount of product packaging required. However, there is also a drive in the market to reduce packaging for non-concentrated products, with many of the large manufacturers advertising packaging innovations which have this effect. P&G for example, claims to have "*reduced our packaging approximately 4.5 % per consumer use…While we are currently on track to meet our 20 % reduction goal for 2020*".[109]

3.5.1.4 Reusable bottles

Although not yet a widespread trend, a number of laundry detergent manufacturers have begun to sell products across Europe in refillable packaging. The US brand Method is, in particular, taking this approach in order to minimise the amount of laundry packaging disposed of by consumers[110]. Across Europe, the Ecover brand also produces refills for their laundry detergents[111]

In addition, using refillable packs may present an opportunity to secure brand loyalty to a greater extent than is currently possible in such a price sensitive market[112]. Once a consumer invests in an initial product they may be more likely to buy refills of the same brand.

3.5.1.5 Unit dose products

Unit dose products are a relatively new innovation in the laundry care market and act as a direct replacement for the more traditional liquid and powder laundry detergents. These products consist of 'pods' or packets which contain a pre-measured unit dose of laundry detergent. Liquid 'pod' detergents in particular are advertised as a sustainable innovation in the laundry market. These consist of a liquid detergent in a water-soluble and (typically) biodegradable film capsule. This prevents the user from over-dosing the laundry detergent, a common problem with liquid or powder detergents. Interestingly, this innovation is thought to have had a negative effect on the laundry market as a whole. Consumers using too much detergent with every laundry load results in greater sales and unit dose products prevent this. Indeed, a high uptake of unit dose detergents is thought to potentially lead to reduced LD purchases.[113,114]

3.6 Consumer trends

3.6.1 *Product fragrance*

As the laundry care market is well developed across Europe, innovations in laundry products are most often driven by consumer demand for enhanced experience in using these products. As well as the efficacy of the product (e.g. ensuring that white clothes remain white), the product's fragrance has become an important factor for consumers. In fact, 51 % of consumers worldwide state that the fragrance of a laundry care product has high or very high influence over their product choice, while only 42 % state that product efficacy has an equal influence.[115] As a direct result of this, more brands are introducing new fragrances to the market, often accompanied with 'long-lasting' fragrance technologies. The demand for new fragrances is especially strong in

[109] P&G (2013) *Sustainability report.* Available at: http://www.pg.com/de_DE/downloads/PG_2013_Sustainability_Report.pdf
[110] Information available at: http://methodhome.com/shop/method-laundry-detergent-refill-85-loads/
[111] Information available at: http://www.ecoverdirect.com/products/non-bio-laundry-liquid-15l-bag-in-box/eliquidbagbox15l.aspx?productid=eliquidbagbox15l
[112] Mintel (2012) *Laundry Detergents and Fabric Conditioners - UK*
[113] The Wall Street Journal (2013) *Is Innovation Killing the Soap Business,* Published April 3, 2013. Available at: http://online.wsj.com/news/articles/SB10001424127887323916304578400521297972496
[114] HAPPI (2013) *Where's the Bounce?* Published January 21, 2012. Available at: http://www.happi.com/issues/2013-01/view_features/wheres-the-bounce/
[115] Datamonitor (2012) *Consumer and Innovation Trends in Laundry Care. available at:* http://www.datamonitor.com/store/Product/consumer_and_innovation_trends_in_laundry_care?productid=CM00198-019

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the UK (the largest market in Europe for laundry care products) and a number of large manufacturers have launched products with new fragrances, such as Unilever's Exhilarations range which includes fragrances such as 'bluebell and bergamot', 'peach and poppy', and 'strawberry and lily'.[116]

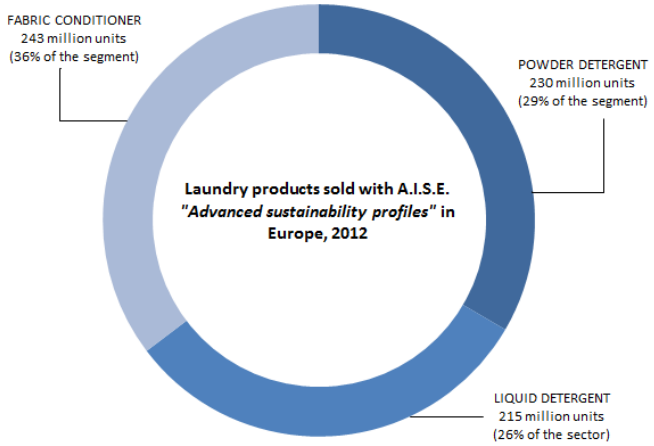
This had led to an increasing amount of product research being carried out into the preferred fragrances for laundry care products across Europe. This includes the strength of fragrance – for example: in most Nordic countries a slight scent is preferable; in the UK a strong, lasting fragrance is preferred by consumers.[117]

3.6.2 *Sustainable cleaning products*

Sustainability is growing in importance for consumers of cleaning products, including laundry products. Worldwide, over two-thirds of consumers place significant importance on reducing unnecessary packaging and almost two-thirds also place an emphasis on other environmentally friendly aspects of packaging such as recyclability and reusability.[118]

A recent A.I.S.E. consumer study (2011) suggests that, across Europe, 72 % of consumers look for advice and commitments on sustainability when buying detergents[119] – showing the importance for manufacturers to consider the environmental impacts of their products. Consideration of sustainability is essentially becoming one way of differentiating laundry care products in an increasingly competitive market. There is little evidence to suggest, however, that price does not remain the most significant factor at the time of purchase.

Importantly, the drive towards a more sustainable cleaning product includes all aspects of a laundry care product, not just the chemical make-up of the detergent. A.I.S.E. has been particularly active in promoting sustainable design of cleaning products, including laundry detergents. In 2010, the organisation added product assessment to its on-going Charter for Sustainable Cleaning, allowing Advanced Sustainability Profiles (ASPs) to be awarded to products which meet set sustainability criteria. These criteria have been defined based on a life cycle analysis, and for laundry products include product formulation, packaging weight per job, packaging recycled content and provision of end user information on pack (to include tips for safe use and an indication of the ability to wash at 30 °C).[120]



Source: A.I.S.E. (2013) *Activity and sustainability report*

Figure 19: Units of laundry care products sold with A.I.S.E. ASP profiles in Europe, 2012

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[116] Passport (2012) *Laundry Care, UK* available at: http://www.euromonitor.com/laundry-care-in-the-united-kingdom/report
[117] Henkel (2011) *The world of fragrances; how washing and cleaning can affect the senses.* Available at: http://www.henkel.com/henkel-headlines/news-2011-20111024-the-world-of-fragrances-34010.htm
[118] *Consumer and Innovation Trends in Laundry Care*, Datamonitor Consumer, December 2012
[119] A.I.S.E. (2013) *The Case for the "A.I.S.E Low Temperature Washing" Initiative*: Substantiation Dossier June 2013 available at: http://www.iprefer30.eu/component/attachments/attachments?task=download&id=244
[120] A.I.S.E. (2013) *Activity and sustainability report* available at: http://www.aise.eu/documents/document/aise_asr_2012_2013.pdf

The data in Figure 19 above have been developed by A.I.S.E based on data from four companies that share the majority of the laundry care market. It shows that, overall, 688 million units of ASP products were sold in 2012, which represents on average 30 % of all laundry products sold across the EU.116

3.6.3 *Low temperature washing*

A recent area of focus for laundry detergent producers has been the offer of products that clean laundry effectively at lower temperatures and shorter washing cycles, saving the consumer energy and money.

Across Europe, this information is disseminated to consumers through a number of initiatives including:

- *I Prefer 30.* This consumer-facing campaign is led by the European detergent industry, headed by A.I.S.E. and including with national associations in five European countries (Belgium, Denmark, France, Italy and UK). The aim of this campaign is to drive down the average wash temperature of domestic laundry washing through raising consumer awareness of the benefits of washing laundry at 30 °C.
- Advertising from major brands, and information on packaging to encourage lower temperature washing where appropriate. For example P&G, the largest laundry detergent supplier in Europe, has recently launched a number of communication programs aimed at 'washing at 30°'. In addition, all versions of Ariel, the leading laundry detergent in Europe, now carry a '30°C' icon to encourage consumers to wash in cold water.[121] P&G estimates that its cold-water washing campaigns (including 'Ariel Turn To 30°C') have helped reduce 58,000 tonnes of CO_2 emissions by educating consumers to save energy.[122]

3.7 Conclusions of the market analysis

The aim of the market analysis is to identify any significant changes in the market for laundry detergents since the last revision or the development (for IILD) and further to understand whether any such changes need to be reflected in the criteria.

- An analysis of the Eurostat databases PRODCOM and COMTEXT showed that neither of the 'cleaning product' categories are broken down in a way that could be useful for analysis of laundry detergents. As a consequence it was not possible to use data directly from Eurostat in this study.
- In 2013, the retail value of the EU market for laundry detergents was an estimated €13,203million.[123] Of this, an estimated 4 % (or €528 million) represents the I&I market, with the remaining 96 % (or €12,675 million) representing domestic laundry detergent use.
- Overall in Europe liquid laundry detergents have the largest share of the household laundry detergent market (28 %), closely followed by powder laundry detergents (25 %). Unit doses represent an estimated 7 % of the market, with the remainder consisting of fabric conditioners, laundry aids and others.[124]
- Sales of these different types of laundry detergents vary by country. In Poland, the UK and Denmark sales value of powder detergents is higher than liquid or detergent tablets (92 %, 44 % and 52 % of the sales value of all detergents respectively). In Italy and Germany sales values of liquid detergents are higher in comparison to powder or detergent tablets (representing 60 % of the total detergent sales value in Italy and 52 % in Germany). The sale of detergent tablets is very varied across countries. Sales values in Denmark and Poland represent less than 0.1 % of all detergent sales, but represent 13 % in Italy and 22 % in the UK.
- The laundry detergent market across Europe is heavily dominated by a few well-known and globally recognised organisations and brands such as Procter & Gamble, Henkel and Unilever.
- The rates of washing machine ownership vary throughout Europe, from 79 % in Sweden to 99 % in Austria and Spain. This does have an impact on the types of laundry detergent used (i.e. those without

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[121] P&G (2013) *Sustainability report.* Available at: http://www.pg.com/de_DE/downloads/PG_2013_Sustainability_Report.pdf
[122] *Ariel Sustainable Commitment*. Available at: https://www.ariel.co.uk/AboutAriel/Ariel_Sustainable_Commitment.aspx
[123] N.B. Data on the total value of the laundry market are not readily available, but throughout this analysis the most recent figure for market size has been used; a 2013 figure of €13,203 million. This figure includes the EU-28 minus Cyprus, Luxembourg and Malta, for which there is no data. This figure is also assumed to include the total laundry care market, both household and I&I products.
[124] Euromonitor International, cited on A.I.S.E website http://www.aise.eu/our-industry/market-and-economic-data.aspx

washing machines will be more likely to use hand-washing detergents for laundry), although other factors will also influence the consumption of laundry detergents (including preferences for detergents (e.g. a preference for liquid or powder detergents), and the approach to dosing of detergents).

- Within Europe, France and the Nordic countries have the highest penetration of ecolabelled laundry products (Nordic Swan and EU Ecolabel).
- Sustainability is growing in importance for consumers of laundry detergents, with an increase in concentrated/compacted products, use of plant-based ingredients, minimisation of packaging, the introduction of reuseable bottles and an increase in the availability of unit dose products. Another market trend - closely linked to sustainability – is the development and widespread marketing of laundry detergents which clean at lower temperatures, saving the consumer energy when using a washing machine.

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4. TECHNICAL ANALYSIS

A technical analysis of the environmental performance of laundry detergents has been carried out and is presented in this chapter. The main objective of this analysis is to identify the environmental hot spots across the whole of the life cycle for laundry detergents.

This analysis incorporates:

- an overview of technological aspects – production and ingredients
- a review of existing LCA studies
- investigation into I&I laundry, auxiliaries and laundry alternatives
- a review of non-LCA impacts
- a bespoke LCA analysis
- a sensitivity analysis.

4.1 Technological aspects

4.1.1 *Supply chain for laundry detergent production*

An overview of the supply chain for home and fabric care products, including laundry detergents, is shown in Figure 20. Manufacturers of laundry detergents (formulators/blenders) such as Procter & Gamble, Unilever and Henkel acquire ingredients such as surfactants from speciality manufacturers and then blend these to produce laundry detergents. Within Europe there are around 40-50 companies active in the market for home and fabric care speciality ingredients.[125] Further information on laundry detergent ingredients can be found later in this section.

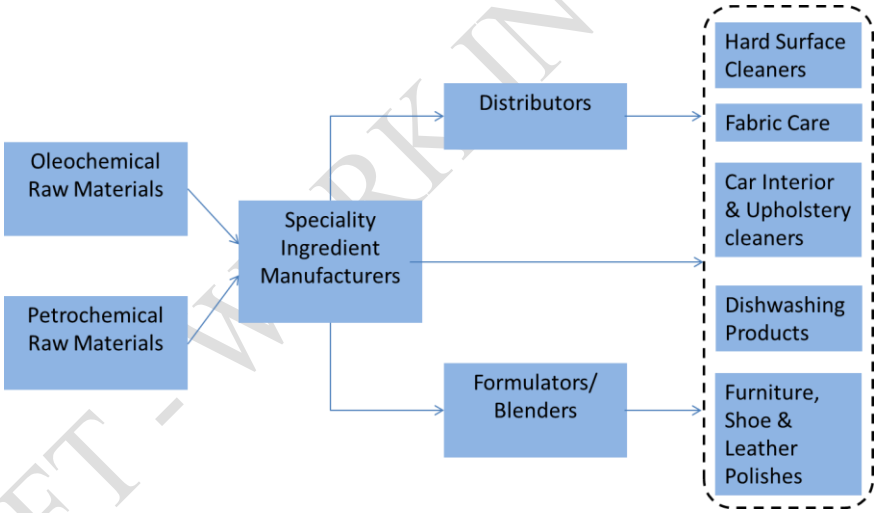

Figure 20: Supply chain for home and fabric care products

The raw materials used for the production of detergent ingredients are obtained either from oleochemical or petrochemical sources. Oleochemical raw materials are derived from plants and animal fats, including coconut oil, tallow, palm kernel oil and palm oil. These raw materials are often referred to as 'renewable' raw materials. Petrochemical raw materials are derived from crude oil or natural gas, these materials are often termed 'synthetic'. According to the American Cleaning Institute, there is no inherent environmental advantage to using surfactants from one source or the other and there are environmental trade-offs associated with both oleochemical and petrochemical sources.[126] This will be discussed in further detail in the technical background report.

[125] Strategic Analysis of the Home and Fabric Care Speciality Ingredients Markets in Europe, Frost & Sullivan, July 2009.
[126] Sustainability resources from the American Cleaning Institute, available from: http://www.cleaninginstitute.org/sustainability/some_facts_about_4.aspx

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Companies active in the European market for detergent speciality ingredients include Clariant, Rhodia, Solvay, Rohm & Hass, Cognis, Croda, Dow Corning, Elementis, Alco Chemical and BASF. Within the home and fabric care ingredients sector, speciality surfactants hold the largest market share in Europe.[100]

4.1.2 *Description of the production processes*

The first step of laundry detergent production is to select the ingredients. This is done according to several criteria which will typically include: cost, sustainability, human health, environmental safety and performance. Detergent manufacturers use different approaches to ensure that their products have the least impact on the environment and human health. One example of such an approach is the Greenlist™ process developed by SC Johnson, which scores ingredients by their impact on the environment and human health.[127] Using this process, a final product score is obtained that takes into consideration the environmental classifications of both chemical and packaging constituents.[128]

The manufacturing process employed for laundry detergent products in general consists of mixing and pumping the ingredients into mixing vessels. The exact process employed will depend on the manufacturer and the format of the final product. Different processes will be employed for liquids, gels and powders.

- Powder detergents are produced by spray drying, agglomeration, dry mixing or combinations of these methods.[129] During the spray drying process, liquid and powder ingredients are combined to form a slurry which is then pumped through a tower and sprayed under high pressure to form small droplets. A current of hot air is used to dry the droplets and form hollow granules. Following a screening process to ensure granules are of the correct size, temperature sensitive ingredients such as enzymes are added. An agglomeration process consists of blending dry and liquid ingredients in the presence of a liquid binder. This process leads to higher density powders. For the production of powders, processes are required for densification, to ensure that the final product has the desired bulk density.

- Liquid detergents are produced either in a batch process or a continuous process. A batch process is the simplest as ingredients are introduced to an agitated tank and additional mixing or heating can be provided through a recirculation loop.[130] In comparison, continuous processes are more sophisticated and better suited to large-scale operations. In a continuous process both dry and liquid ingredients are added and then blended using in-line mixers. In the production of liquid laundry detergents, solubilisers are used to help the detergent and water blend together.

The final stage in the manufacturing process for all laundry detergents is packaging. Liquid and gel laundry detergents are typically packed in bottles, whereas powders are packaged in boxes. During the selection process for packaging materials, product compatibility, product stability, cost, safety, solid waste impact, ease of use and shelf appeal are all taken into consideration.

4.1.3 *Laundry detergents ingredients*

Laundry detergents for both household and professional use are complex formulations, often containing 25 or more different ingredients that can be categorised as: surfactants, builders, bleaching agents and auxiliary agents. Information on detergent ingredients can be found in Annex II.

Surfactants are the most important group of ingredients, present in all types of detergents. They take care of full moistening of the surface, removal of soil and stains, and keep the soil in the aqueous solution. In general,

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[127] For more information http://www.scjohnson.com/en/commitment/focus-on/greener-products/greenlist.aspx
[128] *S.C. Johnson's Greenlist Program for raw material selection: pushing the sustainability frontier*, presentation by Dr Pat Guiney, S.C. Johnson & Son Inc. at Minnesota Green Chemistry Conference, January 2012. Available from: http://www.greenchemistrymn.org/sites/greenchemistrymn.org/files/presentations/Pat%20Guiney.pdf
[129] Soaps & Detergents: Manufacturing, American Cleaning Institute. Available from: http://www.cleaninginstitute.org/clean_living/soaps__detergents_manufacturing.aspx
[130] Handbook of Detergents, Part F: Production, Surfactant Science Series Volume 142, Uri Zoller and Paul Sosis, CRC Press, 2009.

both adsorption and cleaning performance increases with increasing hydrocarbon chain length.[131] Most laundry detergents use a combination of different surfactants in order to achieve optimum levels of performance. Examples of surfactants commonly used in laundry detergents include alkyl ether sulphates, alkyl sulphates, alcohol ethoxylates, alkyl polyglycosides and alkyl phenol ethoxylates.

The function of builders is to support detergent action and soften water, i.e. eliminating calcium and magnesium ions, which arise from the water and from soil. They account for 20 % or more of the product formulation. Both inorganic and organic builders are used in laundry detergents. Inorganic builders include phosphates, carbonate compounds and silicates; examples of organic builders include polycarboxylates, ether polycarboxylates, fatty acids and salts of polyacetic acids.

Bleaches are used to remove coloured stains, such as coffee or wine. In the past, chlorine bleaches were used but, since these affect the fabric, oxygen bleaches such as sodium perborate and sodium percarbonate are used nowadays. They function properly at a temperature of at least 60°C, so a bleach activator such as tetraacetylethylenediamine (TAED), is required to guarantee proper functionality at 40°C.[132]

Auxiliary agents are used in small quantities only, each with its own specific purpose. For instance: enzymes are used to remove stubborn proteinaceous stains; soil re-deposition agents are used to prevent soil return to the fibres; foam regulators are used to give the desired foam characteristics; corrosion inhibitors are used to prevent corrosion of the machine components that are made of metals or alloys; fluorescent whitening agents are used to prevent a slight yellowish tinge on properly washed and bleached white laundry; dye transfer inhibitors are used to impede re-adsorption or re-deposition of detached dyestuff on other textiles; dyes are used to give the desired colour; and fragrances are used to give a distinctive odour.

4.2 LCA review

Before performing an LCA analysis on the environmental performance of laundry detergents, a detailed LCA screening of publicly available studies has been carried out. This screening has enabled the main environmental hotspots for this product group to be identified, and the need to perform additional studies to be evaluated. The results of this review will aid the revision of the EU Ecolabel criteria for the LD and IILD product groups, since they allow for the identification of the environmental hot spots and their alternatives in terms of criteria and restrictions.

4.2.1 *Selection criteria*

Relevant LCA studies were identified in the literature and critically reviewed for the robustness of their results. The criteria considered for this assessment were:

- **Subject of the studies**: This refers to the representative features of the product group, sub-categories, technologies or specifications.
- **Functional unit:** The functional unit refers to a quantified performance of a product system for use as a reference unit in LCA studies.
- **Time-related coverage of data**: This refers to the year the inventory data of the analysis is based on; studies should ideally be less than four years old.
- **Comprehensiveness and robustness:** This refers to the environmental impacts considered in the study. Impact categories should be comprehensive, ideally reflecting the European Commission's Product Environmental Footprint (PEF) methodology or other recognized LCA methodologies and scientifically robust when considered against the evaluation provided in the JRC's ILCD Handbook. Studies should also be cradle-to-grave.
- **Reliability:** This refers to the information and the data quality provided by the authors. Studies should ideally be subject to an external critical review.

[131] Ullmann's encyclopedia of industrial chemistry. 2012. Laundry Detergents, 2. Ingredients and Products
[132] The function of builders is to support detergent action and soften water, i.e., eliminating calcium and magnesium ions, which arise from the water and from soil.

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The different studies' compliance with the ISO standards for life cycle assessment (ISO 14040 and 14044) was considered as well as the information provided regarding:

- **Cut-off criteria**: According to the ISO 14040/44:2006 and the ILCD Handbook, cut-off criteria should be documented in an LCA study. The reasons for assuming cut-offs should be stated and their effects on results should be estimated.
- **Allocation**: Allocation rules should be documented in the description of the studies.
- **Data quality** requirements and data sources: Data quality level and sources of primary and secondary data should be documented, e.g. information on the geographical and technological representativeness of the selected LCA studies.
- **Assumptions:** Information and documentation of the important assumptions is crucial to ensure the transparency and reproducibility of the results. Therefore, information about the assumptions made whilst modelling should be provided.

4.2.2 *Selection of reports*

An overview of the available LCA and environmental risk assessment studies is shown in Table 29. Of them, the following studies were selected for a more detailed revision: EPA Victoria and City West Water (2010)[133], The Sustainability Consortium (2011)[134], and Nielsen et al. (2013)[135]. Even though the study by The Sustainability Consortium (2011) focussed on only three impact categories, it was selected for further revision because of the limited availability of studies and because this study was well documented. Table 30 lists the studies which were disregarded for further analysis and the reasons for their non-inclusion.

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[133] *LCA of Clothes Washing Options for City West Water's Residential Customers: Life Cycle Assessment – Final Technical Report*, EPA Victoria and City West Water, May 2010

[134] *Product Category Life Cycle Assessment (PCLCA) Laundry Detergent: Sustainability Measurement and Reporting System pilot project*, The Sustainability Consortium, 2011

[135] *Compact detergents in China – a step towards more sustainable laundry a Life Cycle Assessment of four typical Chinese detergents*, Nielsen A.M., Li H., Zhang H., 2013

Table 29: Overview of studies on laundry detergents

Source	Saouter et al. 2001	Saouter et al. 2002	Van Hoof et al. 2003	Eberle et al. 2007	Henkel AG & CO, 2008	A.I.S.E., 2010	EPA Victoria and City West Water, 2010	The Sustainability Consortium, 2011	Nielsen et al. 2013
Title	The effect of compact formulations on the environmental profile of northern European granular laundry detergents. Part I: environmental risk assessment	The effect of compact formulations on the environmental profile of northern European granular laundry detergents. Part II: life cycle assessment	Comparative Life-Cycle Assessment of Laundry Detergent Formulations in the UK	LCA study and environmental benefits for low temperature disinfection process in commercial laundry	Case study Persil megapearls	Charter for Sustainable Cleaning – ASPs for Liquid Laundry Detergents Substantiation Dossier	The life cycle assessment of clothes washing options for city west water's residential customers	Product Category LCA (PCLCA) laundry detergent: sustainability measurement and reporting system pilot project	Compact detergents in China – a step towards more sustainable laundry a Life Cycle Assessment of four typical Chinese detergents
Subject of the study and goal	Regular (1988) and compact granular (1992, 1998) laundry detergents were compared on the basis of two distinct, complementary approaches: Environmental Risk Assessment and Life-Cycle Assessment.	Regular (1988) and compact granular (1992, 1998) laundry detergents were compared on the basis of two distinct, complementary approaches: Environmental Risk Assessment and Life-Cycle Assessment.	The environmental profiles of five different laundry detergents on the UK market in 2001 are analysed using LCA. Products analysed are: regular powder (RP), compact powder (CP), powder tablet (PT), compact liquid (CL) and liquid unit-dose system (LT).	This study aims to compare the energy requirements and potential environmental impacts associated with three different commercial laundry processes for washing microbiologically contaminated hospital and care home laundry.	Powder laundry detergent. Gain further knowledge and deeper insight on the carbon footprint of our detergents. Furthermore, the objective was to create transparency of the greenhouse gas (GHG) emissions along the value chain and to find potential leverages for process optimizations and product improvement.	Liquid laundry detergents. Get an understanding of the environmental impacts of the various stages of a liquid detergent's life cycle.	Top loader powder concentrate. Quantify the level of water consumption, other environmental impacts, and the environmental benefits of changes in key variables within the life cycle of clothes washing and drying; understand the dependent relationships between each of the key variables; understand the optimum time within the life of a washing machine at which to replace it; and prioritize strategies and actions for communicating the preferred approaches to clothes washing and drying.	Powder and liquid laundry detergents: worst-case market-typical product. Identify hotspots and characterize the uncertainty inherent in the life cycle assessment.	To study the environmental impacts of two typical compaction cases where two Chinese detergents – one powder and one liquid – are replaced with a compacted version.
Study type	Risk assessment	LCA	LCA	LCA	Carbon footprint + LCA	LCA	LCA	LCA	LCA

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Source	Saouter et al. 2001	Saouter et al. 2002	Van Hoof et al. 2003	Eberle et al. 2007	Henkel AG & CO, 2008	A.I.S.E., 2010	EPA Victoria and City West Water, 2010	The Sustainability Consortium, 2011	Nielsen et al. 2013
Functional Unit	Not applicable. To make a fair comparison, we assumed that each product accounted for 100 % of the market.	1 kg of finished product	One wash	1 kg washed hygiene laundry	One wash load (results are expressed for loads of 2.5 kg, 3.9 kg (i.e. average load), and 5.0 kg of clothes)	One wash cycle: standard washing machine loads are 4,5 kg dry fabric for heavy-duty detergents and 2,5 kg dry fabric for low-duty detergents	1 kg of dry clothes	Washing and drying one load of regularly soiled laundry	One wash in an average Chinese washing machine (~ 2.5 kilograms of clothes)
System boundaries	Aquatic compartment	Cradle to grave	Cradle to grave	Based on available data, the system boundaries include detergent manufacturing, the professional wash process, waste water treatment, but excluding the laundry finishing process.	Cradle to grave	Cradle to grave	Cradle to grave	Cradle to grave	Cradle to grave
Time related coverage	1988-1998	1988-1998	Most detergent ingredient data originate from the period 1990 –1995	2000-2004, For some processes data were older, i.e. 1995-1996	Not specified	Data collection for relevant LCA parameters in 2008 and 2009	Data collection between August 2009 and February 2010	Reference year 2010	Data from EcoInvent (2010)
Reliability (data quality, external critical review?)	Not specified	Peer-reviewed by the Ecobilan PwC group, in accordance with ISO	LCI database has been reviewed by PwC	This study is based on a screening Life Cycle Assessment (LCA) prepared in 2002 by Öko-Institut (Germany), which was carried out following the requirements of the ISO 14040 series standards.	Carbon footprint calculations based on PAS 2050. ISO 14040 and 14044 were considered as the basic methodological framework. Some methodological conditions had to be adapted, as they are loosely formulated.	No information on data quality of (existing) LCA. The ASPs and the substantiation dossier were subject to consultation with Charter member companies and other interested parties (industry/ external stakeholders)	ISO 14040 and ISO 14044 Cross-check of data in SimaPro, uncertainty analysis of raw data, LCA experts (UNSW) peer reviewed both the LCA process and the Final Technical Report	ISO 14044:2006. Limitations and assumptions are transparently reported.	Peer reviewed in accordance with ISO 14040

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Source	Saouter et al. 2001	Saouter et al. 2002	Van Hoof et al. 2003	Eberle et al. 2007	Henkel AG & CO, 2008	A.I.S.E., 2010	EPA Victoria and City West Water, 2010	The Sustainability Consortium, 2011	Nielsen et al. 2013
Impact assessment	Risk assessment for the aquatic compartment	1. Acidification, 2. Aquatic toxicity, 3. Eutrophication, 4. Greenhouse gases, 5. Human toxicity, 6. Ozone layer depleting substances, 7. Smog formation	1. Acidification, 2. Eutrophication, 3. Climate change, 4. Ozone depletion, 5. Photochemical ozone creation, 6. Aquatic toxicity, 7. Human toxicity	1. Energy resource consumption, 2. Water resource consumption, 3. Climate change, 4. Eutrophication, 5. Acidification potential, 6. Aquatic eco-toxicity potential, 7. Photochemical oxidant formation 8. Ozone depletion potential	1. Global warming, 2. Eutrophication, 3. Human toxicity, 4. Summer smog, 5. Biological oxygen demand, 6. Resource depletion	1. Primary energy, 2. Water consumption, 3. Total solid waste	1. Water use, 2. Energy use, 3. Global warming, 4. eutrophication, 5. Fossil fuels depletion, 6. Minerals depletion, 7. Land use	1. Global warming potential, 2. Water use, 3. Fossil depletion	1. Global warming; 2. Acute aquatic toxicity; 3. Chronic aquatic toxicity; 4. Acidification; 5. Nutrient enrichment; 6. Energy consumption; 7. Agricultural land use

Table 30: Reasons for excluding available studies

Study	Reason for disregarding
Saouter et al. (2001)[136,]	Outdated
Saouter et al. (2002) [137]	Outdated
Van Hoof et al. (2003)[138]	Outdated
Eberle et al. (2007)[139]	Outdated
Henkel AG & CO (2008)[140]	No specification of the time related coverage
A.I.S.E. (2010)[141]	Impact assessment model unknown; few impact categories considered

[136] *The effects of compact formulations on the environmental profile of North European granular laundry detergents. Part I: Risk Assessment*, Saouter E., Van Hoof G., Pittinger C.A., Feijtel T.C.J., International Journal of Life Cycle Assessment, 2001

[137] *The effects of compact formulations on the environmental profile of North European granular laundry detergents. Part II: Life Cycle Assessment*, Saouter E., Van Hoof G., Feijtel T.C.J., and Owens J.W., International Journal of Life Cycle Assessment, 2002

[138] *Comparative Life-Cycle Assessment of Laundry Detergent Formulations in the UK Part I: Environmental fingerprint of five detergent formulations in 2001*, Van Hoof G., Schowanek D., Feijtel T.C.J., Tenside Surf. Det., 2003

[139] *LCA study and environmental benefits for low temperature disinfection process in commercial laundry*, Eberle U., Dewaele J., Schowanel D., International Journal of Life Cycle Assessment, 2007

[140] Case study Persil megaperls by Henkel AG & CO. KGAA. Case Study undertaken within the PCF Pilot Project Germany. 2008

[141] A.I.S.E *Charter for Sustainable Cleaning – ASPs for Liquid Laundry Detergents Substantiation Dossier*, A.I.S.E, 2010

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4.2.3 *Detailed revision of selected reports*

Table 31 presents an overview of the functional unit, system boundaries, data sources, cut-off criteria, allocation rules applied, and geographical scale of the selected studies. Table 32 presents an overview of the comprehensiveness based on the PEF methodology.

Table 31: Cut-off criteria, allocation and geographical scale of the selected studies

	EPA Victoria and City West Water, 2010	**The Sustainability Consortium, 2011**	**Nielsen *et al.* 2013**
Functional unit	Washing 1 kg of dry clothes	Washing and drying one load of regularly soiled laundry	Washing one load in an average Chinese washing machine (~ 2.5 kg of clothes)
System boundaries	Cradle to grave	Cradle to grave	Cradle to grave
Data sources	Data collection from previous LCA reports, government databases, and data embedded in the SimaPro databases, a.o. from the Australian LCA Database 2009 and Ecoinvent 2.0 (covering predominantly Switzerland and Western-Europe).	Modified version of the Ecoinvent database version 2.2[142]	Members of the Chinese Cleaning Industry Association: use of energy and ingredients in detergent manufacture, packaging of detergent, transport of main ingredients to the detergent manufacturer and transport of detergents from the manufacturer to the supermarkets. Ecoinvent database version 2.2: production of detergent ingredients, energy supply, packaging materials and transport. Chinese Life Cycle Database: sensitivity data.
Cut-off criteria	Significance cut off value of 1 %.	Some small flows were omitted when no data was available. These were assumed to contribute less than 1 % at the scale of individual life cycle phases.	Preservatives and perfumes which make up to 0.5 % of the formulation have been excluded due to lack of reliable data and because they are used in insignificant amounts. All other cut-offs in the process tree are based on the cut-offs in Ecoinvent (2010).
Allocation	No allocation issues in waste treatment. The recycling of machines is assigned a credit for the avoided production.	For production, no chemical specific allocation is specifically needed. For consumer transport, mass allocation is applied. Volume allocation is applied for burdens occurring during distribution centre or retail store storage.	Not specified.
Geographical scale	Focus on Australia, but also generic data (see data sources).	The study is focused on the USA as geographical scenario. Due to the lack of production data specific to the USA, the chemical production data is primarily of European scope.	China

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[142] *Implementation of Life Cycle Impact Assessment Methods*. Hischier, R., Weidema, B., Althaus, H.J., Bauer, C., Doka, G., Dones, R., Frischknecht, R., Hellweg, S., Humbert, S., Jungbluth, N., Köllner, T., Loerincik, Y., Margni, M., and Nemecek, T. (2010). Final report ecoinvent v2.2 No. 3. Swiss Centre for Life Cycle Inventories, Dübendorf, CH. Retrieved 01.20.2011, from http://www.ecoinvent.org/documentation/reports/

Table 32: Evaluation of comprehensiveness based on the PEF methodology

EF impact category	EF impact assessment method	EF impact category indicators	Source	EPA Victoria and City West Water, 2010	The Sustainability Consortium, 2011	Nielsen et al. 2013
Climate Change	Bern model - Global Warming Potentials (GWP) over a 100 year time horizon	kg CO_2 equivalent	Inter-governmental Panel on Climate Change, 2007	+	+	+[1]
Ozone Depletion	EDIP model based on the ODPs of the World Meteorological Organization (WMO)	kg CFC-11 equivalent	WMO, 1999	0	0	0
Ecotoxicity for aquatic fresh water	USEtox model	CTUe (Comparative Toxic Unit for ecosystems)	Rosenbaum et al., 2008	0	0	- Acute aquatic toxicity CDV_{acute} (m^3) Chronic aquatic toxicity $CDV_{chronic}$ (m^3)
Human Toxicity - cancer effects	USEtox model	CTUe (Comparative Toxic Unit for humans)	Rosenbaum et al., 2008	0	0	0
Human Toxicity – non-cancer effects	USEtox model	CTUe (Comparative Toxic Unit for humans)	Rosenbaum et al., 2008	0	0	0
Particulate Matter/ Respiratory Inorganics	RiskPoll model	kg PM2.5 equivalent	Humbert, 2009	0	0	0
Ionising Radiation – human health effects	Human Health effect model	kg ^{235}U equivalent (to air)	Dreicer et al., 1995	0	0	0
Photo-chemical Ozone Formation	LOTOS-EUROS model	kg NMVOC equivalent	Van Zelm et al., 2008 as applied in ReCiPe	0	0	0
Acidification	Accumulated Exceedance model	mol H+ eq	Seppälä et al., 2006; Posch et al., 2008	0	0	-[2] (mg SO_2 quivalent)
Eutrophic-ation – terrestrial	Accumulated Exceedance model	mol N eq	Seppälä et al.,2006; Posch et al., 2009	0	0	0
Eutrophic-ation – aquatic	EUTREND model	fresh water: kg P equivalent marine: kg N equivalent	Struijs et al., 2009 as implemented in ReCiPe	- (Heijungs 1992, kg of PO4 eq.)	0	-[2] (mg PO_4^{2}- equivalent)
Resource Depletion – water	Swiss Ecoscarcity model	m^3 water use related to local scarcity of water	Frischknecht et al., 2008	- (total volume of water extracted from natural resources (KL))	- (Ecoinvent datasets, water depletion (m^3) but no degradative use and depletion potential)	0

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EF impact category	EF impact assessment method	EF impact category indicators	Source	EPA Victoria and City West Water, 2010	The Sustainability Consortium, 2011	Nielsen et al. 2013
Resource Depletion – mineral fossil	CML2002 model	kg antimony (Sb) equivalent	van Oers et al., 2002	- (Eco-indicator 99 method, egalitarian version based on Chapman & Roberts (1983), MJ surplus energy required)	- (ReCiPe, kg oil eq. based on their heat content)	0
Land Trans-formation	Soil Organic Matter (SOM) model	Kg (deficit)	Milà i Canals et al., 2007	- (m^2 occupiable land used)	0	-[2] Agricultural land use (cm^2·a)
Energy consumption	Not applied	Decrease in energy available		- (energy use in MJ Low Heat Value (LHV))	0	-[2] (energy use in KJ Low Heat Value (LHV))
The number of environmental impact categories that are investigated within the studies				6	3	6
The number of impact categories that are the same as PEF but don't use the same methodology				5	2	5
The number of impact categories compliant with the PEF methodology, i.e. use the same methodology				1	1	1

+ = compliant with the requirements of the PEF methodology
- = not compliant with the requirements of the PEF methodology
0 = not taken into account
1. Although a 100 year time horizon is not explicitly mentioned, we assume that GWP100 is investigated
2. Characterisation model not explicitly mentioned

4.3 LCA review: results

4.3.1 *Results of the selected studies*

The studies reviewed in this section are cradle-to-grave studies and consider a range of different laundry detergents, including liquid and powder formats and in concentrated, tablets, unidose, etc. forms. The studies do not cover pre-treatment products, hand-wash detergents and 2-in-1 products. The functional unit in the selected studies is generally one wash cycle, although the assumed capacity of the standard washing machine loads vary from study to study. With regards to the definition of the reference flow, the dosage is mainly based on recommended information provided by the manufacturer.

4.3.1.1 Results from EPA Victoria and City West Water, 2010

EPA Victoria and City West (2010)[143] performed an LCA on clothes washing options for City West Water's residential customers. The study considered the following impacts: water use, energy use, global warming, eutrophication, fossil fuel depletion, mineral depletion and land use. The results showed that the use phase had the highest overall impacts and contributed to impacts on water use (92 %), energy use (60 %), global warming potential (73 %) and fossil fuel depletion (62 %). Ingredients sourcing had the highest impact on land use (87 %) because a number of ingredients are agriculturally-derived products. This life cycle stage also had an impact on mineral depletion (64 %) due to the extraction of chemical ingredients. The highest impact on eutrophication (94 %) came from the wastewater treatment and it was attributed to the phosphorus content of the detergent output from the washing machine.

[143] *LCA of Clothes Washing Options for City West Water's Residential Customers: Life Cycle Assessment – Final Technical Report*, EPA Victoria and City West Water, May 2010

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Wash temperature scenarios ranging from 20 °C to 90 °C were investigated. Eutrophication, water use, land use and mineral depletion were relatively independent of the wash temperature whereas other impacts showed around 1.5 % to 2.5 % increase per °C rise. It was shown that reducing wash temperature by around 10 °C from maximally 90 °C to minimally 20 °C could result in a decrease in global warming potential of up to 18 %, a decrease in energy use of up to 22 % and a decrease in fossil fuel depletion of 28 %.

4.3.1.2 Results from the study by the Sustainability Consortium, 2011

The Sustainability Consortium (2011)[144] study examined the environmental impacts of powder and liquid laundry detergents. The assessment was based on a market-typical worst-case scenario and included the following indicators: global warming potential, water use and fossil depletion. The use phase dominated the environmental impacts, followed by raw materials extraction and processing. Impacts in the use phase were driven by the energy needed to dry the laundry and to heat the water.

Production, packaging, distribution and retail, and end of life had lower overall impacts when compared to the use phase. Impacts from packaging were mainly driven by the use of high density polyethylene bottles, whereas impacts from distribution and retail were primarily due to transport. Within the end of life phase, most of the impacts were connected to the wastewater treatment.

4.3.1.3 Results from a study by Nielsen et al., 2013

Nielsen et al. (2013)[145] compared four Chinese laundry detergents: a standard powder detergent with a dosage of 50 grams and 16.5 % surfactant, a compact powder detergent with a dosage of 25 grams and 19.5 % surfactant, a standard liquid detergent with a dosage of 40 grams and 19 % surfactant, and a compact liquid detergent with a dosage of 20 grams and 30 % surfactant. Compacted detergents offered environmental benefits on all investigated impact categories: global warming potential, acidification, nutrient enrichment, energy use, land use, acute and chronic aquatic toxicity (see Table 33 for more details). Just one scenario showed that detergent compaction may lead to environmental disadvantages and that occurs if consumers do not reduce dosage and keep using the same amount of detergent per wash.[146] The findings of Nielsen et al. are in agreement with results from other geographical regions (including Europe).

Table 33: Percentage of reduction of environmental impacts due to the compaction of powder detergent

Impact category	Unit	Standard powder detergent	Compact powder detergent	Percentage of reduction of impacts
Global warming	g CO_2 eq.	90	58	36
Acidification	mg SO_2 eq.	0.34	0.22	35
Nutrient enrichment	mg PO_4^{2-} eq.	0.12	0.091	24
Energy consumption	kJ	1,500	950	37
Agricultural land use	cm^2-a	90	61	32
Acute aquatic toxicity	CDV_{acute} (m^3)	190	180	5
Chronic aquatic toxicity	$CDV_{chronic}$ (m^3)	66	59	11

Source: Adapted from Nielsen 2013

4.3.2 *Summary of findings*

Although the scopes and goals of the reviewed LCA studies vary, most of them draw similar conclusions that are summarised in this section. From a life cycle perspective the major environmental impacts associated with laundry detergents are due to:

[144] *Product Category Life Cycle Assessment (PCLCA) Laundry Detergent: Sustainability Measurement and Reporting System pilot project*, The Sustainability Consortium, 2011

[145] *Compact detergents in China – a step towards more sustainable laundry a Life Cycle Assessment of four typical Chinese detergents*, Nielsen A.M., Li H., Zhang H., 2013

[146] *Findings from a pan-European consumer survey on sustainability and washing habits*, A.I.S.E., 2014, from http://www.aise.eu/documents/document/20140211164810-final_aise_habits_survey_2014update.pdf

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- The energy used for heating the washing water during the use stage, which significantly contributes to the energy use impact category. This energy use has an impact in other categories such as fossil fuel depletion and global warming potential.
- The extraction and processing of raw materials that cause impacts on categories such as mineral depletion, land use and energy use.
- The emissions to the environment (water) after use. The discharge of wastewater has impacts on eutrophication while the impacts due to the end-of-life of packaging materials depend on their possible scenarios.

The reviewed studies pointed out several improvement opportunities that can be summarised as follows:

- Detergent compaction could bring environmental benefits due to the savings in resources which are reflected in lower impacts on categories such as global warming potential, energy use or chronic aquatic toxicity.
- Reduction in wash temperature brings environmental advantages due to the lower energy use and therefore lower impacts on categories such as global warming potential, energy use or fossil fuel depletion.
- Detergent formulation can affect environmental categories such as eutrophication and acidification, agriculture land use and acute and chronic aquatic toxicity, among others.

4.4 Opportunities for improvement

The opportunities for potential which have been identified from the literature studies are reviewed in more detail in this section. This review is based on all the works listed in Table 29, whether selected for further study in Section 4.1.3 or not, and aims to provide an overview of the potential improvements that can be addressed during the revision of the current EU Ecolabel criteria for laundry detergents.

The section focuses on the compaction of detergents and the reduction of the wash temperature, including an in-depth analysis of the feasibility and effects of these measures.

4.4.1 ***Compaction of detergents***

There may be significant environmental benefits due to the compaction of detergents such as a reduction in the product dosage and packaging, savings in energy consumption and reduction of waste production. Additionally, savings in transport can be achieved as more product (doses) can be carried per truck.

4.4.1.1 **Van Hoof et al., 2003 study**

Van Hoof *et al.*[147] compared five different laundry detergent formulations available in the UK market: regular powder, compact powder, powder tablet, compact liquid, and liquid unit-dose system. The results showed that compact detergents (both powder and liquid) were environmentally preferable to regular products mainly due to lower use of chemicals per wash. This fact resulted in benefits on aquatic toxicity, eutrophication, ozone depletion and photo-chemical smog. For all product formulations, the use stage is dominant and contributes to above 70 % for most indicators.[148] The results of this study were confirmed by Nielsen et al.[149]

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[147] *Comparative Life-Cycle Assessment of Laundry Detergent Formulations in the UK Part I: Environmental fingerprint of five detergent formulations in 2001*, Van Hoof G., Schowanek D., Feijtel T.C.J., Tenside Surf. Det., 2003

[148] *The effects of compact formulations on the environmental profile of North European granular laundry detergents*, Saouter E., Van Hoof G., Pittinger C.A., Feijtel T.C.J., International Journal of Life Cycle Assessment, 2001

[149] *Compact detergents in China – a step towards more sustainable laundry a Life Cycle Assessment of four typical Chinese detergents*, Nielsen A.M., Li H., Zhang H., 2013

4.4.2 *Wash temperature*

Existing studies showed that the largest environmental impact of the laundry process occurs during the use phase. The use phase consumed 60-80 % of the overall energy used mainly to heat up the wash water. [150] Reducing the wash temperature could thus lead to significant environmental gains.

4.4.2.1 **A.I.S.E. study**

A.I.S.E. commissioned a pan-European survey on consumers' washing habits in 2011.151 European households wash on average 3.2 times per week at average temperature of 41 °C.[152] The most popular program is the 40 °C cycle and approximately 22 % of loads are washed at or above 60 °C. Washing at or below 30 °C is on the rise, with 32 % of loads washed at 30 °C or lower, compared to 28 % in 2008.

A.I.S.E. calculated the effect of varying wash temperatures by using sensitivity analyses.146 Environmental impacts are considerably reduced when wash temperature is reduced to 30 °C in comparison to 40 °C and 60 °C scenarios. The impact categories most affected are climate change, particulate matter formation and fossil depletion. Figure 21 presents the results of this wash temperature sensitivity study.

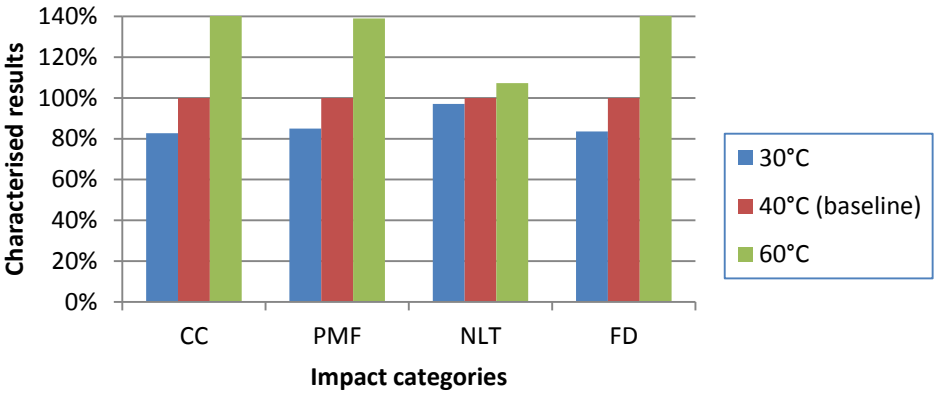

Figure 21: Results for wash temperature sensitivity Source: A.I.S.E. 2013

Impact categories stand for CC: climate change, PMF: particulate matter formation, NLT natural land transformation, FD fossil depletion

The energy savings potential from low temperature washing was also investigated by Kruschwitz et al.[153] A 3 °C reduction of the wash temperature across the EU-28 countries can reduce the average laundry energy consumption by 11.3 % and the 18 % reduction could be achieved if it was reduced by 5 °C.

A generic LCA on liquid laundry detergents and solid laundry detergents was carried out by A.I.S.E.[154,155] Normalization against the average impact of a European citizen (2000) was used to identify the most relevant indicators. The most relevant impact categories identified for solid laundry detergents in Europe are fossil depletion, climate change, natural land transformation, and particulate matter formation.

Both studies showed that the use phase is the life cycle stage with the largest contribution to the overall environmental impact due to the energy needed to heat the water during the wash cycle.[151,156] It dominates impact categories such as fossil depletion, climate change and particulate matter formation. Figure 22 shows the results for solid laundry detergents. The impact caused ranges from 46 % to 95 % in most impact

[150] *The case for the "A.I.S.E. Low Temperature Washing" Initiative*, A.I.S.E., June 2013
[151] *Findings from a pan-European consumer survey on sustainability and washing habits*, A.I.S.E., 2014, from http://www.aise.eu/documents/document/20140211164810-final_aise_habits_survey_2014update.pdf
[152] Laundry washing habits diverse profiles across Europe, Insites report for A.I.S.E. 2011, available via www.iprefer30.eu
[153] *How effective are alternative ways of laundry washing*, Kruschwitz A., Augsburg, A., Stamminger, R., Tenside Surfactant Det., 50 p263-269, 2013
[154] A.I.S.E LCA: *Screening for Cleaning Products in Europe – Solid laundry detergents*, A.I.S.E., 2013
[155] A.I.S.E *Charter for Sustainable Cleaning – ASPs for Liquid Laundry Detergents Substantiation Dossier*, A.I.S.E, 2010
[156] Case study Persil megaperls by Henkel AG & CO. KGAA. Case Study undertaken within the PCF Pilot Project Germany. 2008

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categories, except for the impacts on agricultural land occupation, natural land transformation, marine eutrophication, and metal depletion – which are driven by the ingredients sourcing.

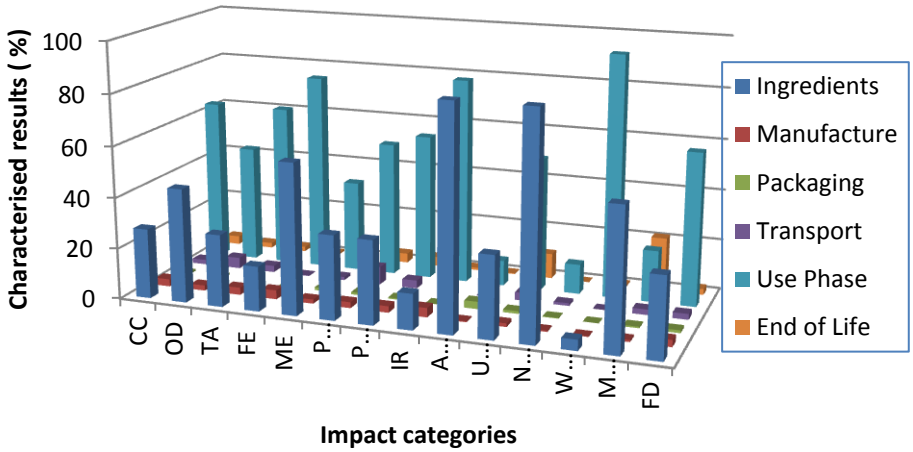

Figure 22: Impact contribution of different life cycle stages to the environmental impact

Impact categories stand for CC: Climate change, OD: Ozone depletion, TA: Terrestrial acidification, FE: Freshwater eutrophication, ME: Marine eutrophication, HTox: Human toxicity, POF: Photochemical oxidant formation, PMF: Particulate matter formation, TTox: Terrestrial ecotoxicity, FTox: Freshwater ecotoxicity, MTox: Marine ecotoxicity, IR: Ionising radiation, ALO: Agricultural land occupation, ULO: Urban land occupation, NLT: Natural land transformation, WD: Water depletion, MD: Metal depletion, FD: Fossil depletion. Source: Adapted from A.I.S.E., Screening LCAs for Cleaning Products in Europe – Solid Laundry Detergents, 2013

4.4.2.2 Procter & Gamble

Modern detergents have been designed to wash efficiently even at low temperatures by including enzymes, catalysts and other activator ingredients into their formulations. P&G compared Ariel '*Actif à froid*' (cool clean), a formula that works at lower temperatures (33 °C), to the regular Ariel 2001 and 1998 formulas used at regular temperatures (45 °C).[157] The results indicated that using Ariel *Actif à Froid* leads to 27 % savings in primary energy consumption and other indicators related to energy use, without incurring significant trade-offs with other categories such as the aquatic toxicity potential.[153] The study, however, did not compare the washing performance of the two products.

4.4.2.3 Henkel, 2008

Henkel[158] carried out a carbon footprint study of a powder laundry detergent. The results confirmed the findings of other LCA studies and pointed out the use phase as the most significant one due to total greenhouse gas emissions. Within the use phase, the environmental impacts were shown to depend on the time and temperature of the washing programme as well as the energy efficiency of the washing machine. Production and transport of raw materials was the second most significant life cycle phase, even though emissions were significantly lower. The study also looked at other environmental indicators such as biochemical oxygen demand (BOD), eutrophication, human toxicity, summer smog and resource depletion. The use phase had the highest contribution to human toxicity, summer smog and resource depletion, whereas the wastewater treatment was the dominant phase for eutrophication and BOD, i.e. the amount of dissolved oxygen needed by aerobic biological organisms in water to break down the organic material present. In general, the authors of the study concluded that consumer information and education is crucial to increase machine loading. After all, efficient machine loading will lead to less frequent washing and thereby a reduction of the energy and water consumption in the use phase – which is dominant with regard to the environmental impact. On the other hand, manufacturers should improve detergent formulations in order to produce detergents that can efficiently clean at lower wash temperatures.

[157] *Comparative Life Cycle Assessment of Ariel "Actif à froid" (2006), a laundry detergent that allows to wash at colder wash temperatures, with previous Ariel laundry detergents*, Procter & Gamble, 2006

[158] *Case Study Persil megapearls*, undertaken within the PCF pilot project Germany, Henkel AG & CO, 2008

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4.5 Overview of industrial laundry, auxiliaries and alternatives for laundry washing

4.5.1 *Industrial laundry*

The industrial and institutional laundering sector includes industrial wash goods, hospital wash goods, kitchen and food factory wash goods and goods from the lodging industry. Professional laundries do not just buy a product or a range of products but rather they purchase a full service solution which includes installations, a control system and dosing equipment.[159]

The contribution of different life cycle stages to the environmental impact of industrial laundering is similar to that of domestic laundering. The use phase is the most energy intensive phase followed by the production and extraction of raw materials. The use phase is also responsible for the largest contribution to solid waste and air emissions. The main impact on water is associated with the BOD. The main difference between domestic and industrial laundry is that industrial washing uses approximately half the amount of water and detergent per wash than domestic washing.[160]

The European Textile Services Association (ETSA) study[161] showed that industrial laundering of work wear is more environmentally friendly than domestic laundering. The study was based on washing 1 kg of normally soiled blue work wear and showed that the industrial process used 52 % less primary energy, 73 % less water and 85 % less detergent leading to lower CO_2 and NO_X emissions. The main conclusion of this study was that industrial laundering has lower environmental impacts than domestic laundering because of the optimisation in the washing process. Most professional laundries use programmable washing machines meaning that they can tailor the programs with regard to the number and type of cycles, time, temperature, water levels and dosing of detergents and auxiliary chemicals. Commercial laundries also soften their water to minimise detergent use resulting in laundry systems that use 60-70 % less builders. Moreover, professional laundries use less energy, water and detergent per kg of clothing because of detergent delivery and dispensing systems, monitoring and controlling systems and recycling systems for water and energy. Moreover, the industrial laundry market mostly uses concentrated detergents and liquids.

Nevertheless, the industrial laundry sector varies widely. According to ETSA[157] some laundry systems can use three times more energy and 1.5 times more water than others for the same process. Differences in the washing equipment and process control and differences in on-site energy generation are some reasons for these variations.

4.5.2 *Auxiliaries*

Fabric conditioners are added at the end of the washing process to soften clothes by neutralising the very small amounts of residual detergents left in clothes and preventing static electricity. Fabric conditioners also often include small amounts of fragrance and anti-wrinkle agents and improve the release of dirt. A generic LCA on household fabric conditioners was carried out by A.I.S.E. in 2010.[162] The environmental categories evaluated were nitrification potential, photochemical ozone creation potential, acidification potential and global warming potential. Environmental impacts were dominated by the ingredients and water treatment phase as the use phase was not taken into account in this study (Figure 23).

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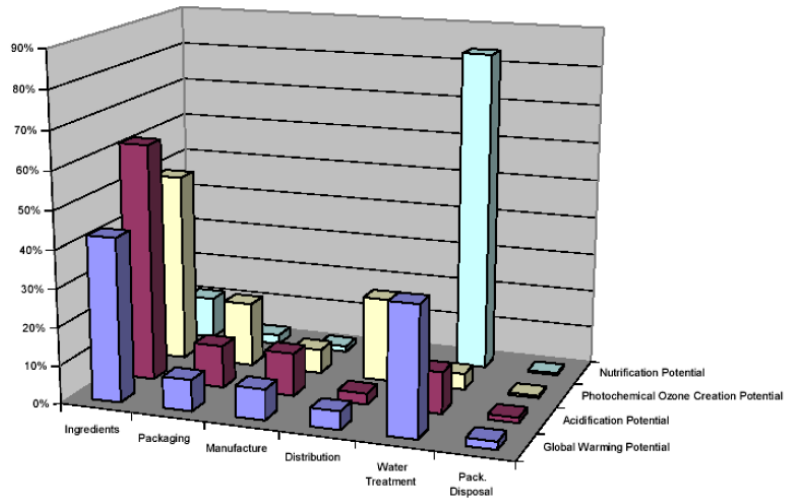
[159] A.I.S.E *Charter for Sustainable Cleaning – ASPs for Liquid Laundry Detergents Substantiation Dossier*, A.I.S.E, 2010
[160] *Industrial & Institutional Sector – Environmental dossier on professional laundry*, A.I.S.E., 2000
[161] *Industrial Laundering: Good for the Environment, Life Cycle Assessment Study – Summary, European Textile Services Association* (ETSA), March 2000
[162] A.I.S.E Charter *Substantiation dossier on "Fabric Conditioners (household)"*, A.I.S.E, 2010.



Source: A.I.S.E 2010

Figure 23: Contribution of life cycle stages to environmental impact for household fabric conditioners

The study concluded that the most important factor to reduce the overall environmental impact is the reduction in resources used to manufacture the product. Concentrating fabric conditioners reduces dosage and packaging and delivers savings in energy consumption and waste production. Similarly, impacts from transport are reduced because more doses can be carried per batch.

The environmental impact of washing with or without fabric softeners was investigated by EPA Victoria and City West Water.[163] Across all seven impact categories the use of a fabric softener (compared with its absence) increased the impacts of land use and cumulative energy demand. Land use impacts were primarily due to the assumption of a (renewable) palm oil derived fabric softener.

There are no publicly available studies which evaluate the environmental impact differences between different fabric conditioners with different properties. However, based on the review of existing studies on laundry detergents it is expected that compact fabric softeners or fabric conditioners which are effective at low temperatures should have lower environmental impacts. Such fabric conditioners are already on the market.

4.5.3 *Laundry washing alternatives*

A study by Kruschwitz et al.[149] evaluated the effectiveness of alternative ways of laundry washing using soap nuts, soapwort and two kinds of wash balls and compared it with the use of regular detergent and washing with pure water. The tests were carried out in a 30 °C and 60 °C cotton program. The results showed that none of the investigated alternative cleaning methods delivers any washing effect better than the result achieved with pure water. This confirmed the findings of Laital et al.[164] who investigated washing pellets and laundry magnets in addition to the abovementioned alternatives.

These studies on laundry washing alternatives also came up with another important conclusion: they showed that water alone has a substantial cleaning effect. Tests showed that when clothes are only slightly soiled, a wash temperature of 30 °C with a reduced amount of detergent (e.g. 50 %) may already provide sufficient cleaning results.[149]

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[163] *LCA of Clothes Washing Options for City West Water's Residential Customers: Life Cycle Assessment – Final Technical Report*, EPA Victoria and City West Water, May 2010

[164] *Potential for environmental improvements in laundering*, Laital K., Boks C., Klepp I.G., International Journal of Consumer Studies, 35, 254-264, 2011

4.6 Summary of the key environmental impacts of laundry detergents

Figure 24 shows a schematic representation of the life cycle stages of laundry detergents. A cradle to grave study of a laundry detergent takes into account the extraction and processing of the materials, production of the detergent, packaging, transport, use and end of life. Table 34 describes the impacts of each life cycle stage, based on the reviewed literature.

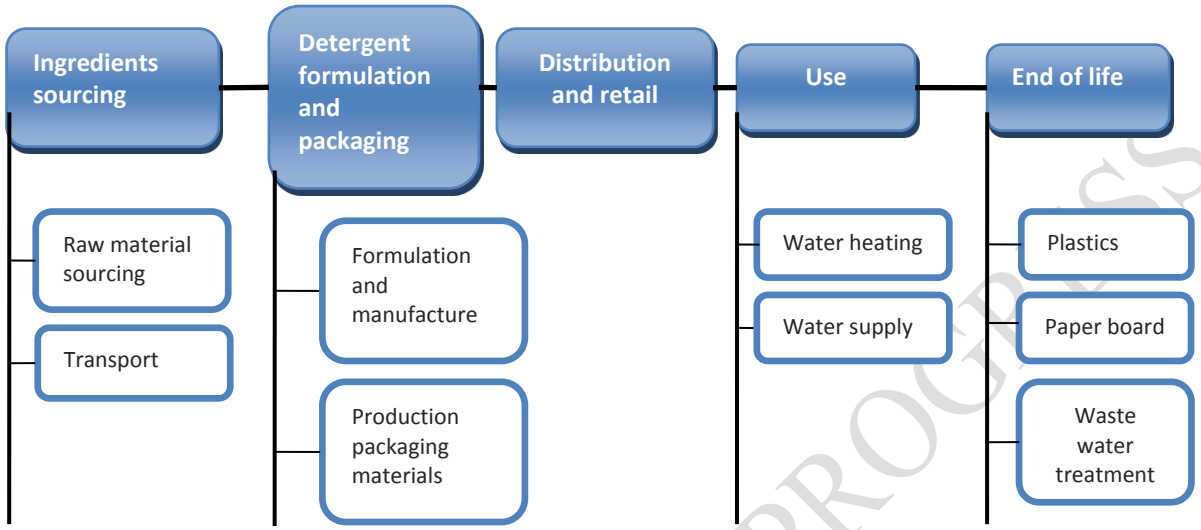

Figure 24: Schematic representation of laundry detergent life cycle

Table 34: Impacts per life cycle stage

LC stage	Impacts
Ingredients sourcing	The raw materials sourcing phase has the second largest environmental impact after the use phase. If we exclude the use phase, ingredient sourcing contributes to 75 % of the global warming potential. In the reviewed studies, the ingredient composition of the detergent varies based on the product format and on manufacturer formulation. Commonly used ingredients are surfactants, water and other chemicals. Results show that only a few ingredients - the surfactants and builders - are responsible for most of the impact. Concentrated detergents perform better across all impact categories than the 'generic' variant, and the effect of over-dosing even by 1% leads to increased impacts across all categories.
Detergent formulation and packaging	Detergent formulation includes the use of different energy carriers, water and the wastewater treatment in the production of the detergent. Technologies used in this stage are rarely described since formulation technologies seem to be common to all manufacturers. Packaging generally consists of primary and secondary packaging, and sometimes tertiary packaging. Overall, impacts from this stage are very low, at 1-3 %.
Distribution and retail	Assumptions on transport differ between studies. Most studies include transport of ingredients/packaging to the manufacturing site. For distribution to retail, studies include either one distribution route or a selection of routes. Transport to retail is excluded by most studies and storage is rarely considered. Overall, the impact from transport is around 1-2 % of total environmental impact, and mostly due to transport to retail.
Use	All studies show that the use phase has the highest environmental impact. Among the reviewed studies, the considered use scenario is either based on average use or a range of different use scenarios. Impacts in this phase are mainly related with the heating of the water in the washing machine. If cloth drying is included in the assessment, the impact increases significantly. Energy use impacts are closely linked to machine size. Similarly the energy source used to heat the water also influences the results. Studies also indicate that the lowest impacts are associated with cold washing and that an increase by 10 °C can lead to a disproportional

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	increase in impacts. Water consumption impacts for front loading are lower than top loading machines.[165] With regard to loading, impacts increase exponentially as washing machine loads decrease.
End of life	Within this phase, most of the impact is related to the treatment of wastewater produced during laundering. Among the reviewed studies, two main approaches are considered for the end of life and wastewater treatment: a) an average scenario for the disposal of wastewater with a municipal wastewater treatment and b) specific scenarios with a specific focus on toxicity to aquatic organisms and biodegradability of ingredients.

4.7 Non-LCA impacts

4.7.1 *Toxicity to aquatic organisms*

The preferred approach for safety and regulatory management of chemicals (e.g. Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)) is a chemical-specific environmental risk assessment, based on specific exposure data and tonnages. The toxicity data underlying the assessment are often acute toxicity data from laboratory experiments because of the lack of chronic toxicity data.

However, scientists agree that the critical dilution volume (CDV) chronic gives a more accurate picture of the environmental effects of a given substance.[166] CDV was originally developed as an evaluation criterion for detergent ingredients in the context of the European Eco-label scheme[167,168]. It expresses the substance-specific amount of water needed for dilution to a safe level, and is therefore expressed in L per functional unit (FU). The Detergent Ingredient Database (DID) List, a public source of agreed ecological data for detergent production ingredients, can be used to perform CDV calculations as well as laboratory and *in silica* test results. The outcomes can be considered as a product-based relative assessments, on the basis of a functional unit – dose per wash[169,170].

CDV calculations are based on the dosage, degradation and toxicity of a substance using the formula below:

$$CDV = \sum CDV_i = \sum (((dosage_i \cdot DF_i) / TF_i) \cdot 1000)$$

Where $dosage_i$ is the recommended dosage expressed in g per wash, DF_i is the degradation factor and TF_i is the toxicity factor.

4.7.1.1 **Toxicity**

Per chemical, a chronic toxicity 'base set' of three species should ideally be collected (fish, crustaceans and algae). The lowest toxicity value of these three values is then used for CDV calculations. The toxicity test results to be used can be expressed as the effect concentration at different percentages of effect, e.g. EC10 or EC50, which is the calculated effect concentration at 10 % or 50 % effect, or LC50, which is the concentration at 50% lethality. Measured effects may be on for example growth rate, immobility or mortality, depending on the test organism.

[165] In general, front loading machines, which are more high-tech and more efficient in cleaning clothes with less water, are much more prevalent in Europe than top loading machines, which are more popular in the US and Japan.
[166] Ovesen R.K., M.B. Eskeland, and L. Axelsson. 2013. *Revision of the Detergent Ingredients Database List. Final report.*
[167] EU Eco-label 1995. *Commission decision of 25 July 1995 establishing the ecological criteria for the award of the community ecolabel to laundry detergents.* Official J European Communities L217:0014–0030, 95/365/EC
[168] Van Hoof G., D. Schowanel, H. Franceschini, I. Muñoz, 2011. *Ecotoxicity impact assessment of laundry products: a comparison of USEtox and critical dilution volume approaches.* Int J Life Cycle Assess, 16:803–818
[169] DID list (2007) Detergent Ingredient Database (DID list) – 2007 version.
http://ec.europa.eu/environment/ecolabel/ecolabelled_products/categories/did_list_en.htm (accessed 17/12/2010)
[170] DID list Part B (2004) Detergent ingredients database version 30 June 2004.
http://ec.europa.eu/environment/ecolabel/ecolabelled_ products/categories/did_list_en.htm. Accessed 17 Dec 2010

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As there are substances with very small amounts of chronic toxicity data or which only have been tested for acute toxicity, there is a need to distinguish between these and other substances where the toxicity factors are based on more solid grounds. TF is calculated as the lowest value of toxicity test results complemented by a safety factor (SF) that is based on the availability of aquatic toxicity data and ranges from 10 to 10000.

4.7.1.2 Degradation

Degradation of substances in CDV calculations is taken into account through the Degradation Factor which considers the ready biodegradability of a substance[171]. It can take four discreet values ranging from 0.05, if an ingredient is degraded in under 5 days, to 1, if an ingredient is persistent in the environment. An exceptional 5th value, 0.01, was introduced in the 2014 version of the DID list that is only assigned to very toxic substances that degrade extremely rapidly.

DF only considers biodegradation and not adsorption. This choice was made in the scope of the EU Ecolabel as adsorpted substances end up in sludge and the presence of harmful substances in sludge can cause problems when the sludge is used as a fertilizer.

4.7.1.3 DID list

The DID-list is a public tool containing toxicity and degradation information on over 200 commonly used ingredients in detergents and cosmetics. The DID list is revised on regular basis to update existing entries and introduce new ones, based on input from industry, competent bodies and ecotoxicology specialists.[162] The list is meant to facilitate the work of companies applying for EU Ecolabel and that of competent bodies reviewing applications. Besides listing input data for CDV calculations, it also provides companies, especially SMEs, with an easy way of comparing and ranking ingredients, making it possible for them to spot a possible substitution that would result in a less impacting product.

Table 35 shows an example of the information available for common detergent ingredients in the DID-list.

Table 35: Toxicity values and degradation data for example detergent ingredients in the DID-list 172

DID number	Ingredient name	Acute toxicity			Chronic toxicity			Degradation		
		LC50 / EC50	SF (acute)	TF (acute)	NOEC	SF (chronic)	TF (chronic)	DF	Aerobic	Anaerobic
DID category: Cationic surfactants										
2301	C8-16 alkyltrimethyl or benzyldimethyl quaternary ammonium salts	0,08	1000	0,00008	0,0068	10	0,00068	0,05	R	O
DID category: Other ingredient										
	Surfactants									
2505	Zeolite (Insoluble Inorganic)	100	1000	0,1	100	50	2	1	NA	NA
	Builders									
2507	Polycarboxylates homopolymer of acrylic acid	40	1000	0,04	12	10	1,2	1	P	N
2508	Polycarboxylates copolymer of acrylic/maleic acid	100	1000	0,1	5,8	10	0,58	1	P	N
	Bleachers									
2525	Perborates (as Boron)	14	1000	0,014			0,014	1	NA	NA

[171] OECD Ready Biodegradability test - http://www.oecd-ilibrary.org/environment/test-no-301-ready-biodegradability_9789264070349-en

[172] Detergents Ingredients Database (DID-list) Part A. List of ingredients 2014

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2526	Percarbonate	4,9	1000	0,0049	0,7	50	0,014	0,01	NA	NA
	Auxiliaries									
2533	Carboxymethylcellulose (CMC)	250	5000	0,05			0,05	0,5	I	N

R = Readily biodegradable according to OECD guidelines, I = Inherently biodegradable according to OECD guidelines, P = Persistent. The ingredient has failed the test for inherent biodegradability, 0 = The ingredient has not been tested, NA = Not applicable, N = Not biodegradable under anaerobic conditions

4.7.2 *Risk assessment of chemical release*

The emissions that occur during the life cycle of washing detergents may have negative health effects on humans and ecosystems. Air emissions occur primarily during the ingredients sourcing and use, with the use phase contributing the most due to the energy required for heating the water and the functioning of laundry machines.

Energy source plays a role in the environmental impacts, and the lower the fossil fuel share in the national mix the lower the impacts of the overall life cycle.

4.7.3 *Human health*

Due to occupational exposure or frequent consumer use, the exposure levels to emitted chemicals can be higher for some groups of people such as manufacturing workers or laundry workers[173] via inhalation of detergent dust, aerosol particles or inhalation of volatile compounds when, for example, loading the washing machine. According to Van de Plassche *et al.*[174] a cup containing 200 g of washing powder can generate up to 0.27 µg of dust, which is, in the worst case, completely airborne. The typical frequency at which a consumer generally uses a product is 3.2 times per week.[148]

4.7.4 *Ecosystems*

Saouter *et al.*[175,176] compared the effect of compact formulations on the environmental profile of regular (1988) and compact granular (1992, 1998) laundry detergents in the Netherlands and Sweden. The results from Environmental Risk Assessment and LCA were presented separately. Despite the very conservative nature of the risk assessment, all ingredients had a risk quotient well below 1 in both the Netherlands and Sweden and at all times. In the LCA, no significant differences were found between the products as manufactured between 1988, 1992 and 1998.

Due to the introduction of compact detergents, risk quotients decreased two- to five-fold between 1988 and 1998 in each country. After the introduction of compact detergents in 1988, the consumption of raw materials and energy, as well as environmental emissions (air, water and solid waste) decreased. This results in the decrease of a number of indicators in the LCA results (e.g. acidification, aquatic toxicity greenhouse effects, eutrophication, toxicity, ozone depletion and smog).

Slightly lower risk quotients were observed in Sweden compared to the Netherlands, attributable to the lower water hardness and thus the lower detergent usage per wash cycle in that country. If water hardnesses were equal, the outcome of the product risk assessments would have been the same in the two countries.

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[173] Prud'homme de Lodder L.C.H., H.J. Bremmer, J.G.M. van Engelen, 2006. Cleaning Products Fact Sheet to assess the risks for the consumer. Bilthoven, The Netherlands: National Institute for Public Health and the Environment (RIVM). Report no.320104003
[174] Plassche E.J. van de, P.H.F. Bont, J.M.Hesse, 1999. Exploratory Report on Fluorescent Whitening Agents (FWAs). Bilthoven, The Netherlands: National Institute for Public Health and the Environment (RIVM). Report no. 601503013
[175] *The effects of compact formulations on the environmental profile of North European granular laundry detergents. Part I: Risk Assessment*, Saouter E., Van Hoof G., Pittinger C.A., Feijtel T.C.J., International Journal of Life Cycle Assessment, 2001
[176] *The effects of compact formulations on the environmental profile of North European granular laundry detergents. Part II: Life Cycle Assessment*, Saouter E., Van Hoof G., Feijtel T.C.J., and Owens J.W., International Journal of Life Cycle Assessment, 2002

Concerning the life cycle impacts, the differences between the Netherlands and Sweden are due to differences in electrical generation mix, in energy consumption during consumer use, in detergent dosage per wash and in the wastewater treatment infrastructure.

4.7.5 *Sustainable sourcing*

In order to protect nature and its ecosystem services, sourcing of ingredients for laundry detergents and their packaging materials should be done in a sustainable way. This means sourcing in a way that takes into account the consequences for the environment. For instance, ensuring that adverse effects on biodiversity are minimised and positive contributions are made where possible[177] by, for example, implementing a farmers' code to adopt better agricultural practices that are sensitive to biodiversity without harming agricultural yield or profitability.

4.8 In-house LCA studies

Due to the scarcity of publicly available studies on the environmental performance of laundry detergents, in-house LCA analyses were carried out in this study. This section describes the methodology followed, the sources and assumptions considered as well as the obtained results and their interpretation and discussion.

4.8.1 *Methodology*

The technical analysis was performed using an LCA approach and taking into account the *Product Environmental Footprint. General Guide*.[178] The LCA allowed assessing the relative environmental load of each life cycle stage to have an overall profile of the products' performance. Moreover, several comparative analyses and sensitivity analyses were performed regarding the ingredients, wash temperature, etc. to assess their importance and identify associated improvement potentials. The LCAs were performed in accordance with the standard methodology of ISO 14040 and 14044. The four steps presented in Figure 25 were carried out in an iterative process.

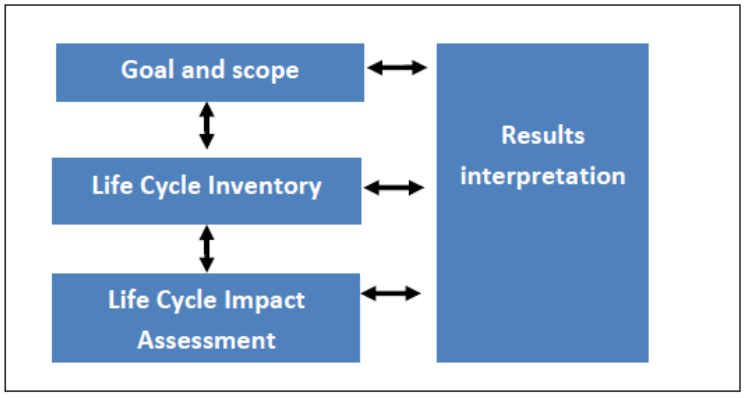

Figure 25: Steps of the life cycle assessment, according to UNE-EN ISO 14040: 2006

4.8.2 *Goal definition*

Goal definition is the first step of an LCA study. It defines the general context for the study. In the goal definition, parameters such as the intended application, the reasons for carrying out the study, the target audience, the limitations and assumptions have to be described.

[177] http://www.unilever.com/sustainable-living-2014/reducing-environmental-impact/sustainable-sourcing/protecting-biodiversity/index.aspx

[178] Product Environmental Footprint (PEF) Guide. Official Journal of the European Union (2013/179/EU). Commission Recommendation of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations. Available from: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013H0179

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The goal of this analysis is to quantify the potential environmental impacts of products included in the category 'laundry detergents' during all their life cycle phases. This analysis does not aim to make a comparison among different products or brands. The main objective is to analyse the impact of each life stage and its contribution in relation to other stages and the global environmental load of the product. Thus, even though specific products are taken as case studies for some stages, the study only aims to analyse the performance of an average product manufactured in Europe. Consequently, a general LCA has been performed in order to have the complete environmental profile of the selected products.

4.8.3 *Scope of the study*

The scope of an LCA study consists of describing the system to be analysed along with the associated considerations and specifications. In the study proposed, an LCA from cradle to grave is considered and the following phases are covered by the analysis, as shown in Figure 24: sourcing of the ingredients and packaging materials, manufacture of laundry detergent, product packing, distribution to retail, use phase and disposal/ end of life.

4.8.4 *Functional unit and reference flow*

The functional unit describes qualitatively and quantitatively the function(s) or the service(s) provided by the product analysed. The functional unit is used to define what the LCA is measuring, and provides a reference to which the inputs and outputs can be related. In this case the functional unit chosen is *one laundry cycle*. The reference flow describes the amount of the product required to fulfil the functional unit. The reference flow is assumed to be 85 grams of a powder laundry detergent for an average load of normal soiled laundry, using medium hardness water. The reference flow is an estimate based on the review of the existing literature and is not based on the performance of a specific laundry detergent. The reference wash temperature is 40 °C.

4.8.5 *System description and boundaries*

The **system boundaries** were defined following general supply-chain logic including raw materials (including raw materials extraction and ingredients manufacturing), manufacturing, packaging, distribution, use and final disposal (see also Table 36):

- **Raw materials**: In this sub-system raw materials and processing of ingredients are included. Composition and formulation of these products were taken into account and studied through the following parameters: origin of substances (e.g. vegetable, petroleum), production processes (energy and resources used) of substances and the performance of substances (toxicity properties to assess potential environmental impacts).
- **Manufacturing**: Standard processes and technologies to manufacture the products were analysed. The use of energy and water during manufacturing is reported, together with waste generation, air emissions and water emissions.
- **Packaging**: The primary and secondary packaging were analysed. Some relevant aspects are the weight of material, origin of materials (virgin vs. recycled), recyclability and use of hazardous substances. A common packaging has been considered for all laundry detergents (see Table 36).
- **Transport/Distribution:** The average distribution of products in the European market was analysed, consisting in the transport from the plant to the final point of sale, including transport among intermediate storages. Storage processes in the manufacturing plant and intermediary storage have not been included in the system.
- **Use**: During use a risk exists that the product may have negative health impacts. The potential for negative health impacts could be reduced by increasing the health requirements on fragrances, preservatives and hazardous compounds. LCA results do not reflect these effects in the use phase (either due to generic use of data or because the inputs are 'diluted' with the inclusion of all LCA inputs). These effects were discussed in the section on other impacts (Section 4.7). We assume

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49 litres of water at 40 °C was used for washing.[179] Energy required to heat the water falls within the system boundaries, being considered as energy mix for continental Europe in 2000 for the base case.

- **Disposal**: Two kinds of "waste" were included in the system:
  - Disposal of the product into water after use phase. As products studied are rinsed off, it is considered that the whole product is released to wastewater after the laundering and that it is subsequently purified in a household sewage plant.
  - Disposal of the packaging. Scenarios were defined for each kind of packaging considering the shares to be recycled and to be disposed. Impacts from recycling were included in the system and balanced with environmental credits due to the avoidance of use of virgin materials. All impacts coming from waste disposal are included in the system.

4.8.6 *Life cycle inventory*

Life-cycle inventory (LCI) is a 'cradle to grave' accounting (compilation and quantification) of the environmentally significant inputs and outputs of the system throughout its life cycle (Figure 26). The environmental burdens in this study include material input requirements, total energy consumed, air and water emissions released, and total solid wastes associated with the product's life-cycle. LCI data is converted to the study's functional unit.

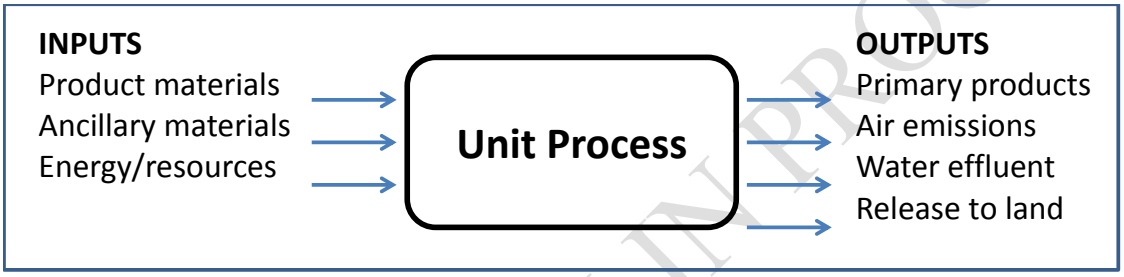

Figure 26: Inventory inputs and outputs

For each sub-system defined, inputs and outputs of the processes were gathered and quantified. For the most important stages primary data (information gathered from products) were used when possible. For secondary data other studies and existing databases (such as Ecoinvent) were used. For a few stages, e.g. distribution, generic data from other studies were also used as they were not considered of high relevance. For each sub-system, the key assumptions and information sources are summarized in Table 36.

Table 36: Key assumptions and information sources

	Reference	Powder detergent
Functional unit	Review of LCA studies	1 wash at 40˚C
Reference flow	Van Hoof et al. 2011 [180]	85 g
Raw materials and ingredients	Van Hoof et al. 2011	Standard formulation
Transport ingredients to product manufacturing site	Assumed	Renewable part in surfactants 5,000 km (boat) Other ingredients 2,000 km (lorry)
Energy for processing raw materials	Franke et al. 1995 [181]	40.7 KJ
Packaging (primary and secondary)	TSC [182]	Cardboard (5+6.5E-2 g)
Transport retail	Frischknecht and	100 km by truck and 600 km by train

[179] Koehler A and C Wildbolz, 2009. Comparing the Environmental Footprints of Home-Care and Personal-Hygiene Products: The Relevance of Different Life-Cycle Phases. ES&T 43(22):8643-8651.
[180] *Ecotoxicity impact assessment of laundry products: a comparison of USEtox and critical dilution volume approaches*, Van Hoof G., Schowanek D., Francheschini H., International Journal of Life Cycle Assessment, 16, p803-818, 2011.
[181] Franke, M., Klüppel, H., & Olschewski, P. (1995). Ökobilanzierung - Sachbilanz fürdie Waschmittel-Konfektionierung. *Tenside Surf. Det. 32(2)* .
[182] *Product Category Life Cycle Assessment (PCLCA) Laundry Detergent: Sustainability Measurement and Reporting System pilot project*, The Sustainability Consortium, 2011.

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	Reference	Powder detergent
	Jungbluth (2002) [183]	
Energy use in the use phase	Koehler and Wildbolz 2009[184]	0.53k Wh
Water use in the use phase	Koehler and Wildbolz 2009[180]	49 L
Waste water treatment	Based on EU Statistics	100 % connection to secondary treatment
Recycling rates solid waste	Eurostat (2012)[185]	Paper & board 83.2 %
Solid waste treatment (i.e. the fraction that is not recycled)	Eurostat (2012)	Landfill 65.3 % Incineration 34.7 %

4.8.6.1 Raw materials for laundry detergents

There is no 'standard' laundry detergent formulation. A large number of different ingredients can be used in a variety of combinations giving rise to different detergent formulations. Generally however, all laundry detergents contain the following categories of ingredients but in different concentrations: surfactants, builders (a.o. alkalis), bleaches, enzymes, and auxiliaries. Table 37 shows the general characteristics of a laundry detergent.

Table 37: Generic laundry powder detergent formulation

Product formulation	Function	Concentration (WT %)
Surfactant	Wetting agent, soil removal, soil/film prevention, sheeting action, soil dispersion, drying aid	10-15 %
Builder	Sequestration, soil suspension, alkalinity, emulsification, soil pepitization	30-85.5 %
Bleach (optional)	Soil removal, stain removal, sanitation, disinfection	7-21 %
Defoamer (optional)	Foam prevention, wash efficiency	0-1 %
Colour, perfume (optional)	Aesthetic enhancement	0-1 %
Water (optional)	Solvent, carrier, flow property	Balance

Source: Oakdene Hollins, based on data from www.isditproductveilig.nl

Thus, considering the number of different formulations possible, assessing the environmental impact of all varieties of detergents is impractical and a representative product is needed. The bill of materials for a laundry formulation for this study was created based on Van Hoof *et al*.[186] Table 38 shows the inventory data used to model the generic laundry detergent.

Ingredients of laundry detergents contain very specific substances: some of these substances are not included in the Ecoinvent database. In cases where there has been a lack of information, alternative substances that fulfil similar functions in soaps were chosen as a best guess.

Table 38: Ecoinvent data inventory for a laundry detergent frame formula

Laundry product formulation	Concentration (wt%)	Ecoinvent data

[183] Frischknecht, R., and Jungbluth, N.(2002). Working paper: Qualitiy guidelines ecoinvent 2000 (in German: Arbeitspapier: Qualitätsrichtlinien ecoinvent 2000). Swiss Centre for Life Cycle Inventories, ecoinvent Center: Duebendorf, Switzerland. Retrieved 10.12.2010, from http://www.ecoinvent.org/fileadmin/documents/en/presentation_papers/Qualitaet_5.7.pdf.

[184] Koehler A and C Wildbolz, 2009. *Comparing the Environmental Footprints of Home-Care and Personal-Hygiene Products: The Relevance of Different Life-Cycle Phases*. ES&T 43(22):8643-8651.

[185] Eurostat. (2012). EU Packaging recycling 2005. Retrieved from http://epp.eurostat.ec.europa.eu.

[186] *The effects of compact formulations on the environmental profile of North European granular laundry detergents*, Saouter E., Van Hoof G., Pittinger C.A., Feijtel T.C.J., International Journal of Life Cycle Assessment, 2001

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Water	7.80	Water, completely softened, at plant/RER S
Sodium carbonate	22.17	GLO: Sodium carbonate from NH_3Ch production, at plant
Sodium sulphate	19.89	Sodium sulphate, powder, production mix, at plant/RER S
Sodium percarbonate	13.27	Sodium percarbonate, powder, at plant/RER S
Na, Linear alkylbenzene sulfonate	8.69	Alkylbenzene, linear, at plant/RER S
Zeolite	7.04	Zeolite, powder, at plant/RER S
Sodium silicate	4.71	Layered sodium silicate, SKS-6, powder, at plant/RER S
Bentonite	4.48	Bentonite, at processing/DE S
C12-15 alkylethoxysulphate (3EO)	3.08	RER: fatty alcohol sulphate mix, at plant*
Sodium acrylic acid	1.48	Empty process**
Carboxymethyl cellulose	1.23	Carboxymethyl cellulose, powder, at plant/RER S
Citric	0.99	Empty process
Perfume	0.76	Empty process
Polycarboxylate polymer	0.57	Polycarboxylates, 40 % active substance, at plant/RER S
Phosphonate (HEDP)	0.53	Empty process**
Enzymes	0.34	Empty process**
Sodium chloride	0.07	Sodium chloride, powder, at plant/RER S
Dye	0.01	Empty process**

* Alcohol sulphate (AS) C12-18, 25 % mix of petrochemical, palm kernel oil, coconut oil, palm oil

** Due to a lack of data, these ingredients are modelled as empty processes which causes uncertainty in the impact assessment.

4.8.6.2 **Manufacturing**

This module contains energy inputs for the manufacturing of a laundry detergent. As described in Section 4.1.2, the manufacturing process employed for laundry detergent products generally consists of mixing and pumping the ingredients into mixing vessels. The exact process employed will depend on the manufacturer and the format of the final product. For the manufacture of powder laundry detergents, the required energy was based on a study by Franke *et al.*[187] and set to 40.7 kJ. The average EU energy mix from the Ecoinvent database 2.2 was used. We assume the detergent is produced and subsequently packaged at the same location. In the LCA, the required ingredients, packaging and transport are combined under the assembly of the laundry detergent. Production of waste and emissions for the production of a laundry detergent was not included due to lack of data. Infrastructure has also not been included.

4.8.6.3 **Packaging**

Packaging can be defined as the materials used for the containment, protection, handling, delivery, and presentation of goods. Packaging can be divided into three categories: primary, secondary and transport packaging.

There are different published definitions of packaging; thus it is proposed that, in the context of EU Ecolabel criteria, the definitions given in Article 3 of the EU Directive on Packaging and Packaging Waste 94/62/EC[188] are used (as already done for some other product groups e.g. rinse-off cosmetics). These definitions are as follows:

a) *"Sales packaging or primary packaging, i.e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of purchase;*
b) *Grouped packaging or secondary packaging, i.e. packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale; it can be removed from the product without affecting its characteristics;*

[187] Franke, M., Klüppel, H., & Olschewski, P. (1995). Ökobilanzierung - Sachbilanz fürdie Waschmittel-Konfektionierung. *Tenside Surf. Det. 32(2)* .

[188] Directive 94/62/EC of the European Parliament and of the Council on 20 December 1994 on packaging and packaging waste

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c) *Transport packaging or tertiary packaging, i.e. packaging conceived so as to facilitate handling and transport of a number of sales units or grouped packaging in order to prevent physical handling and transport damage. Transport packaging does not include road, rail, ship and air containers".*
It covers wooden pallets, board and plastic wrapping and containers that are used to collate the groups into larger loads for transport, which facilitates loading and unloading of goods

In this study, both primary and secondary packaging have been included. Table 39 shows the inventory data used for the packaging materials. The secondary packaging (i.e. cardboard box/carton) consists of recycled material (80 %). It has been assumed that 20 boxes of laundry detergent fit into one case.

Table 39: Primary & secondary packaging for laundry detergent

Packaging (Primary& Secondary)	Weight (g)	Ecoinvent data
Cardboard box	5 g*	Packaging, corrugated board, mixed fibre, single wall, (80 % recycled)
Case for 20 boxes	6.5E-2 g*	Packaging, corrugated board, mixed fibre, single wall, (80 % recycled)

* The weight is allocated based on the functional unit

4.8.6.4 Transport

Transport of raw materials is assumed to be 5,000 km (boat) for the renewable part in surfactants, and 2,000 km (lorry) for other ingredients. The ingredients are assumed to come from another continent (Asia) - hence the large distance. Literature data have been used to estimate the transport distance during the distribution phase. Normally in the European market products are distributed via lorry first to an intermediate storage, then to the storage facilities of direct customers (retailer) and from there to the point of sale (e.g. supermarket). Transport from retail to consumer homes was omitted as data were unavailable. This omission should not have significant consequences as studies for other categories show that these impacts are generally minimal when compared to other activities and typical shopping habits. Based on Frischknecht and Jungbluth (2002)[179] the distance transported in the EU was set to 100 km by truck (>16 tonnes, fleet average) and 600 km by freight train.

4.8.6.5 Use

The energy for the wash temperatures was taken from the *Preparatory studies for eco-design requirements of energy using products (EuPs): Domestic Washing machines and dishwashers*, December 2007.[62] The inventory data for water withdrawal is of poor quality and this should be remembered when interpreting the findings of the study. The water inventory does not distinguish between sources of water or water quality.

4.8.6.6 Disposal

The release of the product to water and the waste packaging generation is split. It is considered that the whole product is rinsed off, i.e. 85 g of laundry detergent is released to water that subsequently goes to a residential wastewater treatment plant. Packaging waste is partially recycled (values based on Eurostat (2012) rates for paper and board).The remaining waste is landfilled and incinerated. See Table 36 for the percentages of the waste treatment flows.

4.8.6.7 Data quality

Data quality concerning the ingredients is fair. For some ingredients for which no information was available, proxies were used as a best guess. Data for electricity and production are quite good. Data for waste water treatment are fair, but waste water treatment does not contribute much to the life cycle impacts. We used typical municipal waste water treatment data. For the use phase, which is dominant in the impact, data quality is good.

4.8.7 *Life Cycle Impact Assessment (LCIA)*

This section presents the LCI assessment. It is based on the data obtained in the inventory stage and includes the analysis of alternative substances for different products.

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4.8.7.1 Impact assessment method used

The impact assessment method used is ReCiPe.[189] ReCiPe proposes a feasible implementation of a combined midpoint categories (expressed in units of a reference substance) and damage approach, linking all types of LCI results (elementary flows and other interventions) via midpoint categories to four damage categories: human health, ecosystem quality, climate change, and resources.
Normalization can be performed either at midpoint or at damage level. Midpoints are used for a more specific and detailed analysis, whereas damage endpoints are useful to communicate the results obtained to a broader audience. The pre-defined (mathematical) weighting of the different midpoint scores within the ReCiPe assessment method allows us to come to a single score. However, as previously mentioned, this should be used more for communication purposes than for analysis, as weighting is not standardised and it is generally considered more relevant for the experts groups to hold discussions in greater detail – on midpoints level.

4.8.7.2 Contribution analysis by life cycle stage

The life cycle stages with the highest contribution to the environmental impacts were identified using characterised midpoint results from ReCiPe. The list of the impact categories and their abbreviations is given in Table 40.

Table 40: Glossary

Impact Category	Unit	Abbreviation
Climate change	kg CO_2 eq	CC
Ozone depletion	kg CFC-11 eq	OD
Terrestrial acidification	kg SO_2 eq	TA
Freshwater eutrophication	kg P eq	FE
Marine eutrophication	kg N eq	ME
Human toxicity	kg 1,4-DB eq	HTox
Photochemical oxidant formation	kg NMVOC	POF
Particulate matter formation	kg PM10 eq	PMF
Terrestrial ecotoxicity	kg 1,4-DB eq	TTox
Freshwater ecotoxicity	kg 1,4-DB eq	FTox
Marine ecotoxicity	kg 1,4-DB eq	MTox
Ionising radiation	kg ^{235}U eq	IR
Agricultural land occupation	m^2*yr	ALO
Urban land occupation	m^2*yr	ULO
Natural land transformation	m^2*yr	NLT
Water depletion	m^3	WD
Metal depletion	kg Fe eq	MD
Fossil depletion	kg oil eq	FD

The results for a powder laundry detergent are shown in Figure 27. For more information, please see Annex V.

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[189] Goedkoop, M., Heijungs, R., Huijbregts, M., De Schryver, A., Struijs, J., & Van Zelm, R. (2009). ReCiPe 2009. A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level. The Hague, The Netherlands: VROM.

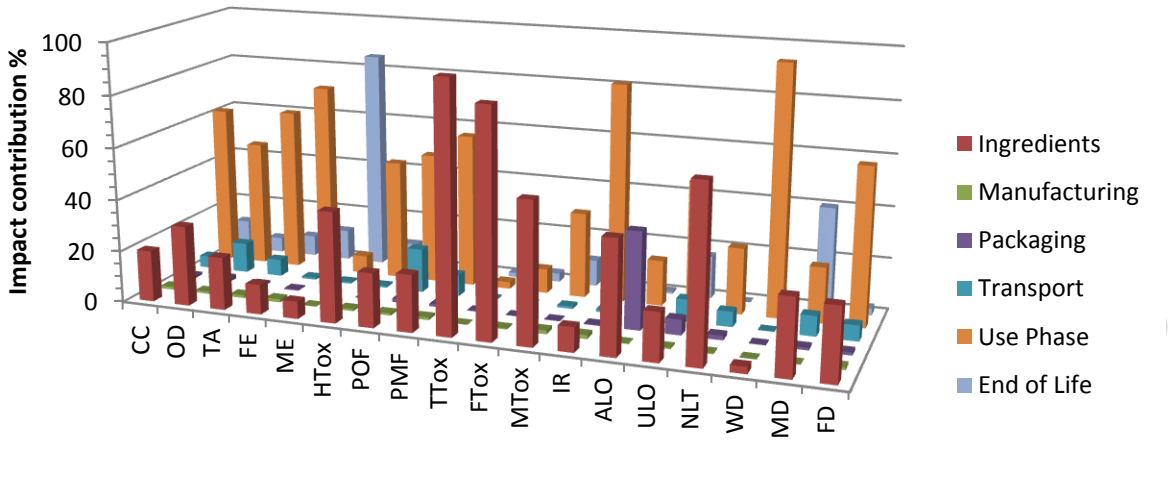

Figure 27: Impact contribution of different life cycle stages of a laundry detergent

Ingredients: For terrestrial ecotoxicity, the ingredient sodium percarbonate is important (63 % of impacts), as well as the surfactant fatty alcohol sulphate (28 %). The surfactant modelled in this study is of a mixed origin, i.e. both oleo chemical origin (palm and coconut resources) and petrochemical, which has an effect on both natural land transformation and agricultural land occupation. The largest share of freshwater ecotoxic impacts is also caused by the ingredients (81 %, mainly sodium percarbonate). The impacts related to occupation of agricultural land are mainly caused by the ingredients (39 %), i.e. fatty alcohol sulphate (20 %) and carboxymethyl cellulose (12 %). For natural land transformation, the largest share of the impacts is caused by the ingredients (57 %, of which fatty alcohol 40 %). For the impacts related to metal depletion, the ingredients (a.o. zeolite) caused 24 % of the environmental impact. For marine ecotoxicity, the ingredients contributed 43 % to the environmental impact. The most important ingredient was sodium percarbonate, a bleaching agent.

Use phase: The life cycle stage with the largest contribution to the overall environmental impact is the use phase. In particular, the energy needed to heat the water during the wash cycle. For climate change, ozone depletion, terrestrial acidification, freshwater eutrophication, human toxicity, photochemical oxidant formation, particulate matter formation, ionising radiation, urban land occupation, water depletion, and fossil depletion, the use phase contributed 60-97 %. For the impacts related to occupation of urban land, the energy of the use phase contributed 59 % to the environmental impact, for marine ecotoxicity 45 %, for natural land transformation 37 %, for metal depletion 29 %, for agricultural land occupation 26 %, for freshwater ecotoxicity 15 %, for marine eutrophication 10 %, and for terrestrial ecotoxicity 4 %.

End of life: For marine eutrophication, the end of life was important: 84 % of characterised midpoint results. In particular, the wastewater sent to wastewater treatment plant contributed much to the impact. Furthermore, the treatment of wastewater contributed 40 % for the environmental impact related to metal depletion.

Other life cycle stages: Manufacture and transport a have a minor contribution towards the total environmental impact when compared to the use phase or the ingredients sourcing (Annex V). Packaging is only relevant for agricultural land occupation (33 %, related to the non-recycled content of the cardboard).

Table 41: Aggregate midpoint results for a laundry detergent

Impact category	Unit	Laundry detergent
Climate change	kg CO_2 eq	9.8E-01
Ozone depletion	kg CFC-11 eq	5.5E-08
Terrestrial acidification	kg SO_2 eq	4.1E-03
Freshwater eutrophication	kg P eq	8.9E-04

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Marine eutrophication	kg N eq	1.7E-03
Human toxicity	kg 1,4-DB eq	7.6E-01
Photochemical oxidant formation	kg NMVOC	2.3E-03
Particulate matter formation	kg PM10 eq	1.3E-03
Terrestrial ecotoxicity	kg 1,4-DB eq	5.4E-04
Freshwater ecotoxicity	kg 1,4-DB eq	4.5E-02
Marine ecotoxicity	kg 1,4-DB eq	2.8E-02
Ionising radiation	kg U235 eq	6.5E-01
Agricultural land occupation	m^2a	3.7E-02
Urban land occupation	m^2a	5.2E-03
Natural land transformation	m^2	2.0E-04
Water depletion	m^3	6.3E+00
Metal depletion	kg Fe eq	2.9E-02
Fossil depletion	kg oil eq	2.7E-01

4.8.7.3 Identification of significant impacts

The magnitude of different environmental impacts cannot be compared to each other because each impact category is expressed in a different unit. We can, however, identify how significant an impact is when compared to a reference - in this case, the average impacts of a European citizen in the year 2000. This step in LCIA is known as normalization.

The results were calculated based on the ReCiPe endpoint approach[190], using the hierarchist perspective with European normalisation data from the year 2000.[191] The hierarchist perspective can be seen as a method based on scientific consensus, unlike the more explicit views like egalitarian (precautionary principle) and individualist (short-term impacts only). It is therefore the recommendation of the method developers to use the hierarchist perspective.[187] Normalization at endpoint helps identify whether the contribution of an impact indicator is relevant in a damage category (i.e. effect of an indicator such as climate change on human health, ecosystem quality, and resource depletion). The normalised values of the different life cycle stages of a laundry detergent are shown in Figure 28.

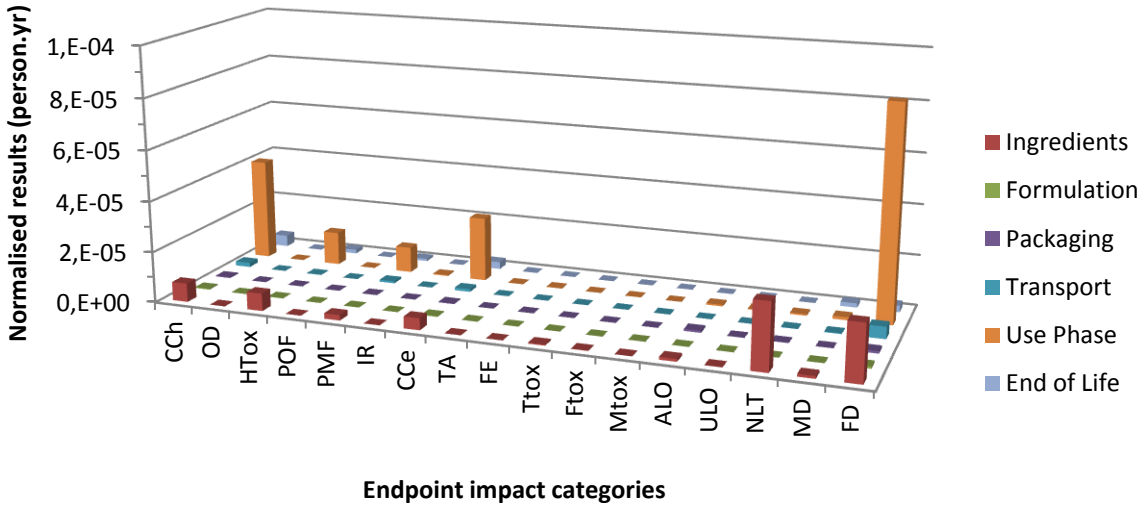

Figure 28: Normalised endpoint results for laundry detergent

[190] Goedkoop, M., Heijungs, R., Huijbregts, M., De Schryver, A., Struijs, J., & Van Zelm, R. (2009). ReCiPe 2009. *A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level*. The Hague, The Netherlands: VROM.

[191] Sleeswijk AW, et al, *Normalization in product life cycle assessment: An LCA of the global and European economic systems in the year 2000*, Sci Total Environ (2007), doi:10.1016/j.scitotenv.2007.09.040

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For a laundry detergent, the most relevant impact categories relative to the reference (average impacts of a European citizen in the year 2000) are climate change (both human health (h) and ecosystems (e)), human toxicity, fossil depletion, and natural land transformation. The level of significance is set by the overall contribution of an impact indicator to an area of protection.

Climate change impacts are mainly related to the electricity used to heat the water in the use phase. Human toxicity impacts are mainly due to the emissions of the bleaching agent sodium percarbonate, and to electricity. Fossil depletion impacts are mainly caused by electricity use too. The impacts on natural land transformation are mainly driven by the surfactant, the fatty alcohol sulphate, and the electricity used to heat the water in the use phase is also important.

4.9 Sensitivity analysis

In this section we explore the consequences of the assumptions on the overall results. The following variables were analysed: product dosage, wash temperature, surfactant origin, energy mix and use of fabric softener. These variables were selected because of their significant contribution from a particular life cycle phase. Since climate change, human toxicity, natural land transformation and fossil depletion were shown to be the most important impact categories according to the endpoint normalisation, in this section we graphically present the results for those four impact categories.

4.9.1 *Washing program*

Existing studies and the in-house LCA have shown that the largest environmental impact of the laundry process occurs during the use phase. This is due to the energy consumed to heat the water; reducing the wash temperature through altering the wash program can lead to significant environmental gains. The washing program takes into account wash temperature and washing duration, which are both determinants of the amount of energy that is used in the use phase. In this sensitivity analysis we have adjusted the energy use as if the water temperature in the use phase would be reduced by 10 °C or increased by 20 °C. In the reference scenario, an energy consumption of 0.53 kWh was used for a wash temperature of 40 °C (standard conditions, based on Koehler and Wildbolz).[180] The clothes were assumed to be medium soiled, and the water hardness was assumed to be medium.

The results show that the impacts are significantly reduced for the 30 °C wash compared to the 40 °C and 50 °C wash programs. Figure 29 shows that a change in energy consumption, due to e.g. a change in wash temperature (a reduction of 10 °C or an increase of 20 °C), results in proportional changes in the environmental impact. Marine eutrophication, terrestrial toxicity, freshwater toxicity, and water depletion were the least influenced by a reduction in energy use, with a change of reduction of less than 2 % impact contribution when switching from 40 °C to 30 °C.

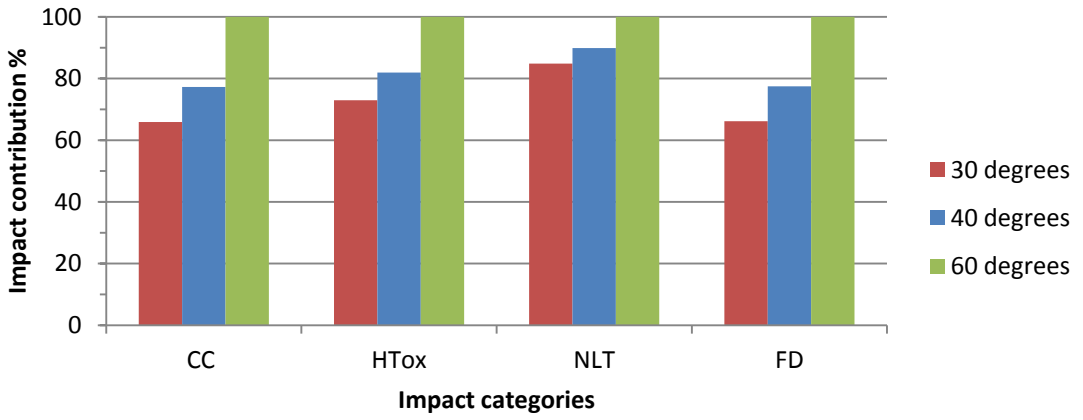

Figure 29: Characterised results for washing program sensitivity

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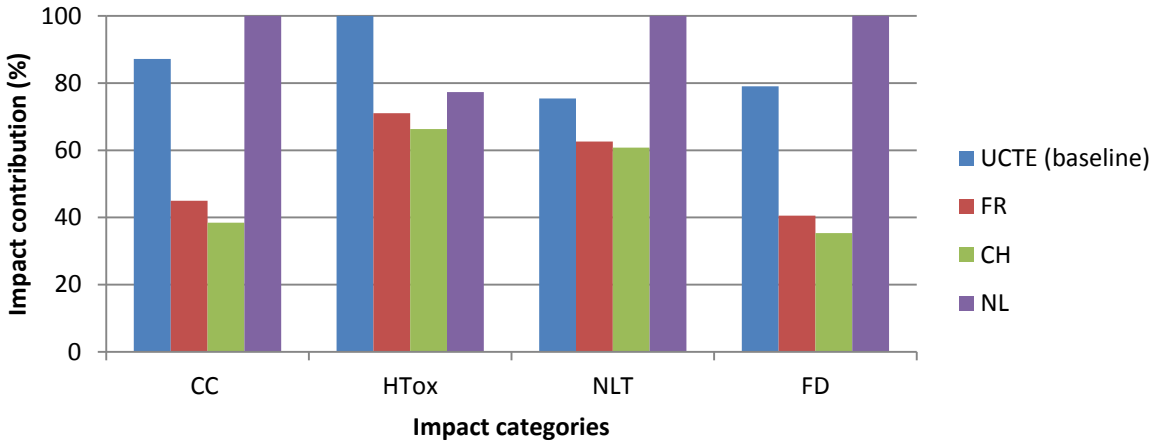
4.9.2 *Energy source for heating the water*

In the baseline scenario we used the energy mix for Continental Europe (the Union for the Coordination of the Transmission of Electricity) from Ecoinvent. This represents the electricity net production shares by the member countries based on annual averages from the year 2000. For the sensitivity analysis we used the dataset for electricity production in France (approximately 50 % is derived from nuclear energy), electricity production in Switzerland (approximately 50 % derived from hydropower), and electricity production in the Netherlands (approximately 50 % is derived from natural gas). The results are shown in Figure 30*Impact categories stand for CC: climate change, HTox: human toxicity,NLT: natural land transformation and FD: fossil depletion.*
Figure 30.

The results show that an energy mix based mostly on nuclear energy or hydro power significantly reduces the environmental impacts in all impact categories which were shown to be the most important according to the normalisation, i.e. climate change, human toxicity, natural land transformation and fossil depletion. This is because these sources are a cleaner source of energy compared to the electricity mix used in the study, which includes coal, crude oil, lignite, etc., which have higher greenhouse gas (GHG) emissions. Switching to an energy mix based mostly on gas is also an improvement for the toxicity categories freshwater and eutrophication, but – obviously – not for transformation of natural land.

Trade-offs occurs between other impact categories. Switching to the Dutch country mix would significantly reduce the impacts on freshwater eutrophication, human toxicity and ionising radiation (related to nuclear energy), but increase the impacts in a.o. natural land transformation, fossil depletion, and climate change. (NB: these results do not indicate the advantages of a shift toward a nuclear based electricity production since a limited number of environmental indicators have been analysed in this study. It needs to be remembered that there are trade-offs between various energy sources and their comparison is not straight forward.)



Impact categories stand for CC: climate change, HTox: human toxicity,NLT: natural land transformation and FD: fossil depletion.

Figure 30: Sensitivity analysis of energy source mix

4.9.3 *Dosage*

In the reference scenario we assumed a dosage of 85 g of a laundry detergent per wash. The effect of using a lower (-20 %) or higher (+20 %) dosage is investigated in the sensitivity analysis (see Figure 31). Changing the dose by 20 % results in changes in impacts of 6-13 % for CC, HTox, NLT and FD and maximally 16 % for terrestrial toxicity.

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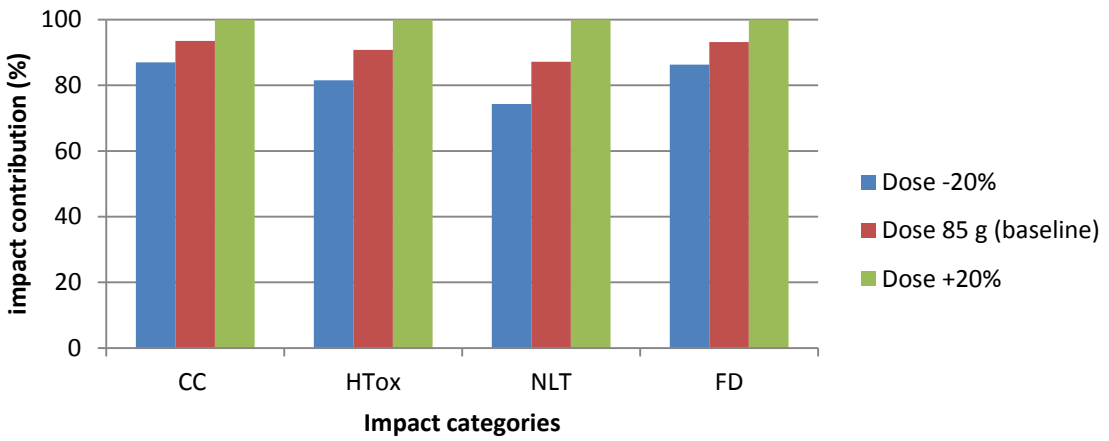

Impact categories stand for CC: climate change, HTox: human toxicity,NLT: natural land transformation and FD: fossil depletion

Figure 31: Characterised results of dosage sensitivity

4.9.4 *Surfactant origin*

For the reference scenario the surfactant modelled is a mix from both oleochemical (palm kernel oil and coconut oil) and petrochemical origins. For the sensitivity analysis we replaced this surfactant with a petrochemical surfactant and an oleochemical surfactant (only palm kernel oil). The results are shown in Figure 32. For more information about the surfactant used in the reference scenario please see Table 38.

The LCIs for surfactants, whilst the best available, are over 15 years old and do not contain adequate data relating to direct land use change. For compliance with the World Resources Institute GHG protocol, ILCD and ISO 14040/44, any direct land use change occurring in the previous 20 years should be considered for above and below ground biomass and for soil organic matter (differentiated for peat and mineral soil).

Consequently the results for impact categories relating to direct land use change and its associated GHG emissions are compromised and must be interpreted with caution. However, the available (outdated) LCI datasets have been included for the purposes of completeness and for future comparison with the updated and improved surfactant inventories which have not been published at the time of this revision.

The impact category most affected by the origin of the surfactants used is natural land transformation. Replacing a partly renewable surfactant with a purely petrochemical equivalent will reduce the impact on natural land transformation by 10 %. Similarly replacing a partly renewable surfactant with an oleochemical surfactant, based only on palm kernel oil, will reduce the impact on natural land transformation by 10 %. This is because the largest impacts on natural land transformation are from the coconut oil in mixed origin surfactant used the baseline scenario.

Impacts of surfactant origin on freshwater eutrophication, freshwater, human or marine toxicity do not change substantially primarily because these impacts are driven by the use phase. These results will likely undergo some changes as the new surfactant data become available.

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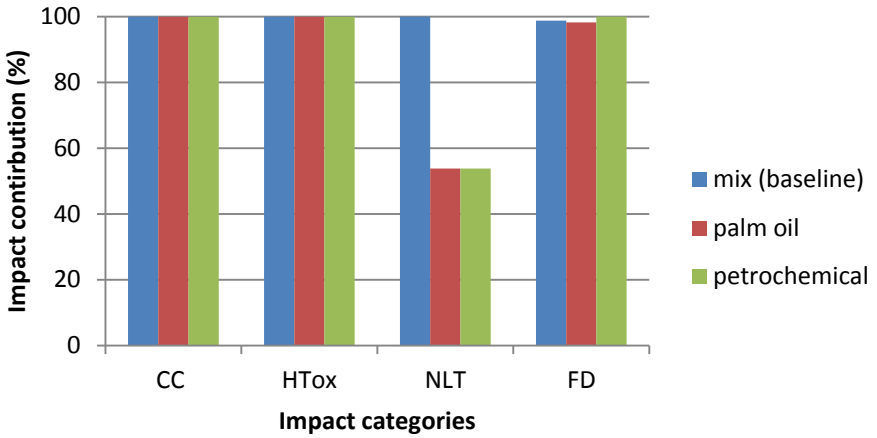

Impact categories stand for CC: climate change, HTox: human toxicity,NLT: natural land transformation and FD: fossil depletion

Figure 32: Sensitivity analysis of surfactant origin

4.9.5 *Toxicity impact of ingredients*

There is no 'standard' laundry detergent formulation. A large number of different ingredients can be used in a variety of combinations giving rise to a large number of possible detergent formulations. Table 42 shows the toxicity impacts of some key ingredients used in laundry detergent formulations. Here the potential impact of an equal quantity (i.e. 1 g) of different ingredients is compared. A full toxicity impact assessment was performed as part of the LCA. The ingredient with the highest impact on human toxicity, freshwater toxicity, and marine ecotoxicity is sodium percarbonate. The ethoxylated alcohols are also among the most toxic ingredients. For terrestrial ecotoxicity the surfactants, fatty alcohol sulphate and ethoxylated alcohols, have the highest impact.

Table 42: Toxicity impacts of key ingredients per gram

Ingredients (1 gram)/ (kg 1,4-DB)	Human	Terrestrial	Freshwater	Marine
Alkylbenzene, linear, at plant/RER S	3.78E-03	1.38E-06	8.57E-05	9.71E-05
Bentonite, at processing/DE S	2.87E-03	9.77E-07	1.81E-05	2.61E-05
Sodium chloride, powder, at plant/RER S	1.60E-03	1.80E-07	1.22E-05	1.51E-05
Sodium hydroxide, 50% in H_2O, production mix, at plant/ RER U	1.01E-02	1.09E-06	5.65E-05	6.49E-05
Zeolite, powder, at plant/RER S	2.19E-02	4.20E-06	1.42E-04	1.85E-04
Polycarboxylates, 40% active substance, at plant/RER S	3.57E-03	3.80E-07	2.59E-05	3.02E-05
Layered Sodium silicate, SKS-6, powder, at plant/RER S	7.88E-03	8.80E-07	5.04E-05	6.04E-05
Ethoxylated alcohols (AE3), coconut oil, at plant/RER S	6.22E-03	9.92E-07	1.39E-04	1.48E-04
Ethoxylated alcohols (AE3), palm kernel oil, at plant/RER S	7.65E-03	1.28E-03	3.68E-04	1.93E-04
Ethoxylated alcohols (AE3), petrochemical, at plant/RER S	6.25E-03	9.49E-07	1.49E-04	1.54E-04
Ethylene glycol diethyl ether, at plant/RER S	1.49E-02	3.02E-06	3.03E-04	3.04E-04
Sodium percarbonate, powder, at plant/RER S	1.46E-01	3.02E-04	1.56E-02	2.59E-03
Carboxymethyl cellulose, powder, at plant/RER S	1.63E-02	6.23E-06	1.07E-04	1.49E-04
Sodium carbonate from ammonium chloride production, at plant/GLO S	4.22E-03	1.26E-06	3.12E-05	4.19E-05
Polycarboxylates, 40% active substance, at plant/RER S	3.57E-03	3.80E-07	2.59E-05	3.02E-05
Fatty alcohol sulfate, petrochemical, at plant/RER S	6.16E-03	1.14E-06	4.32E-05	5.60E-05
Fatty alcohol sulfate, mix, at plant/RER S	6.61E-03	5.82E-04	1.37E-04	6.76E-05
Fatty alcohol sulfate, palm oil, at plant/RER S	6.18E-03	8.14E-04	1.70E-04	6.50E-05
Sodium sulphate, powder, production mix, at plant/RER S	2.02E-03	2.04E-07	1.58E-05	1.82E-05

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4.9.6 *Use of fabric softener*

Based on a report by the Dutch National Institute for Public Health and the Environment[192] and the portal www.isditproductveilig.nl[193], a generic formula for fabric softeners was produced (see Table 43).

The fabric softener was packed in bottles of 1 litre, made of a mixture of LDPE and PP.[178] The assumptions for formulating and transport were similar to the assumptions for the laundry detergent, and are shown in Table 44. Furthermore, the system boundaries were the same as for the laundry detergent and defined following general supply-chain logic including: raw materials (including raw materials extraction and ingredients manufacturing), manufacturing, packaging, distribution, use and final disposal. The fabric softener was added to the use phase of the life cycle of the laundry detergent.

Table 43: Ecoinvent data inventory for a fabric softener formula

Fabric softener product formulation	Concentration (wt %)	Ecoinvent data
Cationic surfactants*	20	Ammonium chloride, at plant/GLO S
Non-ionic surfactants**,	4	Ethoxylated alcohols, unspecified, at plant/RER S
Solvent: ethanol	5	Ethanol from ethylene, at plant/RER S
Solvent: isopropanol	5	Isopropanol, at plant/RER S
Additives***	1	Empty processes
Water	65	Water, completely softened, at plant/RER S

*: Quaternary ammonium chlorides, e.g. dialkyl dimethyl ammonium chlorides
**, e.g. alkyl polyethyleneglycol ethers (AEO)
***: preservatives, dye, perfume, silicones

Table 44 Key assumptions for fabric softener

	Reference	Fabric softener
Functional unit	Review of LCA studies	1 wash at 40 ˚C
Reference flow	Consumer studies	10 g
Transport ingredients to product manufacturing site	Assumed	Renewable part in surfactants 5,000 km (boat) Other ingredients 2,000 km (lorry)
Energy for processing of raw materials	Franke *et al.* 1995[194]	40.7 KJ
Packaging (primary)	TSC[195,178]	LDPE (3.48E-1g), PP 3.41E-2g)
Packaging (secondary)	TSC[191]	Cardboard (5+6.5E-2g)
Transport retail	Frischknecht and Jungbluth (2002) [196]	100 km by truck and 600 km by train
Inserted in the LC of laundry detergent		
Energy use in the use phase	Koehler and Wildbolz 2009[180]	0.53 kWh
Water use in the use phase	Koehler and Wildbolz 2009[180]	49 L
Waste water treatment	Based on EU Statistics	100% connection to secondary treatment

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[192] *Cleaning Products Fact Sheet - To assess the risks for the consumer,* L.C.H. Prud'homme de Lodder, H.J. Bremmer, J.G.M. van Engelen RIVM report 320104003/2006
[193] www.isditproductveilig.nl (translation: "is this product safe"), a website by the Dutch Association of Soap Manufacturers (NVZ)
[194] Franke, M., Klüppel, H., & Olschewski, P. (1995). Ökobilanzierung - Sachbilanz fürdie Waschmittel-Konfektionierung. *Tenside Surf. Det. 32(2)* .
[195] *Product Category Life Cycle Assessment (PCLCA) Laundry Detergent: Sustainability Measurement and Reporting System pilot project*, The Sustainability Consortium, 2011
[196] Frischknecht, R., and Jungbluth, N.(2002). Working paper: Qualitiy guidelines ecoinvent 2000 (in German: Arbeitspapier: Qualitätsrichtlinien ecoinvent 2000). Swiss Centre for Life Cycle Inventories, ecoinvent Center: Duebendorf, Switzerland. Retrieved 10.12.2010, from http://www.ecoinvent.org/fileadmin/documents/en/presentation_papers/Qualitaet_5.7.pdf.

Recycling rates solid waste	Eurostat (2012)[197]	Paper & board 83.2 % Plastic 31.9 %
Solid waste treatment	Eurostat (2012)	Landfill 65.3 % Incineration 34.7 %

The use of fabric softener was negligible for most impact categories (see Figure 33). The highest contribution to environmental impacts was found for freshwater toxicity, where fabric softener accounted for an additional 4 % of the normalized results. As such it can be concluded that using a fabric softener in addition to laundry detergent has a small impact on the overall environmental impact.

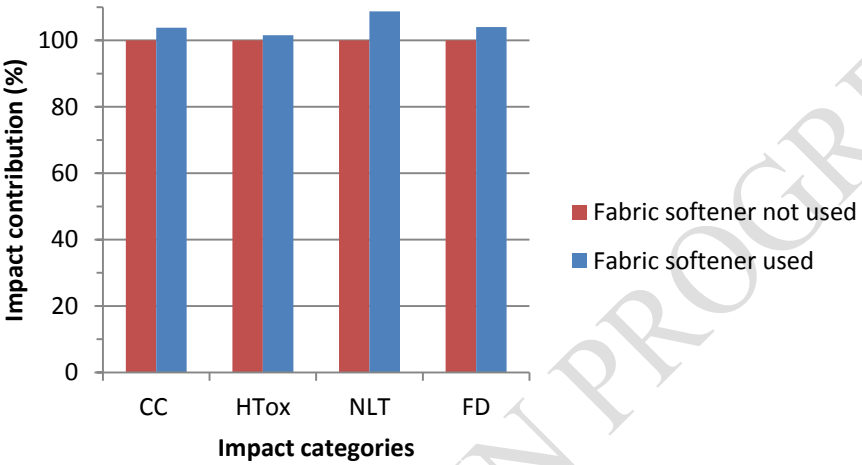

Figure 33: Sensitivity analysis of fabric softener use

4.9.7 *Sensitivity of the surfactant to the database used*

In the present screening LCA the widely used Ecoinvent database version 2.2 was chosen as a reference for the ingredients data. Recently, another LCI database containing data on palm and coconut oil production became available: the Agri-footprint® database. It is important to note that the differences in data collection methods between these databases result in differences in environmental impact of coconut and palm oil when using the ReCiPe endpoint method. Here we compare the results of the two databases on two renewable surfactants: coconut oil and palm kernel oil, which have shown to have a significant contribution to the environmental impact of detergents, which is to a large extent due to land transformation.

In general, the Agri-footprint database based land transformation data on observed changes of palm fruit or coconut cropland for the past in 20 years in the countries where they are grown. Ecoinvent based its inventory data on permanent transformation of primary forest into agricultural land, and subsequently transformation into forest (planted forest) when the palm trees are not productive anymore, as reported by the farmers.

4.9.7.1 Coconut oil

The Ecoinvent database assumes that for coconut trees, primary forest is permanently transferred into agricultural land. In Agri-footprint it is assumed that the coconut area did not increase in the Philippines for the past 20 years, based on observed data. As a result, 1 kg of ethoxylated alcohols from coconut oil in Ecoinvent scores higher on natural land transformation (see Figure 34). Furthermore, the total environmental impact at endpoint level of 1 kg of ethoxylated alcohols from coconut oil is slightly higher in Ecoinvent. This is because the impact from other categories is much higher in case of Agri-footprint, due to different assumptions on yield per hectare and fossil fuel use. As the difference between the total impact of this ingredient is small,

[197] Eurostat. (2012). EU Packaging recycling 2005. Retrieved from http://epp.eurostat.ec.europa.eu

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Agri-footprint will lead to the same overall conclusion regarding the importance of the surfactants in the life cycle of detergents.

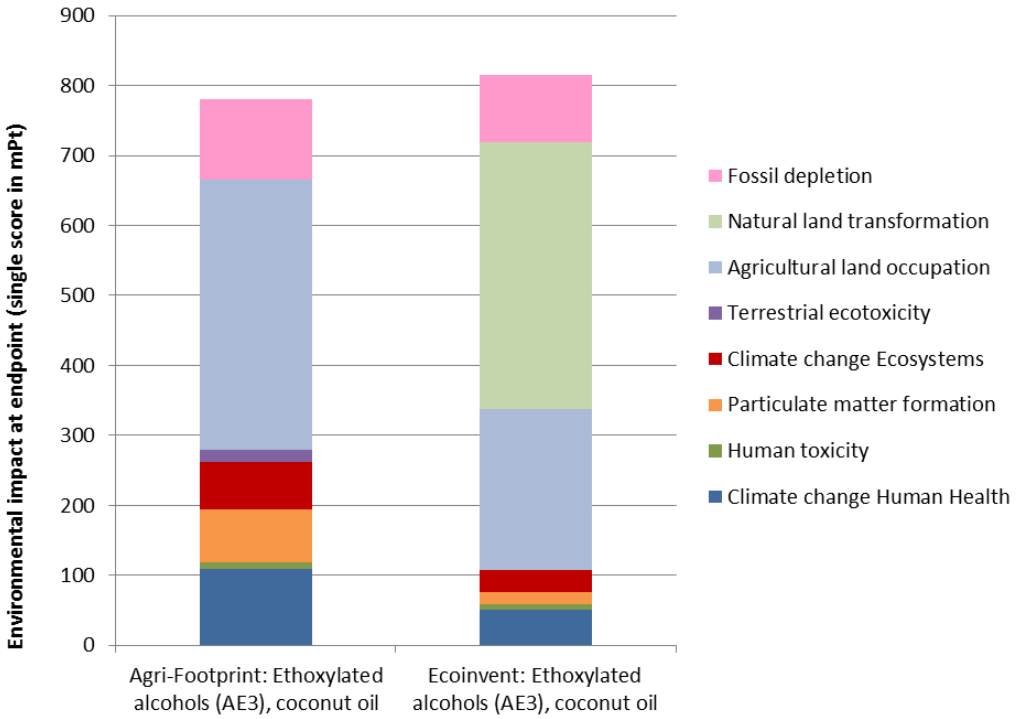

Figure 34: Comparison between the environmental impact at endpoint level of 1 kg of ethoxylated alcohols from coconut oil in Ecoinvent and in Agri-Footprint[198]

4.9.7.2 Palm kernel oil

In the Ecoinvent database, the amounts of transformation for palm kernel oil are based on numbers for tropical forest transformed into palm kernel oil cropland and transformation to forest (planted forest), as reported by the farmers. Conversely, in Agri-footprint the amounts for palm kernel oil are based on data that indicate there was an increase in palm kernel oil cropland in Malaysia in the past 20 years. In Ecoinvent there is more transformation of tropical forest into palm kernel oil cropland, but there is also transformation to forest (not specified as being tropical forest). In Agri-footprint there is less transformation of tropical forest transformed into palm kernel oil cropland, but there is no planting of new forest.[199] This is because the developers of Agri-footprint calculated the net transformation to palm fruit area.

As the characterisation factor for damage at the end point level for transformation from tropical forest is about 30 times higher than the characterisation factor for transformation from forest (and the negative factor for transformation to tropical rain forest is about 30 times higher than for transformation to forest), the higher number for transformation from tropical forest in Ecoinvent leads to a higher impact on natural land transformation for 1 kg of ethoxylated alcohols from palm kernel oil in Ecoinvent (see Figure 35). Furthermore, the total environmental impact at endpoint level of 1 kg of ethoxylated alcohols from palm kernel oil higher in Ecoinvent.

The information that is currently available does not give an insight into which of the methods lead to more realistic results. However, as natural land transformation is also the most important impact category in our study when using coconut or palm oil from Agri-footprint, just as it is when using Ecoinvent, from the use of Agri-footprint it can also be concluded that the surfactants are an important contributor to the life cycle impact of detergents. The magnitude of the impact, however, is variable.

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[198] Impact categories that are not shown contribute less than 1%

[199] A bug correction in the current version of Agri-Footprint was made for the process oil palm fruit bunch: "Tranformation, from forest" changed into "Transformation, from tropical rain forest".

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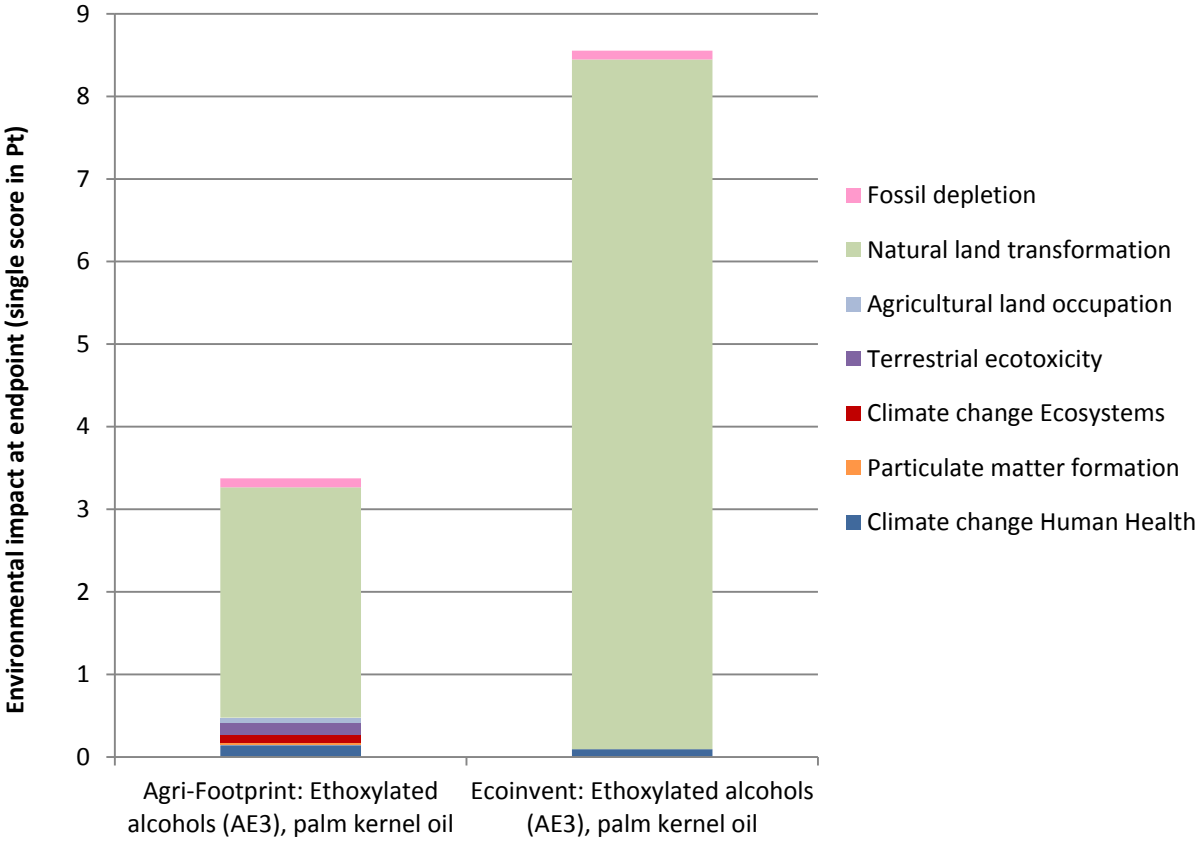

Figure 35: Comparison between the environmental impact at endpoint level of 1 kg of ethoxylated alcohols from palm kernel oil in Ecoinvent and in Agri-Footprint[194]

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4.10 Summary of findings

The following conclusions can be derived from the screening LCA:

I. The life cycle stage with the largest contribution to the environmental impact profile of laundry detergents is the use phase, particularly the energy needed to heat the water for the wash cycle. For some impact categories, the sourcing of raw materials is also important.

II. Based on the normalisation assessment, the most significant impact categories for laundry detergents in Europe are: freshwater eutrophication, human toxicity, freshwater ecotoxicity, marine ecotoxicity, and natural land transformation.

These impacts are strongly correlated to each other via the energy use in the use phase (with the exception of natural land transformation). The use phase dominates the impact categories freshwater eutrophication, human toxicity, and marine ecotoxicity, whereas freshwater ecotoxicity and natural land transformation are dominated by ingredients sourcing.

Based on the results of this study, the key environmental performance indicators (KPIs - i.e. those variables that mainly drive the results) for laundry detergents in Europe are:

- amount of product used
- choice and amount of surfactant (but there are trade-offs between impact categories)
- wash temperature
- energy source used to heat the water
- emissions to water.

Based on this information the following conclusions can be made about the key environmental considerations that should be linked to the EU Ecolabel criteria of laundry detergents (see Table 45):

Table 45: Overall summary of the key environmental considerations linked to the EU Ecolabel criteria

Conclusion	Significance[200]	Improvement measures
The use phase has the most significant contribution to the environmental impact, driven by energy needed to heat water. Therefore, the environmental impact can be lowered by encouraging low temperature washing.	Very high	Indirectly through consumer information on the product packaging encouraging low temperature washing. Innovations for effective washing at low temperatures will be investigated.
Raw materials extraction and processing are the second largest contributor to environmental impact. Surfactants and builders are responsible for most of the impact.	High	Directly by restricting the use of the worst performing builders and surfactants.
Concentrated products perform better than other product formats, across all impact categories.	High	By encouraging the use of concentrated products.
An important environmental impact arises from the end of life, specifically related to municipal wastewater treatment.	Medium	Directly, through the toxicity to aquatic organisms.
Impacts of detergent manufacturing and packaging are very low.	Low	Directly, through the packaging requirements criteria.
The impacts of distribution and transport are low.	Low	No, would require specification for local sourcing.

[200] Significance assessed depends on the number of impact categories for which it is high.

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5. PRODUCT INNOVATIONS AND IMPROVEMENT POTENTIAL

5.1 Introduction and approach

The aim of this section of the report is to assess the potential improvement that might be delivered by the implementation of revised criteria for the EU Ecolabel for laundry detergents. For laundry detergents, the most sensible way to assess the improvement potential is by analysing different scenarios through sensitivity tests.

In order to assess the potential improvement of laundry detergents, the following have been undertaken: a sensitivity analysis using the results from the LCA study; identification of product innovations through recent laundry product innovations; an estimation of the potential benefits associated; and identification of the possible measures to be undertaken in the EU Ecolabel.

The sensitivity analysis conducted using results from the LCA study is presented in Section 4.9. We have chosen to conduct the sensitivity analysis on the attributes which showed significant contribution to the environmental impact. These are product dosage, washing program, surfactant origin, use of fabric conditioner and toxicity of ingredients. The sensitivity analysis showed that varying the wash program had the most significant impact on the overall environmental impact. Wash programs which consumed less energy, for instance low temperature washing, led to substantial reductions across nearly all the impact categories. Reducing the product dosage by 20 % also led to a reduction in the overall impact, but to a lesser extent than lowering the wash temperature.

5.2 Laundry detergent product innovations

In order to understand the scope of improvement options for laundry detergents, recent product innovations which lead to enhanced environmental performance have been identified. These product innovations are: compaction, low-temperature wash performance, low/no harmful chemicals content, natural/renewable ingredients. Each of these innovations and their improvement potential is discussed below.[201]

5.2.1 ***Compaction***

Compaction is now commonplace amongst the large manufacturers in laundry detergents, with manufacturers such as Unilever and P&G offering products which are at least 2x and often 3x concentrated. However, further innovation in compaction technology has led to the development of 8x concentrated laundry detergents.[202] Compaction of laundry detergents brings several environmental benefits, through reductions in the amount of ingredients and packaging raw materials used, and savings in water, energy and resources. This type of innovation, however, only leads to better environmental performances if consumers do not overdose.

5.2.2 ***Low-temperature wash performance***

In recent years detergent manufacturers have invested significant efforts to improve washing performance at low temperatures. Household laundry detergents are now available on the market which claim wash efficacy at temperatures as low as 15 °C. This has largely been achieved through the choice of surfactants and polymers and the use of sophisticated enzyme systems.[203] As shown in the LCA conducted as part of this study, the use phase has the largest contribution to the overall environmental impact of a laundry detergent; this is largely driven by the energy needed to heat the water. Consequently, washing at lower temperatures will significantly lower the overall environmental impact of the product through energy savings.

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[201] Global Household Care: Green Cleaning – Still an Oxymoron, Euromonitor International, September 2009.
[202] How laundry detergent became a catalyst for green innovation, Yale Environment 360, June 2013. Available from: http://e360.yale.edu/feature/adam_lowry_how_laundry_detergent_became_green_innovation_catalyst/2662/
[203] The case for the 'A.I.S.E Low Temperature Washing Initiative', substantiation dossier, June 2013, A.I.S.E. Available from: http://www.iprefer30.eu/component/attachments/attachments?task=download&id=244

5.2.3 *Low/no harmful chemicals*

According to Euromonitor international, the shift towards home care products with lower levels of harmful chemical ingredients is gaining momentum and this includes laundry detergents.[197] For laundry detergents the reduction and elimination of phosphates has been in focus, as they are a leading cause of fresh water pollution. As a result, manufacturers have begun to produce phosphate-free laundry detergent products, which are now available on the market. P&G has pledged to eliminate phosphates from all of its laundry detergents from January 2014.[204] In addition, many smaller companies such as Ecover and Seventh Generation have been making phosphate-free laundry detergents since the 1980s.

5.2.4 *Natural/renewable ingredients*

The use of ingredients from natural or renewable sources instead of from petrochemical sources is increasing in the laundry detergents market. For most of the bulk ingredients this is not an option as they are inorganic and therefore cannot be easily replaced by renewable raw materials. However, for surfactants it is possible to use raw materials from renewable origins as their lipophilic compound is usually organic. Historically, vegetable and animal oils and fats were used as raw materials for soaps and detergents and thus the use of renewable raw materials in this product group is not a recent innovation. This will be discussed in further detail in technical background report.

5.3 Conclusions

A summary of the results from the sensitivity analysis and the LCA analysis for laundry detergents, along with suggestions for how these issues can be addressed by the EU Ecolabel and an estimate of the potential benefits associated, is presented in Table 46. The outcomes are presented by life cycle stage.

As the results of the LCA and sensitivity analysis have shown that the highest environmental impacts are associated with the use phase and the ingredients used, the focus for improvement should be on for these phases. The high environmental impact of the use phase can be addressed by encouraging consumers to wash at lower temperatures and promoting products which are effective at low temperatures. Product compaction should also be encouraged along with the restriction of harmful substances.

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[204] Procter & Gamble touts 'win-win' of cutting phosphates in all laundry soaps, Guardian Sustainable Business, January 2014. Available from: http://www.theguardian.com/sustainable-business/proctor-gamble-remove-phosphates-laundry-soap

Table 46: Outcomes of sensitivity analysis and improvement potentials

Stage	Environmental impact	Potential environmental gain	Good environmental practices/restrictions	Improvement potential
Ingredients	3-95 % impact contribution, highest for terrestrial ecotoxicity. Also important for natural land transformation, freshwater ecotoxicity and natural land transformation.	High.	For each functional group in the product composition, promote the use of substances which are less harmful in terms of ecotoxicity, aquatic toxicity and biodegradability.	Improving the environmental performance of ingredients used. The sensitivity analysis has shown that, for terrestrial ecotoxicity, the surfactants fatty alcohol sulphate and ethoxylated alcohols have the highest impact. For human toxicity, freshwater toxicity and marine ecotoxicity sodium percarbonate, sodium tripolyphosphate and zeolite have the highest impacts.
			Restrict the use of surfactants which have a significant impact on natural land transformation and agricultural land occupation.	The sensitivity analysis showed that impact can be reduced by excluding surfactants from coconut oil.
Packaging	0-37 % impact contribution, highest for agricultural land occupation.	Moderate.	Reduce the use of packaging materials from virgin sources by encouraging post-consumer materials for packaging.	As most of the environmental impact from packaging is due to the material, a decrease in the use of virgin materials will result in a direct decrease of the environmental impact. The use of compact detergents greatly reduces the amount of raw materials used for packaging.
Transport	0-17 % impact contribution, highest for photochemical oxidant formation. Overall the impact is minor compared to the use phase.	Low.	Decrease product weight and improve transport efficiency and logistics.	Saving of fossil fuel used in transport. Packaging weight can be reduced by using compacted detergents.
Use phase	3-96 % impact contribution, highest for water depletion and ionising radiation. The energy used to heat the water is the highest contributor.	Moderate – can only be addressed indirectly through recommendations on use.	Wash at lower temperatures. Encourage the use of detergents effective at 30 °C and below.	The sensitivity analysis has shown that reducing the wash temperature from 60 °C to 30 °C brings environmental gains of up to 46 %.
			Do not overdose the product as this increases the overall chemical load.	The sensitivity analysis has shown that by reducing the dosage by 20 % brings environmental gains for terrestrial ecotoxicity (19 %), freshwater ecotoxicity (15 %) and metal depletion (21 %) as well as for other impact categories. The overall chemical load of the product in the use phase is reduced and fewer raw materials are consumed.

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Stage	Environmental impact	Potential environmental gain	Good environmental practices/restrictions	Improvement potential
Treatment of packaging waste	1-85 % impact contribution, highest for marine eutrophication, but also significant for marine ecotoxicity.	Impacts depend on the packaging stage.	Encourage the use of packaging which is recyclable and easy to disassemble.	Recycling packaging waste is generally more environmentally preferable than other waste treatment options.

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6. CONCLUSIONS AND FURTHER STEPS

The Preliminary Report presents the research carried out, through stakeholder surveys, market analysis, legal review and an environmental performance investigation, on areas related to the product groups covered by the EU Ecolabel on laundry detergents. The preliminary report is a document that provides the background information and underpins the revision of the EU Ecolabel criteria and proposal for changes for two product groups: laundry detergents and industrial and institutional laundry detergents, due to their multiple overlaps.

The main findings of the Preliminary Report are:

-The *legal review* revealed that the 2012 Revision to the EU Detergents Regulation (EU/259/2012) will impact on the consumer laundry detergents on the market. The revision limits the use of **phosphates and phosphorus compounds** and lays down requirements for **dosage information**. The revision of the EU Ecolabel criteria shall take into account these changes to the Detergents Regulation.

-The *market analysis* revealed that the laundry detergent market in Europe is dominated by a few well-known brands, including Procter & Gamble, Henkel and Unilever. Laundry detergents are available in a range of formats, but **liquid laundry detergents** account for the **largest market share** in Europe, closely followed by powder laundry detergents. Market trends show that **sustainability is of growing importance** to consumers of laundry detergents, with an **increase in concentrated/compacted products**, use of **plant-based ingredients** and **minimisation of packaging**.

-The *technical analysis* revealed that the key environmental impacts associated with the product group can be summarised as follows:

- The life cycle stage with **the largest contribution to the environmental impact** profile of laundry detergents is the **use phase**, particularly the **energy** needed to **heat the water** for the wash cycle. For some impact categories, the **sourcing of raw materials** is also important.
- Based on the normalisation assessment, the most significant impact categories for laundry detergents in Europe are **Freshwater Eutrophication, Human Toxicity, Freshwater Ecotoxicity, Marine Ecotoxicity, and Natural Land Transformation**.

The results of the LCA for a powder laundry detergent conducted as part of the technical analysis are shown in Figure 36.

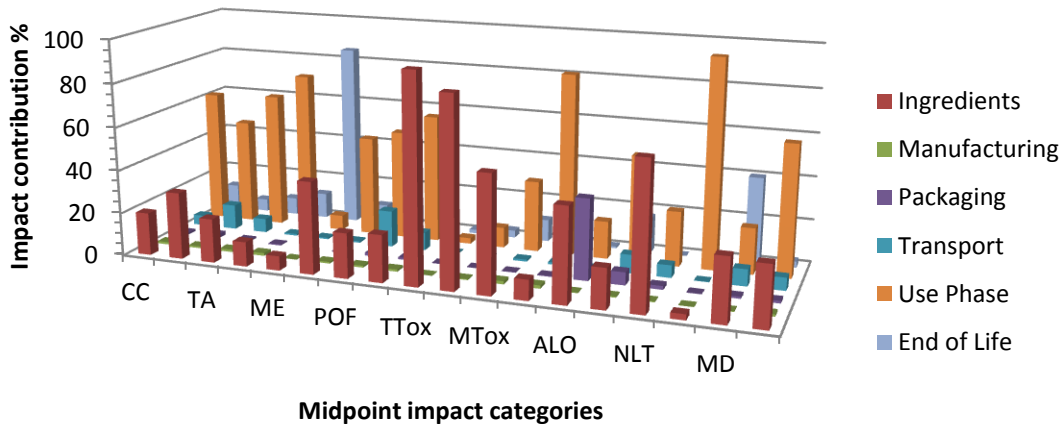

Figure 36: Impact contribution of different life cycle stages of a laundry detergent

These impacts are strongly correlated to each other via the energy use in the use phase (with the exception of natural land transformation). The use phase dominates the impact categories freshwater eutrophication,

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human toxicity, and marine ecotoxicity, and ingredients sourcing dominates the freshwater ecotoxicity and natural land transformation.

The key environmental performance indicators (KPIs), i.e. those variables that mainly drive the results for laundry detergents in Europe, based on the results of this study are:

- Wash temperature,
- Amount of product used per application,
- Choice of and amount of surfactant (although there are trade-offs between impact categories),
- Energy source used to heat the water,
- Emissions to water.

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ANNEXES

ANNEX I: Stakeholder survey

JOINT RESEARCH CENTRE

Institute for Prospective Technological Studies (IPTS)

QUESTIONNAIRE TO ANALYSE THE EXISTING SCOPE, MARKET SEGMENTATION AND ENVIRONMENTAL PERFORMANCE FOR LAUNDRY DETERGENTS

Stakeholders Consultation Document

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1. INTRODUCTION

Objectives

The EU Ecolabel is a key policy instrument in promoting environmentally friendly products and services. This document constitutes one of the initial stages of revision of the EU Ecolabel and the Green Public Procurement criteria (GPP) for laundry detergents. The objective of this first questionnaire relating to the existing Ecolabel criteria for laundry detergents is to determine whether the scope definition is still appropriate and which criteria need to amended, prolonged or withdrawn. In order to evaluate the current criteria in a successful and meaningful fashion, contact with relevant stakeholders is of upmost importance.

The EU Ecolabel criteria for 'Laundry Detergents' were adopted:

- in 2011 (2011/264/EU) for domestic laundry detergents,
- and in 2012 (2012/721/EU) in respect of industrial & institutional laundry detergents.

The aim of these criteria was to promote laundry detergents that correspond to the best 10-20 % of the products available on the community market in terms of environmental performance considering the whole life-cycle (from production, through the use phase and until disposal). These criteria are due to expire in April 2015 and in November 2016, respectively.

One of the goals of the revision is to obtain simplified criteria addressing the most important environmental impacts of laundry detergents from a life cycle perspective. This questionnaire covers both domestic and industrial and institutional laundry detergents.

Analysis of existing criteria

The framework of the Commission Decisions 2011/264/EU and 2012/721/EU that sets out the EU Ecolabel criteria for laundry detergents defines the aims of the criteria as promoting products that have a reduced impact on aquatic ecosystems, contain a limited amount of hazardous substances and whose performance has been tested. In addition, the criteria aim at reducing the energy consumption from laundering by promoting products that are efficient at low temperatures.

The current criteria are set for each of the following aspects of laundry detergents:

Domestic laundry detergents	Industrial and institutional laundry detergents
1. Dosage requirements	1. Product and dosage requirements
2. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)	2. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)
3. Biodegradability of organics	3. Biodegradability
4. Excluded or limited substances and mixtures	4. Excluded or limited substances and mixtures
5. Packaging requirements	5. Packaging requirements
6. Washing performance (fitness for use)	6. Washing performance (fitness for use)
7. Points	7. Automatic dosing systems
8. Consumer information	8. User information
9. Information appearing on the EU Ecolabel	

In the following sections the following abbreviation is used: for domestic products– DLD; for industrial and institutional – IILD.

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1.3 Confidentiality and contact details

All responses received through this questionnaire will be treated as confidential. Where data is published, this will be in an aggregated format only. Comments will not be attributed to an individual person or organisation unless this is specifically requested.

We rely heavily on stakeholder consultation, so your time and expertise are greatly appreciated and valued.

For further information regarding this questionnaire, please contact us writing to **Josie Arendorf** to the following e-mail address: **josie.arendorf@oakdenehollins.co.uk**.

Once this survey has been completed, please email to: JRC-IPTS-LAUNDRY-DETERGENT@ec.europa.eu

Thank you for your participation!

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2. QUESTIONNAIRE

2.1 Your contact details

First name:	Surname:
Email:	
Company/ Organisation:	
Organisation type: ☐ Industry ☐ Government ☐ Environmental Agency ☐Trade Association ☐ Competent body ☐ Other (please specify)	
Company/Organisation details: Email address Country Telephone Number	

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2.2 Scope and definition

a) Domestic laundry detergents

At present the product group "**laundry detergents**" comprises laundry detergents and pre-treatment stain removers, which fall under the following definitions:

Laundry detergents and pre-treatment stain removers whether in powder, liquid or any other form which are marketed and used for the washing of textiles principally in household machines but not excluding their use in laundrettes and common laundries.

Pre-treatment stain removers include stain removers used for direct spot treatment of textiles (before washing in the machine) but do not include stain removers dosed in the washing machine and stain removers dedicated to other uses besides pre-treatment.

This product group **does not compromise** products that are dosed by carriers such as **sheets, cloths or other materials nor washing auxiliaries used without subsequent washing, such as stain removers for carpets and furniture upholstery**.

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1. Do you agree with the existing products in scope?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
2. Is the current definition appropriate and suitable for this product category?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
3. Are there any laundry detergent products which are excluded by this definition which, in your opinion should be included?	☐ Yes ☐ No	If yes, please indicate.
4. Should other stain removers in addition to pre-treatment stain removers also be included in the criteria?	☐ Yes ☐ No	If yes, please indicate.
6. Is the current definition of 'principally used in household machines but not excluding use in laundrettes and common laundries' clear? How could this be improved?	☐ Yes ☐ No	If no, please explain why and/or propose modification.

b) Industrial and Institutional laundry detergents

At present the product group **"industrial and institutional laundry detergents"** comprises laundry detergents products performed by professional users in the industrial and institutional sector:

Included in the product group are **multi-component-systems** constituting of more than one component used to build up a complete detergent or a laundering program for automatic dosing system.

This product group **shall not comprise products for obtaining textile attributes such as water-repellent, waterproof or fire-proof, etc**. Furthermore, the product group shall not comprise **products that are dosed by carriers such as sheets, cloths or other materials**, as well **as washing auxiliaries used without subsequent washing, such as stain removers for carpets and furniture upholstery.**

Consumer laundry detergents are excluded from the scope of this product group.

7. Do you agree with the existing products in scope?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
8. Is the current definition appropriate and suitable for this product category?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
9. Are there any laundry detergent products which are excluded by this definition which, in your opinion should be included?	☐ Yes ☐ No	If yes, please indicate.

c) All laundry detergents

10. Are differences in definition and scope necessary for the EU Ecolabel and GPP?	☐ Yes ☐ No	If yes, please explain why and/or propose modification.
11. Should the criteria for domestic and industrial and institutional laundry detergents be merged? Or remain as two separate criteria?	☐ Yes ☐ No	If yes, please indicate the reasoning behind. If you have a proposal of a joint definition, please share it. If possible, please indicate also expected pros and cons.

These questions are specifically addressed to the EUEB members and Competent Bodies:

11. Have producers or any other interested party had difficulty in understanding the scope of the product group, or encountered difficulties because the product was not covered within the current scope and definition?

☐ Yes ☐ No

If yes, please specify:

12. Have you ever denied the EU Ecolabel licence for the laundry detergents product group because of a product not being covered by the current scope and definition?

☐ Yes ☐ No

If yes, please specify:

These questions are specifically addressed to the stakeholders/licence holders:

13. Do you have any difficulty in understanding the scope of the product group?

☐ Yes ☐ No

If yes, please specify:

14. Have you ever been denied the EU Ecolabel licence for laundry detergents because of a product not being covered by the current scope and definition?

☐ Yes ☐ No

If yes, please specify:

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2.3 The need for criteria revision

Please indicate which of the criteria you believe may need revision and, where appropriate, please explain how in your opinion the criteria should evolve:

a) Domestic laundry detergents

15. Dosage requirements:	☐Keep	☐ Modify/remove Please give further details:
16. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)	☐Keep	☐ Modify/remove Please give further details:
17. Biodegradability of organics	☐Keep	☐ Modify/remove Please give further details:
18. Excluded or limited substances and mixtures	☐Keep	☐ Modify/remove Please give further details:
19. Packaging requirements	☐Keep	☐ Modify/remove Please give further details:
20. Washing performance (fitness for use)	☐Keep	☐ Modify/remove Please give further details:

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21. Points	☐Keep	☐ Modify/remove Please give further details:
22. Consumer information	☐Keep	☐ Modify/remove Please give further details:
23. Information appearing on the EU Ecolabel	☐Keep	☐ Modify/remove Please give further details:

b) Industrial and institutional laundry detergents

24. Product and dosage requirements:	☐Keep	☐ Modify/remove Please give further details:
25. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)	☐Keep	☐ Modify/remove Please give further details:
26. Biodegradability	☐Keep	☐ Modify/remove Please give further details:

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27. Excluded or limited substances and mixtures	☐Keep	☐ Modify/remove Please give further details:
28. Packaging requirements	☐Keep	☐ Modify/remove Please give further details:
29. Washing performance (fitness for use)	☐Keep	☐ Modify/remove Please give further details:
30. Automatic dosing systems	☐Keep	☐ Modify/remove Please give further details:
31. User information - information appearing on the EU Ecolabel	☐Keep	☐ Modify/remove Please give further details:

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2.4 Questionnaire on currently valid criteria

In order to assist with the revision of the criteria, questions for the stakeholders regarding preliminary issues identified for consideration in the revision of the current criteria are outlined in this section.

Criterion 1: Dosage requirements (DLD) / Product and dosage requirements (IILD)

a) Domestic laundry detergents

The recommended maximum dosage amounts, as described in the current criteria, are summarised in the table below:

Product type	Dosage, powder/tablet	Dosage, liquid/gel
Heavy-duty laundry detergent, colour-safe detergent	17.0 g/kg wash	17.0 ml/kg wash
Low-duty detergent	17.0 g/kg wash	17.0 ml/kg wash
Stain remover (pre-treatment only)	2.7 g/kg wash	2.7 ml/kg wash

Dosage corresponds to grams or millimetres of product used per kilogram wash. Heavy-duty detergents are defined as detergents used for ordinary washing of white and coloured textiles at any temperature. Low-duty detergents are defined as detergents promoting special fabric care, e.g. delicate fabrics such as wool and silk or for delicate colours.

32. Are the dosage criteria strict enough for promoting the best 10-20 % (in terms of environmental performance) of laundry detergent products currently available on the market?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
33. Are additional dosage requirements needed? For example dosage depending on water hardness or level of soiling?	☐ Yes ☐ No	If yes, please explain why and/or propose modification

b) Industrial and institutional laundry detergents

The current criteria state that the recommended total dosage for 1 kg of laundry according to the degree of soiling and water hardness shall be given in g/kg laundry or ml/kg laundry. For multi-component systems all products have to be included with the worst case dosage for assessments of the criteria.

34. Are the total chemicals criteria strict enough for promoting the best 10-20 % (in terms of environmental performance) of laundry detergent products currently available on the market?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
35. Are additional dosage requirements needed? Such as maximum dosage limits?	☐ Yes ☐ No	If yes, please explain why and/or propose modification

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Criterion 2: Toxicity to aquatic organisms: Critical Dilution Volume (CDV)

a) Domestic laundry detergents

The current criteria specify that the critical dilution volume of the product must not exceed the following limits (CDVchronic):

Product type	**$CDV_{chronic}$**
Heavy-duty laundry detergent, colour-safe detergent	35,000 l/kg wash
Low-duty detergent	20,000 l/kg wash
Stain remover (pre-treatment only)	3,500 l/kg wash

36. Are the CDV criteria effective in distinguishing between the state of the art and the best performing products in laundry detergents product group?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
37. Should different CDV limits be set for different forms of laundry detergent, for example powder or gel capsules?	☐ Yes ☐ No	If yes, please explain why and/or propose modification.
38. Should CDV limits be set for different levels of water hardness or level of soiling?	☐ Yes ☐ No	If yes, please explain why and/or propose modification.

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b) Industrial and institutional laundry detergents

The current criteria specify that the critical dilution volume of the product must not exceed the following limits (CDVchronic):

Soft water (0-6 °dH)	**$CDV_{chronic}$ (L/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	30,000	40,000	50,000
Liquid	50,000	60,000	70,000
Multi-component-system	50,000	70,000	90,000

Medium water (7-13 °dH)	**$CDV_{chronic}$ (L/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	40,000	60,000	80,000
Liquid	60,000	75,000	90,000
Multi-component-system	60,000	80,000	100,000

Hard water (>14 °dH)	**$CDV_{chronic}$ (L/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	50,000	75,000	90,000
Liquid	75,000	90,000	120,000
Multi-component-system	75,000	100,000	120,000

39. Are the CDV criteria strict enough for promoting the best 10-20 % (in terms of environmental performance) of laundry detergent products currently available on the market?	☐ Yes ☐ No	If no, please explain why and/or propose modification.

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Criterion 3: Biodegradability of organics

a) Domestic laundry detergents

The current criteria specify that the content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable aNBO) and/or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

For aerobically non-biodegradable organics (aNBO)

Product type	**aNBO, powder**	**aNBO, liquid**
Heavy-duty laundry detergent, colour-safe detergent	1.0 g/kg wash	0.55 g/kg wash
Low-duty detergent	0.55 g/kg wash	0.30 g/kg wash
Stain remover (pre-treatment only)	0.10 g/kg wash	0.10 g/kg wash

For anaerobically non-biodegradable organics (anNBO)

Product type	**anNBO, powder**	**anNBO, liquid**
Heavy-duty laundry detergent, colour-safe detergent	1.3 g/kg wash	0.70 g/kg wash
Low-duty detergent	0.55 g/kg wash	0.30 g/kg wash
Stain remover (pre-treatment only)	0.10 g/kg wash	0.10 g/kg wash

40. Are the current limits set for the maximum amounts of aerobically and anaerobically non-biodegradable strict enough for laundry detergents available on the market?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
41. Are the current limits effective in distinguishing between the state of the art and the best performing products in laundry detergents product group?	☐ Yes ☐ No	If no, please explain why and/or propose modification.
42. Should specific requirements apply to the biodegradability of surfactants?	☐ Yes ☐ No	If yes, please explain why and/or propose modification
43. Should the limits be set for different levels of water hardness or level of soiling?	☐ Yes ☐ No	If yes, please explain why and/or propose modification

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b) Industrial and institutional laundry detergents

The current criteria specify that the content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable aNBO) and/or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

For aerobically non-biodegradable organic substances:

Soft water (0-6 °dH)	**aNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	0.70	1.10	1.40
Liquid	0.50	0.60	0.70
Multi-component system	1.25	1.75	2.50

Medium water (7-13 °dH)	**aNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	1.10	1.40	1.75
Liquid	0.60	0.70	0.90
Multi-component system	1.75	2.50	3.75

Hard water (>14 °dH)	**aNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	1.40	1.75	2.20
Liquid	0.70	0.90	1.20
Multi-component system	2.50	3.75	4.80

For anaerobically non-biodegradable organic substances:

Soft water (0-6 °dH)	**anNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	0.70	1.10	1.40
Liquid	0.50	0.60	0.70
Multi-component system	1.25	1.75	2.50

Medium water (7-13 °dH)	**anNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	1.10	1.40	1.75
Liquid	0.60	0.70	0.90
Multi-component system	1.75	2.50	3.75

Hard water (>14 °dH)	**anNBO (g/kg laundry)**		
Product type/Degree of soiling	Light	Medium	Heavy
Powder	1.40	1.75	2.20
Liquid	0.70	0.90	1.20
Multi-component system	2.50	3.75	4.80

44. Are the current limits set for the maximum amounts of aerobically and anaerobically non-biodegradable strict enough for industrial and institutional laundry detergents?	☐ Yes ☐ No	If no, please explain why and/or propose modification.

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45. Are the current limits effective in distinguishing between the state of the art and the best performing products in industrial and institutional laundry detergents product group?	☐ Yes ☐ No	If no, please explain why and/or propose modification.

Criterion 4: Excluded or limited substances and mixtures

Under the existing criteria, the following ingredients must not be included in the product:

Substance	Domestic laundry	Industrial and institutional laundry detergents
Phosphates	X	X
EDTA (ethylene diamine tetraacetate)	X	X
Nitromusks and polycyclic musks	X	
APEO (alkyl phenol ethoxylates) and ADP (alkylphenols and derivatives thereof)		X

In addition, the most critical substances regarding human health and environment must also not be included in the product. This is a standard requirement for ecolabelled washing and cleaning products. However, there are certain substances which are specifically exempted from this requirement:

Substance	Domestic Laundry	Industrial and institutional laundry detergents
Surfactants (in concentrations <25 % in the product)	X	
Surfactants (in concentrations <20 % in the product)		X
Fragrances	X	
Biocides used for preservation	X	X
Enzymes	X	X
Bleach catalysts	X	X
NTA as in impurity in MGDA and GLDA	X	X
Optical brighteners (only for heavy duty domestic laundry detergent)	X	

46. Are there any additional ingredients which should be specifically excluded or limited from ecolabelled laundry detergents?	☐ Yes ☐ No	If yes, please specify and provide rationale or supporting information.

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47. Should the list of exempted substances be reviewed?	☐ Yes ☐ No	If yes, please explain why and/or propose modification and provide rationale or supporting information.

Criterion 5: Packaging requirements

a) Domestic laundry detergents

The current criteria for laundry products specify that the weight/utility ratio (WUR) must not exceed the following values:

Product type	WUR
Powders	1.2 g/kg wash
Others (e.g. liquids, gels, tablets, capsules)	1.5 g/kg wash

Plastic/paper/cardboard packaging containing more than 80 % recycled material is exempt from this requirement.

48. Are the WUR limits acceptable for laundry detergents currently on the market?	☐ Yes ☐ No	If no, please specify.
49. Should additional criteria be set to further promote the use of recycled materials in packaging?	☐ Yes ☐ No	If yes, please explain why and/or propose modification
50. Should the WUR limits be set by water hardness? Such as for industrial and institutional laundry detergents.	☐ Yes ☐ No	If yes, please explain why and/or propose modification
51. Should there be restrictions on combinations of materials used for packaging? For instance to encourage ease of disassembly for recycling.	☐ Yes ☐ No	If yes, please explain why and/or propose modification
52. Should additional criteria be set to promote the use of sustainably sourced virgin wood fibres for paper and cardboard packaging?	☐ Yes ☐ No	If yes, please explain why and/or propose modification

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b) Industrial and institutional laundry detergents

The current criteria for laundry products specify that the weight/utility ratio (WUR) must not exceed the following values:

Product type/water hardness	**WUR (g/kg laundry)**		
	Soft water	Medium water	Hard water
Powders	1.5	2.0	2.5
Liquids	2.0	2.5	3.0

Plastic/paper/cardboard packaging containing more than 80 % recycled material or more than 80 % plastic from renewable origin is exempt from this requirement.

53. Are the WUR limits acceptable for industrial and institutional laundry detergents available currently on the market?	☐ Yes ☐ No	If no, please specify.
54. Should additional criteria be set to further promote the use of recycled materials in packaging?	☐ Yes ☐ No	If yes, please explain why and/or propose modification
55. Should there be restrictions on combinations of materials used for packaging? For instance to encourage ease of disassembly for recycling.	☐ Yes ☐ No	If yes, please explain why and/or propose modification
56. Should additional criteria be set to promote the use of sustainably sourced virgin wood fibres for paper and cardboard packaging?	☐ Yes ☐ No	If yes, please explain why and/or propose modification

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Criterion 6: Washing performance (fitness for use)

a) Domestic laundry detergents

The criteria state that the product shall comply with the performance requirements as specified in the EU Ecolabel laundry detergents performance test's latest version which can be found here: http://ec.europa.eu/environment/ecolabel/ecolabelled_products/categories/laundry_detergents_en.htm.

57. **Please provide us with your comments on the washing performance test and, if appropriate proposals for modification**

b) Industrial and institutional laundry detergents

The existing criteria state that the primary laundering effects of the detergent such as dirt and stain removal capacity must be documented by the producer/applicant with the aid of artificially soiled test clothes which are washed in the process.

58. **Please provide us with your comments on the washing performance test and, if appropriate, proposals for modification**

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Criterion 7: Points (DLD only)

The current criteria utilise a points scoring system which has the objective of 1) promoting cold water and low-temperature products and 2) promoting products with very low emissions of hazardous substances to the environment. The maximum available number of points is 8 and a minimum of 3 points is required.

The points available for heavy-duty and low-duty laundry detergents are summarised below:

For heavy-duty laundry detergents:

Criteria	**Description**	**Points**
Climate profile	Coldwater product (washing performance documents at ≤ 20 °C	2P
	Low-temperature product (washing performance documented at > 20 °C to < 30 °C)	1P
Maximum dosage	Max dosage ≤ 14 g/kg wash (powder/tablet) or ≤ 14 ml/kg wash (liquid/gel)	2P
	Max dosage ≤ 16 g/kg wash (powder/tablet) or ≤ 16 ml/kg wash (liquid/gel)	1P
CDV	$CDV_{chronic}$ < 25,000 l/kg wash	2P
	$CDV_{chronic}$ between 25,000 to 30,000 l/kg wash	1P
aNBO	aNBO ≤ 75 % of limit value	1P
anNBO	anNBO ≤ 75 % of limit value	1P

For low-duty laundry detergents:

Criteria	**Description**	**Points**
Climate profile	Coldwater product (washing performance documents at ≤ 20 °C	2P
	Low-temperature product (washing performance documented at > 20 °C to < 30 °C)	1P
Maximum dosage	Max dosage ≤ 14 g/kg wash (powder/tablet) or ≤ 14 ml/kg wash (liquid/gel)	2P
	Max dosage ≤ 16 g/kg wash (powder/tablet) or ≤ 16 ml/kg wash (liquid/gel)	1P
CDV	$CDV_{chronic}$ < 15,000 l/kg wash	2P
	$CDV_{chronic}$ between 1 5,000 to 18,000 l/kg wash	1P
aNBO	aNBO ≤ 75 % of limit value	1P
anNBO	anNBO ≤ 75 % of limit value	1P

59. Based on laundry detergents currently available on the market, does the points system effectively promote cold water and low-temperature products?	☐ Yes ☐ No	If no, please specify.

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60. Could anything be done to further promote the use of cold water and low-temperature products through Ecolabel?	☐ Yes ☐ No	If yes, please specify.

Criterion 7: Automatic dosing systems (IILD only)

With regards to automatic dosing systems, the existing criteria state that:

Multi-component systems shall be offered to the customer together with an automatic and controlled dosing system.

In this must incorporate customer visits:

- To ensure correct dosage
- To be performed at customers premise
- At least once a year during the license period
- As a minimum must include calibration of dosage equipment
- Can be performed by a third party

61. Are the criteria for automatic dosing systems efficient?	☐ Yes ☐ No	If no, please explain why you think so.

Criterion 8: Consumer information (DLD) / User information – Information appearing on the EU Ecolabel (IILD)

a) Domestic laundry detergents

Dosage instructions

Under the existing criteria, dosage instructions shall be specified for 'normally' and 'heavily' soiled textiles as well as various water hardness' ranges relevant to the countries concerned. The difference between the dosage recommendations for the lowest water hardness range for normally soiled textiles and the highest water range for heavily soiled textiles may not differ by more than a factor of 2.

62. Are the requirements for dosage instructions efficient?	☐ Yes ☐ No	If no, please explain why you think so.

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Information on the packaging

Under the existing criteria, the following washing recommendations shall appear on the packaging:

- Wash at the lowest possible temperature
- Always wash with full load
- Dose according to soil and water hardness, follow the dosing instructions
- If you are allergic to house dust, always wash bedding at 60 °C. Increase wash temperature to 60 °C in case of infectious diseases.
- Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution, waste production and energy consumption.

63. Should further information on washing recommendations be included on the packaging?	☐ Yes ☐ No	If yes, please specify.
64. Do you have any recommendations for information on the packaging which encourages washing at low temperatures?	☐ Yes ☐ No	If yes, please specify.

Claims on the packaging

The current criteria state that any claims on the packaging shall be documented through either performance testing or other relevant documentation (e.g. claims of efficiency at low temperatures).

65. Are the requirements for claims on the packaging efficient?	☐ Yes ☐ No	If no, please explain why you think so.

b) Industrial and institutional laundry detergents

Information on the packaging/product information sheet

Under the existing criteria, the following washing recommendations shall appear on the packaging and/or product information sheet:

- Wash at the lowest recommended temperature
- Always wash with the highest possible load, the textiles allow
- Dose according to the dosing instructions and use the dosage according to water hardness and degree of soiling
- Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution, waste production and energy consumption.

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66. Is this information on the packaging sufficient for encouraging low temperature washing?	☐ Yes ☐ No	If no, please specify.
67. Is there any other information which should be included on the packaging/product information sheet?	☐ Yes ☐ No	If yes, please specify.

Claims on the packaging

The current criteria state that any claims on the packaging shall be documented through either performance testing or other relevant documentation (e.g. claims of efficiency at low temperatures).

68. Are the requirements for claims on the packaging efficient?	☐ Yes ☐ No	If no, please explain why you think so.

2.5 Additional questions

These questions are for <u>all</u> laundry detergents

2.5.1 Measurement thresholds

The framework of the current EU Ecolabel defines the concentration of ingredients in the product which implies documentation at a threshold of more than or equal to 0.010 % by weight of the preparation.

Should the threshold be:

lower, such as: ☐ % higher, such as: ☐ % Remain at 0.010 % ☐

Please, specify your reason if you propose any change in the current threshold:

2.5.2 Further issues or hot spots for laundry detergents

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The current criteria are set for 9 different aspects of laundry detergents (8 for IILD), with the aim of promoting products which have a reduced impact on aquatic ecosystems, contain a limited amount of hazardous substances and whose performance has been tested. Furthermore they aim to promote products that are efficient at low temperatures.

Should further criterion be developed? Either because all the issues are not already covered or because of recent developments which affect the environmental performance of laundry detergents.

2.5.3 Market data

The market analysis forms an integral part of the criteria revision process, as it identifies important drivers, trends and innovations in the market for laundry detergents.

If you have any information on market statistics for laundry detergents product group please mention this here so that we can get in touch with you and collect the details needed for the project. Thank you in advance for your cooperation.

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ANNEX II: Laundry detergent ingredients

Surfactants
Surfactants (surface active agents) are the active cleaning ingredients found in laundry detergents, this is due to their ability to remove dirt from wet hydrophobic surfaces and keep it in suspension. They are organic substances which have both a hydrophobic part and a hydrophilic part. Surfactants are a large group of surface active substances and are used throughout the entire spectrum of cleaning products. The primary function of surfactants in laundry detergents is to remove soil. Three types of surfactants are found in laundry detergent products; these are anionic, non-ionic and cationic. It is common for more than one type of surfactant to be used in a laundry detergents, this is because their actions reinforce each other thus giving rise to increased cleaning ability. As a result of their surface activity properties, surfactants are relatively toxic to aquatic organisms. The toxic effects and biodegradability of surfactants varies depending on their carbohydrate chain structure.

Builders
Builders are used to enhance the action of surfactants (and other ingredients of the detergent) by softening the water, by helping to disperse soils and prevent their redeposition out of solution and to assist with dissolving oil-based soils. Phosphorous compounds are often used as builders in cleaning products. However, phosphorus is a major contributor to eutrophication in water systems and the use of phosphorus compounds in laundry detergents is being phased out. Other builders which do not contribute to eutrophication are available on the EU market, therefore phosphates and other phosphorous compounds can be replaced. Phosphates are currently banned from use in laundry detergents in some European countries and their use is also limited by the EC Detergents Regulation. However, the alternatives such as zeolites are not without issues, in terms of environmental performance. These alternative builders include zeolites, MGDA, GLDA and citrates. Ethylenediaminetetracetic acid (EDTA) is also a commonly used builder in laundry detergents. EDTA is used to improve cleaning ability through water softening, it is a very strong complexing agents. As with phosphates, the use of EDTA in laundry detergents is also of environmental concern as it is poorly biodegradable. The use of EDTA in laundry detergents is restricted under the current Ecolabel criteria.

Biocides/preservatives
Preservatives are used to prevent the product from spoiling during storage, typically they are only required in liquid or gel laundry detergents. They function by preventing the break-down of organic ingredients; some preservatives are anti-bacterial in function. Often biocides are used as preservatives in laundry detergents. However, some biocides are bio-accumulative and this may have negative impacts on human health. Typically they are only added in very small amounts and are not added to powder detergents. The use of biocides is currently restricted by EU regulation and in the current EU Ecolabel criteria for laundry detergents.

Bleaches
Bleaching agents are used for hygienic reasons, to remove stains and to bleach textiles. Bleaching impacts on the fibre structure of textiles and in doing so reduces the life of some textiles. Some halogenated bleaches such as active chlorine bleaches may be toxic and degrade slowly in the aquatic environment. Bleaching agents such as sodium hypochlorite are inherently toxic and can break down into toxic by-products which present a threat to human health and the environment. The environmental impacts of bleaching agents vary greatly depending on the chemical groups used. Other bleaching agents used are percarbonates, perborates, peroxides and peracids.

Optical brighteners
Optical brighteners are used to make fabrics appear whiter and brighter, they do this by enhancing the light reflected from the fabric surface. Substances used as optical brighteners include aminotriazines, coumarins and stilbenes. Many optical brighteners used in laundry detergents are not biodegradable and therefore will remain in wastewater for long periods of time.

Fragrances
Fragrances are used to neutralise the inherent odour of detergent chemicals and give the laundry a pleasant smell. There are many different fragrance substances used by the detergent industry of which several are of environmental concern. For example, nitro-musks and polycyclic musk compounds are suspected of being

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carcinogenic and they show a tendency to accumulate in a mother's milk. As a consequence all nitro-musks are banned from EU Ecolabel laundry detergent products.

Dyes
Dyes are added to laundry detergents for aesthetic reasons and have no effect on the ability of the product to clean textiles. The environmental impacts of dye substances vary greatly depending on the functional group, therefore, no general remarks have been made on their environmental impacts of toxicity.

Enzymes
Enzymes are typically used in laundry detergents to improve washing performance at low temperatures. They function by targeting difficult stains and breaking them down into smaller parts which can be more easily removed by other ingredients. As they do not lose functionality after use, they can replace large quantities of other chemicals with the same function. Enzymes which are commonly used in laundry detergents and stain removers include: protease, lipase and amylase. Enzymes have few negative environmental impacts as they are readily biodegradable and have no adverse effects to the aquatic system.[205]

Solvents
Organic solvents are often added to liquid detergents in order to dissolve the ingredients. Typically alcohols are used as solvents in laundry detergent products. The environmental impact of solvents will vary depending on the exact substance.

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[205] *Environmental assessment of laundry detergents*, European Textile Services Association, http://www.eco-forum.dk/detergents/index_files/Page693.htm

ANNEX III: Market analysis data

A. COMEXT trade data

Table 47: Intra EU-28 Import, 2013

	Intra EU – Import							
	34012090		34012010		34011100		34011900	
	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)
AT	9,860,816	62,034	1,124,141	7,340	26,174,482	107,439	5,764,565	18,035
BE	25,664,690	129,710	1,566,479	8,758	32,046,592	160,771	11,920,610	49,215
BG	905,873	5,503	752,468	2,793	5,952,192	25,297	1,724,299	9,259
CY	690,700	4,314	64,553	484	2,153,361	7,192	314,136	2,970
CZ	6,873,642	52,329	2,378,855	9,761	18,439,363	90,784	3,829,189	25,560
DE	21,195,747	162,789	1,694,411	11,611	88,930,730	497,277	21,558,555	86,957
DK	10,535,994	76,164	1,550,330	9,494	4,657,139	22,385	4,656,260	31,819
EE	1,757,755	6,956	431,086	2,331	1,198,503	3,539	628,852	1,716
ES	13,325,759	90,187	969,078	4,849	30,545,978	188,778	6,977,603	39,721
FI	7,287,388	38,846	460,024	1,635	10,834,368	33,551	2,119,857	6,506
FR	67,417,126	455,955	2,590,283	18,018	68,393,144	374,015	28,936,326	118,231
UK	29,481,643	203,910	9,428,590	82,943	45,901,601	206,401	15,039,155	99,115
EL	5,237,123	33,215	857,724	5,250	9,173,623	49,960	1,706,128	6,123
HR	1,917,315	15,218	43,436	169	5,290,281	28,277	1,114,701	3,752
HU	6,956,298	49,954	85,424	494	16,888,678	103,202	3,914,903	15,013
IE	13,136,920	49,862	12,970,485	53,878	22,761,315	84,656	5,496,298	23,550
IT	10,388,226	59,742	5,670,541	65,435	25,702,018	123,039	7,697,502	51,012
LT	1,829,651	10,078	305,318	3,149	2,965,470	10,297	1,373,456	5,683
LU	2,763,987	8,865	266,810	1,119	2,311,999	10,715	1,164,788	2,660
LV	2,919,171	11,981	137,630	1,120	1,636,046	6,070	742,721	3,921
MT	695,420	5,240	116,791	715	731,756	2,661	214,708	799
NL	11,816,657	79,981	1,999,497	11,650	43,765,012	243,412	14,872,990	85,550
PL	16,182,112	108,465	8,230,003	101,387	24,722,433	134,031	7,083,988	41,675
PT	16,531,568	154,776	4,403,310	42,243	15,060,772	89,111	12,871,024	96,527
RO	6,682,534	72,204	715,009	3,319	14,164,858	71,005	2,583,951	11,897
SE	16,275,142	108,426	430,921	4,050	13,116,281	73,894	2,833,061	9,231
SI	2,730,381	19,026	126,615	778	5,801,524	25,590	984,461	3,726
SK	3,140,560	39,003	86,403	640	7,591,582	36,677	1,806,229	7,544
EU-28	**314,200,198**	**2,114,733**	**59,456,215**	**455,413**	**546,911,101**	**2,810,026**	**169,930,316**	**857,767**

Table 48: Intra EU-28 Export, 2013

	Intra EU – Export							
	34012090		34012010		34011100		34011900	
	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)
AT	1,094,700	4,845	192,903	603	4,718,597	7,502	1,580,637	4,393
BE	27,477,138	255,379	4,403,867	30,035	17,822,614	86,541	15,177,706	69,041
BG	949,131	14,150	493,366	1,413	2,781,554	13,042	256,791	834
CY	12,104	49	0	0	192,796	584	46	0
CZ	3,336,662	22,931	2,663	21	21,321,582	118,392	1,060,645	5,590
DE	47,386,021	392,547	9,028,764	67,457	226,578,415	1,387,417	21,400,132	52,531
DK	11,242,005	67,628	22,467	70	3,932,153	9,280	1,070,521	2,299
EE	405,345	1,778	8,815	51	59,681	211	58,425	208
ES	9,908,208	97,737	2,657,162	17,194	9,972,946	53,802	24,080,173	171,882
FI	374,918	1,683	90	0	73,045	160	84,416	264
FR	27,882,645	114,877	2,025,873	25,365	19,440,672	43,955	16,897,062	89,961
UK	23,490,863	114,139	20,181,125	128,050	56,572,423	251,280	35,999,204	272,031
EL	3,375,052	21,669	277,761	1,049	1,747,191	6,316	3,269,659	20,172

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HR	79,443	446	0	0	293,872	246	5,375	0
HU	1,408,276	12,494	16,677	82	6,476,464	25,488	1,722,603	5,002
IE	1,177,435	4,816	1,161,750	5,694	2,098,506	6,673	3,158,113	7,627
IT	122,879,067	895,849	3,485,510	30,698	35,231,803	123,782	43,383,588	326,914
LT	395,514	1,941	12,987	65	596,157	2,017	584,720	4,071
LU	670,501	2,592	65,879	303	313,102	1,092	307,084	404
LV	138,757	717	16,398	123	1,099,836	2,295	144,924	618
MT	0	0	0	0	0	0	0	0
NL	14,176,639	75,784	1,359,995	10,276	31,147,877	154,328	30,498,680	122,001
PL	25,051,772	258,898	182,434	582	73,844,810	437,245	20,752,106	108,947
PT	940,288	6,594	1,134,634	8,052	7,047,479	25,613	140,059	1,010
RO	528,651	3,637	81,374	415	2,073,865	6,487	321,089	1,587
SE	18,196,810	112,707	542,152	2,402	4,109,648	16,079	682,902	976
SI	433,869	3,275	361,124	3,452	2,498,055	6,737	416,488	1,344
SK	292,570	1,237	2,700	14	3,773,695	26,193	112,146	269
EU-28	**343,304,384**	**2,490,399**	**47,718,470**	**333,466**	**535,818,838**	**2,812,757**	**223,165,294**	**1,269,976**

Table 49: Extra EU-28 Import, 2013

	Extra EU - Import							
	34012090		**34012010**		**34011100**		**34011900**	
	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)
AT	246,195	1,553	11,999	80	5,022,528	23,157	221,476	316
BE	816,756	7,302	764,777	9,019	10,307,464	73,591	9,915,524	67,101
BG	637,037	8,186	2,415,358	32,491	3,741,211	28,992	2,768,199	31,095
HR	605,945	6,932	9,329	18	1,551,290	7,958	147,388	638
CY	17,291	72	227,227	2,213	208,714	1,097	99,296	423
CZ	155,165	1,169	31,296	254	7,931,812	54,491	1,364,856	10,236
DK	362,049	1,549	5,406	9	1,067,266	4,375	2,310,784	16,979
EE	41,662	381	0	0	107,750	689	115,885	765
FI	88,554	442	104	0	184,879	673	21,488	51
FR	7,087,629	74,931	6,159,096	77,272	13,200,985	85,339	5,814,483	39,309
DE	12,932,777	136,276	3,112,561	40,009	25,084,913	162,740	2,544,635	11,612
EL	494,439	3,194	295,164	3,950	768,467	3,418	898,726	6,968
HU	172,617	847	0	0	1,548,461	10,180	328,175	2,317
IE	253,569	2,056	8,774	14	83,309	311	107,769	76
IT	665,500	2,860	4,398,303	57,936	5,901,760	38,371	2,043,344	14,753
LV	88,088	700	67	0	394,950	1,813	565,887	3,274
LT	3,808	12	269,537	3,601	321,255	1,557	241,131	1,586
LU	3,310	1	0	0	368	0	1,304	0
MT	31,714	109	0	0	391,931	1,955	16,318	77
NL	2,848,966	13,695	757,995	9,980	17,185,365	120,928	8,439,748	41,470
PL	1,430,124	14,996	1,213,620	13,217	15,367,611	107,950	747,361	5,326
PT	83,108	973	96,520	1,940	2,049,035	15,273	149,786	986
RO	329,168	3,586	665,918	2,750	5,520,286	46,929	2,063,374	20,255
SK	143,331	1,372	476	0	1,360,324	9,991	82,582	283
SI	155,853	616	73,441	1,280	1,094,165	2,017	640	0
ES	1,227,394	11,949	1,182,972	14,518	6,472,729	28,622	3,616,779	27,319
SE	1,641,364	11,383	772,982	8,472	2,530,516	12,857	335,935	983
UK	22,440,645	112,045	1,853,675	20,864	37,414,669	225,237	10,970,544	64,185
EU-28	**55,004,058**	**419,187**	**24,326,597**	**299,887**	**166,814,013**	**1,070,511**	**55,933,417**	**368,383**

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Table 50: Extra EU-28 Export, 2013

	Extra EU - Export							
	34012090		34012010		34011100		34011900	
	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)
AT	399,586	958	2,062	2	1,113,568	2,561	624,208	2,805
BE	3,726,420	9,726	281,159	2,013	2,176,500	7,286	642,924	1,340
BG	1,291,330	14,903	33,992	273	2,034,154	11,890	392,756	2,477
HR	58,358	391	0	0	2,064,688	8,334	55,951	79
CY	50	0	0	0	42,312	126	0	0
CZ	284,908	1,941	83	0	5,579,107	23,425	629,699	4,777
DK	8,926,081	35,579	504,221	3,863	770,952	2,025	460,424	1,169
EE	1,066	6	0	0	99,778	422	106,848	430
FI	761,726	3,098	0	0	82,844	139	84,077	197
FR	13,276,215	44,909	436,236	2,676	29,392,256	72,597	9,268,074	33,776
DE	11,800,258	71,363	5,150,878	24,039	93,553,880	477,675	6,204,430	14,889
EL	137,441	833	0	0	282,278	677	1,922,056	10,664
HU	569,107	5,060	660	0	2,310,404	9,182	593,934	2,917
IE	2,684	2	4,964	22	153,716	52	51,207	42
IT	11,731,905	72,310	837,540	2,839	13,375,321	33,338	11,241,019	80,519
LV	82,096	418	19	0	1,979,052	3,580	948,620	6,015
LT	1,491,223	7,349	630,394	6,291	1,016,481	3,793	1,572,536	9,321
LU	413	1	11	0	530	0	515	0
MT	175,185	768	0	0	0	0	0	0
NL	2,861,688	14,757	427,105	1,355	33,332,357	135,171	7,039,630	27,206
PL	4,289,527	35,350	230,445	2,009	23,320,411	95,959	1,834,435	7,506
PT	977,221	5,946	316,416	1,854	5,213,924	13,709	5,078,806	75,953
RO	283,368	2,037	0	0	2,787,585	8,954	42,816	38
SK	21,293	134	0	0	117,035	388	249,529	1,244
SI	770,917	4,675	16,623	200	1,138,156	5,825	152,001	1,256
ES	4,344,861	37,698	173,484	1,978	10,088,300	47,191	4,460,650	21,814
SE	8,973,983	46,283	160,248	303	8,082,921	22,948	2,309,127	5,898
UK	20,533,995	81,185	4,475,081	22,135	60,878,460	236,819	18,599,162	86,317
EU-28	**97,772,905**	**497,680**	**13,681,621**	**71,852**	**300,986,970**	**1,224,066**	**74,565,434**	**398,649**

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ANNEX IV: Life cycle impact assessment

For each substance, a schematic cause and effect pathway needs to be developed that describes the environmental mechanism of the substance emitted. Along this environmental mechanism an impact category indicator result can be chosen either at the midpoint or endpoint level. Endpoint results have a higher level of uncertainty compared to midpoint results but are easier to understand by decision makers.

- **Midpoint** impact category, or problem-oriented approach, translates impacts into environmental themes such as climate change, acidification, human toxicity, etc.
- **Endpoint** impact category, also known as the damage-oriented approach, translates environmental impacts into issues of concern such as human health, natural environment, and natural resources.

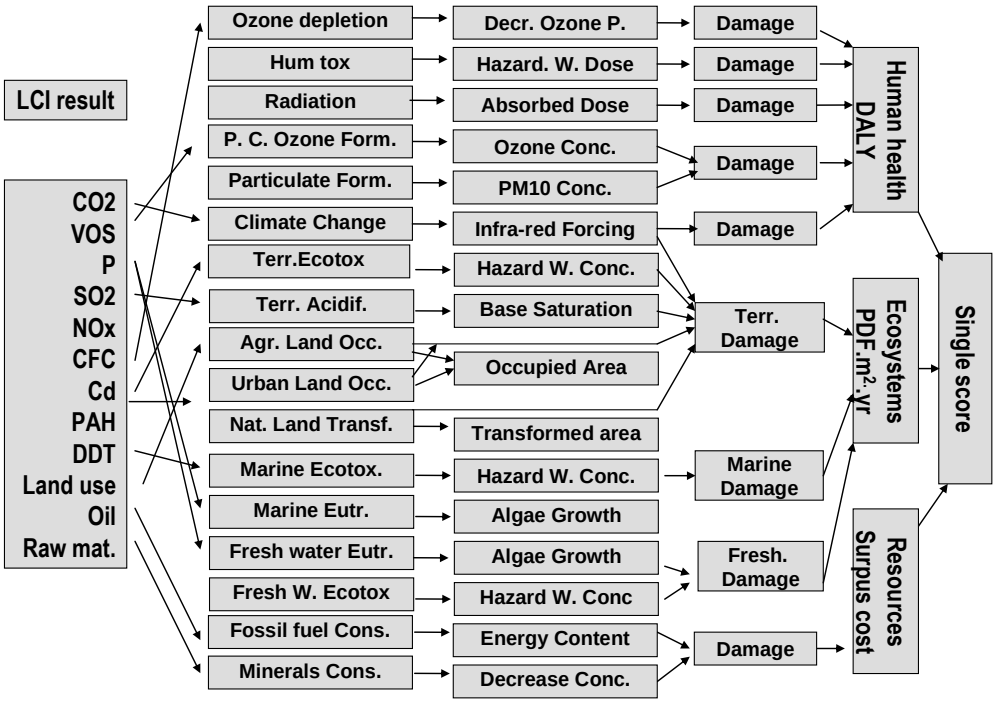

Figure 36: Relationship between LCI parameters (left), midpoint (middle) and endpoint indicator (right) in ReCiPe 2009

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ANNEX V: Contribution analysis of different life cycle stages

Table 51 and Table 52 show the life cycle impact contribution of laundry detergent.

Table 51: Life cycle impact contribution of a laundry detergent

Impact category	Unit	Ingredients	Formulation	Packaging	Transport	Use phase	End of life
CC	kg CO_2 eq	1.1E-01	5.8E-03	5.7E-03	2.5E-02	3.3E-01	6.2E-02
OD	kg CFC-11 eq	1.0E-08	2.9E-10	5.9E-10	3.9E-09	1.6E-08	1.9E-09
TA	kg SO_2 eq	4.5E-04	2.4E-05	1.9E-05	1.5E-04	1.4E-03	1.8E-04
FE	kg P eq	5.2E-05	5.8E-06	2.1E-06	3.5E-06	3.4E-04	5.4E-05
ME	kg N eq	9.2E-05	1.7E-06	5.8E-06	8.7E-06	9.4E-05	1.2E-03
Htox	kg 1,4-DB eq	2.0E-01	3.7E-03	1.6E-03	3.5E-03	2.2E-01	4.3E-02
POF	kg NMVOC	2.9E-04	1.2E-05	1.9E-05	2.4E-04	7.1E-04	1.3E-04
PMF	kg PM10 eq	1.7E-04	7.7E-06	7.5E-06	6.4E-05	4.5E-04	6.0E-05
Ttox	kg 1,4-DB eq	5.0E-04	1.4E-07	1.2E-06	2.2E-06	1.4E-05	8.9E-06
Ftox	kg 1,4-DB eq	1.8E-02	8.9E-05	1.2E-05	4.5E-05	2.0E-03	6.9E-04
Mtox	kg 1,4-DB eq	3.3E-03	8.7E-05	1.4E-05	5.6E-05	2.0E-03	6.2E-04
IR	kg U235 eq	2.9E-02	4.6E-03	1.1E-03	3.2E-03	2.6E-01	1.1E-02
ALO	m^2a	1.4E-02	7.4E-05	1.2E-02	1.3E-04	5.6E-03	2.7E-04
ULO	m^2a	6.7E-04	1.8E-05	2.2E-04	3.1E-04	1.8E-03	5.9E-04
NLT	m^2	1.0E-04	6.2E-07	2.7E-06	9.0E-06	3.9E-05	-1.9E-06
WD	m^3	1.6E-03	4.8E-05	1.1E-04	1.1E-04	5.8E-02	4.5E-04
MD	kg Fe eq	4.4E-03	4.2E-05	1.5E-04	1.2E-03	3.2E-03	6.0E-03
FD	kg oil eq	4.1E-02	1.6E-03	1.7E-03	8.9E-03	8.9E-02	4.1E-03

Table 52: Life cycle impact contribution of a laundry detergent (in percentages)

Impact category	Unit	Ingredients	Formulation	Packaging	Transport	Use phase	End of life
CC	%	20	1	1	5	62	12
OD	%	31	1	2	12	49	6
TA	%	20	1	1	7	63	8
FE	%	12	1	0	1	74	12
ME	%	7	0	0	1	7	85
Htox	%	43	1	0	1	46	9
POF	%	21	1	1	17	51	9
PMF	%	22	1	1	8	60	8
Ttox	%	95	0	0	0	3	2
Ftox	%	86	0	0	0	10	3
Mtox	%	54	1	0	1	33	10
IR	%	10	2	0	1	84	4
ALO	%	43	0	37	0	18	1
ULO	%	19	1	6	9	50	17
NLT	%	66	0	2	6	26	-1
WD	%	3	0	0	0	96	1
MD	%	29	0	1	8	22	40
FD	%	28	1	1	6	61	3

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ANNEX VI: Sensitivity analysis

Dosage sensitivity

Table 53 shows the results of the dosage sensitivity analysis.

Table 53: Impact contribution of the dosage sensitivity

Impact category	Unit	-20 %	Baseline	+20 %
Climate change	kg CO_2 eq	4.98E-01	5.35E-01	5.73E-01
Ozone depletion	kg CFC-11 eq	3.02E-08	3.32E-08	3.63E-08
Terrestrial acidification	kg SO_2 eq	2.09E-03	2.23E-03	2.36E-03
Freshwater eutrophication	kg P eq	4.42E-04	4.55E-04	4.69E-04
Marine eutrophication	kg N eq	1.31E-03	1.37E-03	1.42E-03
Human toxicity	kg 1,4-DB eq	4.21E-01	4.69E-01	5.17E-01
Photochemical oxidant formation	kg NMVOC	1.28E-03	1.40E-03	1.52E-03
Particulate matter formation	kg PM10 eq	7.07E-04	7.58E-04	8.09E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	4.26E-04	5.27E-04	6.27E-04
Freshwater ecotoxicity	kg 1,4-DB eq	1.71E-02	2.07E-02	2.44E-02
Marine ecotoxicity	kg 1,4-DB eq	5.35E-03	6.07E-03	6.79E-03
Ionising radiation	kg ^{235}U eq	2.98E-01	3.05E-01	3.13E-01
Agricultural land occupation	m^2a	2.66E-02	3.18E-02	3.70E-02
Urban land occupation	m^2a	3.29E-03	3.58E-03	3.87E-03
Natural land transformation	m^2	1.28E-04	1.51E-04	1.73E-04
Water depletion	m^3	6.00E-02	6.04E-02	6.07E-02
Metal depletion	kg Fe eq	1.37E-02	1.49E-02	1.61E-02
Fossil depletion	kg oil eq	1.36E-01	1.47E-01	1.58E-01

Wash temperature sensitivity

Table 54 shows the results of the wash temperature sensitivity analysis.

Table 54: Impact contribution of wash temperature sensitivity

Impact category	Unit	30 degrees	40 degrees	60 degrees
Climate change	kg CO_2 eq	4.6E-01	5.4E-01	6.9E-01
Ozone depletion	kg CFC-11 eq	2.9E-08	3.3E-08	4.1E-08
Terrestrial acidification	kg SO_2 eq	1.9E-03	2.2E-03	2.9E-03
Freshwater eutrophication	kg P eq	3.7E-04	4.6E-04	6.2E-04
Marine eutrophication	kg N eq	1.3E-03	1.4E-03	1.4E-03
Human toxicity	kg 1,4-DB eq	4.2E-01	4.7E-01	5.7E-01
Photochemical oxidant formation	kg NMVOC	1.2E-03	1.4E-03	1.7E-03
Particulate matter formation	kg PM10 eq	6.5E-04	7.6E-04	9.7E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	5.2E-04	5.3E-04	5.3E-04
Freshwater ecotoxicity	kg 1,4-DB eq	2.0E-02	2.1E-02	2.2E-02
Marine ecotoxicity	kg 1,4-DB eq	5.6E-03	6.1E-03	6.9E-03
Ionising radiation	kg ^{235}U eq	2.4E-01	3.1E-01	4.3E-01
Agricultural land occupation	m^2a	3.1E-02	3.2E-02	3.4E-02
Urban land occupation	m^2a	3.3E-03	3.6E-03	4.1E-03
Natural land transformation	m^2	1.4E-04	1.5E-04	1.7E-04
Water depletion	m3	6.0E-02	6.0E-02	6.2E-02
Metal depletion	kg Fe eq	1.4E-02	1.5E-02	1.6E-02
Fossil depletion	kg oil eq	1.3E-01	1.5E-01	1.9E-01

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Surfactant sensitivity

Table 55 shows the results for the data source sensitivity analysis.

Table 55: Impact contribution of surfactant sensitivity

Impact category	Unit	Mixed origin	Oleochemical	Petrochemical
Climate change	kg CO_2 eq	5.35E-01	5.35E-01	5.35E-01
Ozone depletion	kg CFC-11 eq	3.32E-08	3.32E-08	3.32E-08
Terrestrial acidification	kg SO_2 eq	2.23E-03	2.23E-03	2.22E-03
Freshwater eutrophication	kg P eq	4.55E-04	4.55E-04	4.55E-04
Marine eutrophication	kg N eq	1.37E-03	1.37E-03	1.36E-03
Human toxicity	kg 1,4-DB eq	4.69E-01	4.69E-01	4.69E-01
Photochemical oxidant formation	kg NMVOC	1.40E-03	1.40E-03	1.40E-03
Particulate matter formation	kg PM10 eq	7.58E-04	7.59E-04	7.52E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	5.27E-04	5.87E-04	3.74E-04
Freshwater ecotoxicity	kg 1,4-DB eq	2.07E-02	2.07E-02	2.07E-02
Marine ecotoxicity	kg 1,4-DB eq	6.07E-03	6.07E-03	6.07E-03
Ionising radiation	kg ^{235}U eq	3.05E-01	3.05E-01	3.05E-01
Agricultural land occupation	m^2a	3.18E-02	2.77E-02	2.48E-02
Urban land occupation	m^2a	3.58E-03	3.58E-03	3.57E-03
Natural land transformation	m^2	1.51E-04	8.10E-05	8.11E-05
Water depletion	m^3	6.04E-02	6.05E-02	6.00E-02
Metal depletion	kg Fe eq	1.49E-02	1.49E-02	1.49E-02
Fossil depletion	kg oil eq	1.47E-01	1.46E-01	1.49E-01

Energy source sensitivity

Table 56 shows the results for the energy source sensitivity analysis

Table 56: Impact contribution of energy source sensitivity

Impact category	Unit	UCTE	FR	CH	NL
Climate change	kg CO_2 eq	5.35E-01	2.76E-01	2.36E-01	6.14E-01
Ozone depletion	kg CFC-11 eq	3.32E-08	2.05E-08	2.66E-08	3.25E-08
Terrestrial acidification	kg SO_2 eq	2.23E-03	1.20E-03	9.64E-04	1.46E-03
Freshwater eutrophication	kg P eq	4.55E-04	1.73E-04	1.51E-04	2.45E-04
Marine eutrophication	kg N eq	1.37E-03	1.29E-03	1.28E-03	1.32E-03
Human toxicity	kg 1,4-DB eq	4.69E-01	3.33E-01	3.11E-01	3.63E-01
Photochemical oxidant formation	kg NMVOC	1.40E-03	9.17E-04	7.84E-04	1.34E-03
Particulate matter formation	kg PM10 eq	7.58E-04	4.56E-04	3.76E-04	5.52E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	5.27E-04	5.23E-04	5.21E-04	5.22E-04
Freshwater ecotoxicity	kg 1,4-DB eq	2.07E-02	2.03E-02	1.99E-02	2.12E-02
Marine ecotoxicity	kg 1,4-DB eq	6.07E-03	5.61E-03	5.16E-03	6.56E-03
Ionising radiation	kg ^{235}U eq	3.05E-01	7.17E-01	3.76E-01	8.80E-02
Agricultural land occupation	m^2a	3.18E-02	2.89E-02	2.81E-02	3.32E-02
Urban land occupation	m^2a	3.58E-03	2.95E-03	2.71E-03	3.84E-03
Natural land transformation	m^2	1.51E-04	1.25E-04	1.21E-04	2.00E-04
Water depletion	m^3	6.04E-02	6.12E-02	6.00E-02	5.91E-02
Metal depletion	kg Fe eq	1.49E-02	2.73E-02	2.63E-02	2.55E-02
Fossil depletion	kg oil eq	1.47E-01	7.54E-02	6.57E-02	1.86E-01

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Fabric softener sensitivity

Table 57 shows the results for the fabric softener sensitivity analysis.

Table 57: Impact contribution of the dosage sensitivity

Impact category	Unit	Fabric softener used	No fabric softener used
Climate change	kg CO_2 eq	5.56E-01	5.35E-01
Ozone depletion	kg CFC-11 eq	3.43E-08	3.32E-08
Terrestrial acidification	kg SO_2 eq	2.27E-03	2.23E-03
Freshwater eutrophication	kg P eq	4.61E-04	4.55E-04
Marine eutrophication	kg N eq	1.39E-03	1.37E-03
Human toxicity	kg 1,4-DB eq	4.76E-01	4.69E-01
Photochemical oxidant formation	kg NMVOC	1.46E-03	1.40E-03
Particulate matter formation	kg PM10 eq	7.76E-04	7.58E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	5.42E-04	5.27E-04
Freshwater ecotoxicity	kg 1,4-DB eq	2.08E-02	2.07E-02
Marine ecotoxicity	kg 1,4-DB eq	6.17E-03	6.07E-03
Ionising radiation	kg ^{235}U eq	3.08E-01	3.05E-01
Agricultural land occupation	m^2a	3.30E-02	3.18E-02
Urban land occupation	m^2a	3.69E-03	3.58E-03
Natural land transformation	m^2	1.64E-04	1.51E-04
Water depletion	m^3	6.05E-02	6.04E-02
Metal depletion	kg Fe eq	1.54E-02	1.49E-02
Fossil depletion	kg oil eq	1.53E-01	1.47E-01

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