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Revision of the EU Ecolabel Criteria for Bed Mattresses

DRAFT BACKGROUND REPORT and PROPOSAL FOR CRITERIA REVISION

Updated Working Document

for

THE REVISION OF THE EU ECOLABEL CRITERIA FOR BED MATTRESSES

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OAKDENE HOLLINS RESEARCH & CONSULTING

Revision of the EU Ecolabel Criteria for Bed Mattresses

Draft Background Report and Draft Proposal for Criteria Revision

Updated Working Document incorporating feedback from the 1st AHWG Meeting

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Contents

Glossary

AHWG	Ad-Hoc Working Group
ATO	Antimony Trioxide
BAT	Best Available Technique
BBP	benzyl butyl phthalate
CAGR	compound annual growth rate
CFC	chlorofluorocarbon
CMR	carcinogenic, mutagenic, toxic to reproduction
CN	Combined Nomenclature
DBP	dibutyl phthalate
DEHP	bis(2-ethylhexyl)phthalate
DINP	di-isononyl phthalate
EBIA	European Bedding Industries Association
ECHA	European Chemicals Agency
EINECS	European Inventory of Existing Commercial chemical Substances
EPD	Environmental Product Declaration
ESBR	emulsion styrene butadiene rubber
EUEB	European Union Ecolabelling Board
EUR	Euro (€)
FIRA	Furniture Industry Research Association (UK)
FSC	Forest Stewardship Council
GBP	Pound sterling (£)
GDP	gross domestic product
GHG	greenhouse gas
GHS	Globally Harmonised System
GPP	Green Public Procurement
GWP	global warming potential
HCFC	hydro chlorofluorocarbon
LCA	Life Cycle Assessment
NBF	National Bed Federation (UK)
PCB	polychlorinated biphenyl
PCR	Product Category Rules
PEFC	Programme for the Endorsement of Forest Certification
ppm	parts per million
PUR	polyurethane
PVC	polyvinyl chloride
REACH	Registration, Evaluation, Authorisation and restriction of Chemicals
SBR	styrene butadiene rubber
SFA	single family accommodation
SLA	single living accommodation
SME	small / medium-sized enterprise
SVHC	substance of very high concern

Units Conventional SI units and prefixes used throughout: {kg, kilogramme, unit mass}; {t, metric tonne, 10^3 kg};{k, kilo, 10^3}; {M, mega, 10^6}; {G, giga, 10^9}

Introduction

This report presents the preliminary results of a study which prepares the ground for the revision of the current EU Ecolabel criteria for "Bed Mattresses". The material could be even used, in future, for the potential development of Green Public Procurement (GPP) criteria.

The study, being carried out by the Joint Research Centre's Institute for Prospective Technological Studies (JRC-IPTS) and Oakdene Hollins Research & Consulting (UK), includes the following activities:

- Collection of preliminary recommendations from stakeholders;
- Collection of information on the main pieces of legislation and labelling schemes of relevance for bed mattresses;
- Collection of market information on bed mattresses;
- Collection of information on technical and environmental issues related to the life cycle of bed mattresses;
- Identification of the most relevant areas for setting criteria and evaluation of the improvement potential;
- Draft criteria proposal.

The tasks undertaken up to this time are outlined through the document in four thematic sections:

1. Background information
2. Definition and Categorisation
3. Market Analysis
4. Technical Analysis

This first section provides a brief introduction to the EU Ecolabel and GPP schemes, a picture of the existing environmental labelling schemes related to bed mattress and a description of the main changes in legislation affecting the product group since the last EU Ecolabel revision in 2009.

The later sections provide further information and evidence for the EU Ecolabel criteria revision and GPP criteria development. Within this process, stakeholder consultation allowed feedback and comments to be submitted from interested parties. The pieces of information provided are discussed within the relevant sections of the report, rather than individually, so that they are integrated within this process.

The information and recommendations contained within this document will be used as the basis for the revision of the EU Ecolabel criteria for Bed Mattresses.

Revision of the EU Ecolabel criteria for textiles is also happening simultaneously. Due to the use of textiles in bed mattresses, it should be borne in mind that the outputs and findings of this other study are likely to influence the revision of the criteria for bed mattresses.

1 Background information

1.1 EU Ecolabel & GPP

The EU Ecolabel and Green Public Procurement (GPP) are mechanisms which have been introduced within the EU to encourage the production and consumption of more environmentally friendly products and services. These schemes help purchasers and consumers to make more informed decisions through the identification of products or services with higher environmental credentials.

The EU Ecolabel is a voluntary scheme, regulated by the European Union[a], which is used to distinguish products and services with high environmental performances. The EU Ecolabel is awarded through an application process which demonstrates that the criteria specified for a particular product group have been met. Successful applicants are then allowed to use the EU Ecolabel logo (the 'Flower') and advertise their product as having been awarded the EU Ecolabel. The environmental criteria for a particular product group are designed in a way that, theoretically, the best 10-20% products on the market in terms of environmental performances can meet them. As technology, markets and legislation change over time, the criteria need to be updated to ensure they remain relevant, as well as strict enough to capture the top 10-20% of products. This approach should also assure that the overall environmental impact of a whole product group is improved.

GPP is a voluntary instrument which European public authorities can utilise in the procurement of products and services.[b] Because of the extensive purchasing power of public authorities, GPP can make important contributions to sustainable consumption and production by motivating manufacturers to adopt more sustainable environmentally friendly practices and by promoting best environmental practices to the public. This in turn will help stimulate a critical mass of demand for these goods and services which otherwise may be difficult to get on the market. Strong but realistic criteria are required to ensure that this has maximum impact over the relevant product categories, whilst allowing producers to meet the performance guidelines.

GPP and EU Ecolabel criteria for several product groups are in the process of being revised and updated. JRC-IPTS and Oakdene Hollins are undertaking the revision of the EU Ecolabel criteria for bed mattresses. The existing set of EU Ecolabel criteria for bed mattresses was adopted in July 2009.[c] To date, the EU Ecolabel appears to have been very limited interest and uptake within the bed mattress industry. Evidence indicates that this may be because the criteria are too difficult to achieve. By contrast there are at present no GPP criteria for bed mattresses.

The present project will focus on the revision of EU Ecolabel criteria only. The revision process will focus on refining the criteria reported in the Commission Decision 2009/598/EC also taking into account for the reasons behind the currently low uptake of the EU Ecolabel for this product groups. This should also encourage greater uptake and support the creation of a market for these products whilst maintaining an adequate level of environmental excellence.

a Regulation (EC) No 66/2010
b Public procurement for a better environment, Communication (2008) 400/2
c Commission Decision 2009/598/EC

1.2 Bed Mattresses and the EU Ecolabel

Several aspects of mattress composition, product manufacture and fitness for use are assessed within the EU Ecolabel criteria. A summary guide of all the criteria can be found in Appendix I. These include, for instance, restrictions on residual heavy metals, pigments and dyes, flame retardants and biocides.

Several environmental labelling schemes have developed criteria for mattresses (see Table 1). These schemes either specifically target mattresses or include mattresses as a part of a wider product group. Other labelling schemes, such as the Japanese Eco-leaf or US Green Seal, were found not to include mattresses within their certified products.

Table 1: Summary of ecolabels applicable to mattresses

Ecolabel name	Region	Product group	Date of adoption of the latest version	Known licences/ companies awarded*
EU Ecolabel	EU	Mattresses	July 2009[a]	3
Blue Angel	Germany	Mattresses	April 2010[b]	4
Austrian Ecolabel	Austria	Mattresses	Jan 2011[c]	4
Nordic Swan	Denmark, Finland, Iceland, Norway, Sweden	Furniture	March 2011 (version 4)[d]	5
Green Mark	Taiwan	Mattresses	September 2011 (version 1.0.1)[e]	14 (products)

**Specifically for mattresses, this may include several products*

The last version of the EU Ecolabel criteria for mattresses was adopted in 2009, and this represents the oldest set of environmental criteria for mattresses. Nevertheless, many similarities exist between the European labelling schemes specifically focusing on mattresses, i.e. EU Ecolabel, Blue Angel and Austrian Ecolabel. A comparison between the three labels is provided in Appendix II. Generally, schemes appear very closely related each other and to address similar points. Perhaps, the largest differences occur in the way the three schemes deal with flame retardants, biocides and halogentated organic compounds. For these criteria, Blue Angel and Austrian are indeed stricter, in general requiring the absolute absence of these substances.

Compared to other product groups, uptake of the EU Ecolabel for bed mattresses appears being relatively low. At present, the authors of this document are aware of only three companies that hold active EU Ecolabel licences:

- Carpenter ApS – certified by Ecolabelling Denmark
- Elite SA – certified by VKI Austria.
- André Renault– certified by Afnor

This is despite the fact that several potential applicants are reported to have made enquiries to different EU Ecolabel Competent Bodies. From preliminary stakeholders consultation, it appears that the industry is well informed of the existence of the EU Ecolabel for this product group. Various reasons were indicated for the limited uptake of the EU Ecolabel:

[a] Commission Decision 2009/598/EC
b http://www.blauer-engel.de/de/produkte_marken/produktsuche/produkttyp.php?id=309, accessed 09/01/2012
c http://www.umweltzeichen.at/cms/upload/20%20docs/richtlinien-lf/uz55_r2a-matratzen_2010.pdf, accessed 09/01/2012
d http://www.nordic-ecolabel.org/Templates/Pages/CriteriaPages/CriteriaGetFile.aspx?fileID=128603001, accessed 09/01/2012
e http://greenliving.epa.gov.tw/GreenLife/eng/E_Criteria.aspx, accessed 09/01/2012

- lack of clarity in existing criteria
- difficulties in meeting existing criteria
- cost for applying
- lack of purchaser awareness/demand.

However, there was wide acknowledgment on the potential benefits of using the EU Ecolabel as a way to differentiate more environmentally friendly products.

In addition, since the last criteria were agreed, other factors have changed, for example the adoption of the EU Ecolabel Regulation 2010/66/EC, which are further drivers for this revision process.

1.3 Legislative background

The main legislative changes which occurred since the last revision took place and which are relevant to this product group are outlined below. Further pieces of legislation were added along the document where relevant for the discussion of issues related to the EU Ecolabel criteria.

1.3.1 CLP, REACH and Biocide Regulations

CLP (Classification, labelling and packaging of substances and mixtures)

The Regulation EC No 1272/2008 entered into force in January 2009, replacing two previous pieces of legislation, the Dangerous Substances Directive (Directive 67/548/EEC) and the Dangerous Preparations Directive (Directive 1999/45/EC), and implementing the UN Globally Harmonised System (GHS) of Classification and Labelling of Chemicals at EU level. In particular, this implies that risk phrases, safety phrases and symbols are replaced with the mostly equivalent UN GHS hazard statements, precautionary statements and pictograms. The new system is to be implemented by 1 December 2010 for substances and by 1 January 2015 for mixtures. However, substances and mixtures will still have to be classified and labelled according to the predecessor Directive 67/548/EEC and Directive 1999/45/EC for preparations until 1 June 2015.

The implications of this legislation are incorporated in the criteria discussion both in terms of definitions and in restricting hazardous substances based on both hazard statements and risk phrases.

REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals)

The REACH Regulation (Regulation (EC) No 1907/2006) is a piece of legislation which regulates the production and use of substances in EU with the aim of improving the protection of human health and the environment from the risks that can be posed by chemicals.[a,b,c]
To comply with the regulation, manufacturers and importers are required to gather information on the properties of their chemical substances, which will allow their safe handling, and to register the information in a central database managed by the European Chemicals Agency (ECHA).

The legislation, which entered into force in June 2007, distinguishes between “phase-in” substances (i.e. those substances listed in the EINECS, or those that have been manufactured in the Community, but not placed on the Community market, in the last 15 years, or the so-called “no longer polymers” of Directive 67/548) and “non-phase-in” substances. Deadlines for the registration of phase-in substances are set as follows:

a Regulation (EC) No 1907/2006
b http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm
c http://echa.europa.eu/

- 30 November 2010 for substances manufactured or imported at 1000 tonnes or more per year, for carcinogenic, mutagenic or toxic to reproduction substances above 1 tonne per year, and for substances dangerous to aquatic organisms or the environment above 100 tonnes per year.
- 31 May 2013 for substances manufactured or imported at 100-1000 tonnes per year.
- 31 May 2018 for substances manufactured or imported at 1-100 tonnes per year.

Non-phase-in substances have to be registered before being placed on the market. All substances notified under Directive 67/548/EEC are considered as registered under REACH.

Substances with properties of very high concern (SVHC) are subject to authorization. In this case, applicants have to demonstrate that risks associated with uses of these substances are adequately controlled or that the socio-economic benefits of their use outweigh the risks associated. Applicants must also analyze whether there are safer suitable alternative substances or technologies. If there are, they must prepare substitution plans, if not, they should provide information on research and development activities. A Member State, or ECHA at the request of the European Commission, can propose a substance to be identified as a Substance of Very High Concern (SVHC). If identified, the substance is added to the Candidate List, which includes candidate substances for possible inclusion in the Authorisation List. Substances of Very High Concern (SVHCs) are identified among:

- Substances meeting the criteria for classification as carcinogenic, mutagenic or toxic for reproduction category 1A or 1B in accordance with Commission Regulation (EC) No 1272/2008 (CMR substances);
- Substances which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) according to REACH (Annex XIII)
- Substances for which there is scientific evidence of probable serious effects that cause an equivalent level of concern as with CMR or PBT/vPvB substances (e.g. endocrine disruptors)

If the chemical risks cannot be adequately controlled, authorities can restrict the use of substances. Restrictions may limit or ban the manufacture, market and use of a substance.

With respect to substances contained in articles, producers and importers must submit a registration for any substance fulfils both the conditions below:

(a) the overall quantity of the substance in the articles is above 1 tonne per year

(b) the substance is intended to be released under normal or reasonably foreseeable conditions of use.

In case the overall quantity of the substance in the articles is above 1 tonne per year and the substance is present in the articles above a concentration of 0.1 % weight by weight (w/w), it must also be notified if the substance may be classified as SVHC. The notification does not apply where exposure to humans and environment can be excluded during normal conditions of use including disposal.

The implications of this legislation are incorporated in the criteria discussion both in terms of definitions and in restricting hazardous substances of very high concern.

Biocides

The Biocidal Products Directive (Directive 98/8/EC) regulates the placing of biocidal products on the market and aims at the establishment at Community level of a positive list of active substances which may be used in biocidal products. These are list in Annex IA – “Active substances with requirements agreed at community level for inclusion in low-risk biocidal products”. Active substances cannot be added to the list if, according to the Directive 67/548/EEC, they can be classified as: carcinogenic, mutagenic, toxic for reproduction, sensitising, or bioaccumulative and not readily degrade. Each Member State must authorise products containing the biocide before they can be placed on the market in that Member State. Once authorised by a Member State, the product can be placed on the market in any other Member State.

The Directive also planned a 10-year programme of work for the systematic examination of all active substances already on the market. All provisions necessary for the establishment and implementation of the programme were provided in 2003 through the Regulation (EC) 2032/2003. The mandate for the regulation of biocidal products will be regularly transferred to the REACH system.

If biocides are allowed, a standardised text should be included in the EU Ecolabel criteria to ensure that only authorised and assessed biocidal substances are used. This is incorporated in the criteria discussion.

1.3.2 EU Ecolabel Regulation

The revised EU Ecolabel Regulation was adopted on 25 November2009 and entered into force on 19 February 2010. The key points of the new regulation are:

- To take into account the environmental performance of products, taking into account the strategic objectives of the Commission (Article 6.1)
- To determine criteria on a scientific basis (Article 6.3)
- To focus on the most significant environmental impacts over the product lifecycle (Article 6.3.a)
- To substitute hazardous substances by safer substances whenever technically feasible (Article 6.3.b)
- To improve the durability and reusability of products (Article 6.3.c)
- To take into account the net balance between environmental benefits and burdens at each life cycle stage of the product (Article 6.3.d)
- To take into account for social and ethical aspects if appropriate (article 6.3.e)
- To align with other Ecolabels to enhance synergies (Article 6.3.f)
- To restrict the use of substances or preparation/mixtures which can be classified as toxic, hazardous to the environment, carcinogenic, mutagenic or toxic for reproduction (CMR) according to CLP Regulation or as SVHC according to Article 57 of REACH Regulation (Article 6.6)
- Derogations may be given in respect of the above point, 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 Article 59 of REACH Regulation and that are present in mixtures, in an article or in any homogeneous part of a complex article in concentrations higher than 0,1 % (weight by weight) (Article 6.7).

In developing practical means to implement the provisions of Articles 6.6 and 6.7, the EU Ecolabelling Board (EUEB) has identified the hazard classifications for the restriction of substances and preparations. These are reported in Appendix III and form the basis for the criteria proposal set out with this study.

2 Definition and Categorisation

Mattresses are products designed to provide support and comfort for lying and sleeping, with the specific focus of this product group being bed mattresses. Within this group further distinction is often made between mattress types, often by their main core material (e.g. latex, PUR, springs). There is therefore a variety of common mattress types to consider within this product group. Other special types of mattresses designed for a specific purpose, e.g. medical mattresses and air beds, may also be described separately and are often considered outside the standard 'everyday' mattress types. "Scandinavia bed mattresses" are also included within the EU Ecolabel bed mattress classification, though they can be also defined as "mattress supports". Mattress supports are differentiated from bed frames or bedsteads (which are widely categorised as furniture) as they provide extra spring or support, rather than just providing a surface to place a mattress on. Items typically defined as mattress supports for instance include divans and metal and wood sprung supports (i.e. "Scandinavian bed mattress"). A further description is provided below in Section 2.1. Wood sprung supports are sold as part of a mattress system and cannot be separated from the mattress. Further description is provided below.

This section provides a technical description of the most common 'everyday' mattress types and reviews the existing categorisation used in the EU Ecolabel and in other sources.

2.1 Technical Description of Mattresses

Before analyzing the categorization used for bed mattresses in the EU Ecolabel, it is useful to provide the reader with a technical description of the different types of mattress included in the labelling scheme. In particular, the description includes composition of these mattresses and how this is linked to their functionality.

2.1.1 Mattresses components

A typical mattress consists of three main sections:

- The **Core**, which provides support in the mattress and whose composition is generally used to classify mattresses in one of the categories described above (e.g. latex foam, PUR foam or springs).
- The **Shell** (or padding/wadding), which is a layer around the core used to refine the overall properties of the mattress. All mattresses with a spring interior and some of the mattresses with other core materials contain a shell
- The **Tick** (or ticking) is the outer cover of the mattress and provides a comfortable and protective top layer.

The precise composition of a mattress depends on the desired properties of the mattress; for example the firmness can be varied to suit customer needs. Each of these sections is described in more detail below.

Core Materials

The core of the mattress is usually the main factor used to classify mattresses. The different core materials offer distinct properties, and allow manufacturers to offer different mattress types to purchasers. The three main core materials are latex, PUR and springs, though other materials may be used for specific types of mattress, for example wool or coconut fibres in baby mattresses.

Latex

Latex foam is used in mattress cores due to its durability, widespread availability and as it provides suitable levels of comfort for use in mattresses.

The latex used in mattresses can either be naturally or synthetically derived, with a mixture commonly used in mattresses to obtain the desired properties. Stakeholders indicated that synthetic latex accounts for between 5 – 100% of the latex contained in the mattress.

Natural latex originates from rubber trees, where it is contained suspended in the sap. Further processing makes it ready for foaming. Styrene butadiene rubber is commonly used as the synthetic latex in mattresses. This is produced by the polymerisation of styrene and butadiene. Natural and synthetic latex foams are blended together to optimise the product, based on:

- Properties - synthetic latex has more uniform properties and is more durable, natural latex has greater elasticity.
- Consistency – the properties and quality of natural latex can vary, synthetic latex can be produced more consistently
- Cost – synthetic latex is cheaper to produce than natural latex

In addition to the source of the latex, two processes exist for the production of latex foam from feedstock materials: the Dunlop process and the Talalay process. [a] Both are used in the production of the latex cores for mattresses and may use natural, synthetic or mixtures as a feedstock. There was some indication from stakeholders that the Talalay process is more energy intensive, however no studies could be found to quantify this difference. However, both processes are used in industry as they impart different properties to the latex, e.g. Dunlop latex is generally heavier and more durable while Talalay has a wider range of firmness grades.[b]

PUR

Polyurethane foam (or PUR) is a commonly used material for many furniture based applications, including mattresses and seating.

PUR is made through the production of polyurethane through a polymerisation reaction. The feedstock material varies but it is primarily a non-renewable petrochemical resource, such as oil and gas. Polyurethane is foamed using a blowing agent.[c] In the past these blowing agents have been halogenated hydrocarbons, however, according to stakeholders, carbon dioxide is much more common now. The production process can be controlled to define the properties of the foam, particularly the density.

Memory foam mattresses are also derived from PUR, through the addition of modifiers in the production of the foam. This foam is softened by the human body heat, therefore moulds and remoulds to provide close support. Memory foams may either make up a full mattress, but may also be used as a layer in other mattress types.

Springs

The springs used in mattress cores are made from steel, however there are a variety of spring designs used, with different shapes and configurations, c:

- Pocket springs
- Bonnell springs
- LFK (LeichtFederKern) springs
- Continuous springs

Each of these options offers different performance. For example pocket sprung mattresses contain separate, individually wrapped springs and they are considered to offer the best performance as springs are able to move separately. By comparison, continuous springs are composed of wires that form

a Latices: Applications of latices , Blackley D. C., Springer, 1997
b http://www.savvyrest.com/why-savvy-rest/natural-dunlop-talalay, accessed 19/12/2011
cc European Ecolabel – Bed mattresses, Tauw Milieu, 2006

multiple interwoven springs. This is typically seen as a solution offering lower performance, but it is cheaper.

Other factors are varied to further refine the properties of the sprung core, such as the number and size of the springs or the diameter of the wire.

The existing EU Ecolabel criteria specify the use of a closed loop system for cleaning these springs. This is included as the final production stage of spring production involves the production of the spring coil from the wire, which requires oil for lubrication. Oil must be removed before incorporation into the mattress by mean of organic solvents. The EU Ecolabel criteria also ban the use of a galvanic coating on the springs, which may be added to help preventing corrosion.

Shell
Mattresses commonly have a shell of materials around the core to refine the overall properties of the mattress.[a] For example, they may help equalizing weight distribution to provide more support or allowing better air flow or also protecting the mattress core.

All sprung mattresses have this material, and many mattresses with foam based cores. Often mattress shells are composite structures. The materials mainly used include: PUR foam, latex foam, horse or camel hair, coconut fibres, polyester, cotton, wool, flax, hemp, felt, jute and sisal. These materials are held together by glue or sewing.

Tick
The tick is the outer layer of the mattress, helping hold and protect the inner core and shell materials. It is also used to add comfort to the mattress. Common materials used for the tick include cotton, polyester, silk, wool and viscose. The tick can be fixed to the mattress or removable. [a]

2.1.2 Mattresses supports & Scandinavian Type Mattresses

Within the existing EU Ecolabel criteria provision is made for mattress supports made of wood. This is to allow for a type of bed/mattress system commonly found in the Scandinavian countries (i.e. Denmark, Finland, Norway and Sweden).[a] These bed systems can be considered as a hybrid between a mattress and mattress support. They consist of a wooden frame with integrated springs, with a mattress fixed on top of this (normally with a sprung core). This unit is covered with a thin replaceable mattress pad.

This system is typically included within the "mattress supports" category for classifications and statistics. However, it is differentiated from other mattress supports, such as divans, in the sense that mattress and other components of a Scandinavian bed mattress are fixed together.

2.2 Definitions of Mattresses

2.2.1 Existing Ecolabel categorisation

Within the existing EU Ecolabel criteria document, mattresses are described using the following definition[b]:

1. *The product group 'bed mattresses' shall comprise:*
    a. *Bed mattresses, which are defined as products that provide a surface to sleep or rest upon for indoor use. The products consist of a cloth cover that is filled with materials, and that can be placed on an existing supporting bed structure;*

a European Ecolabel – Bed mattresses (Previous revision document), Tauw Milieu, 2006
b Decision 2009/598/EC of 9 July 2009

b. *The materials filling the bed mattresses, which may include: latex foam, polyurethane foam and springs;*
c. *Wooden bed bases that support the bed mattresses.*

2. *The product group shall include spring mattresses, which are defined as an upholstered bed base consisting of springs, topped with fillings, as well as mattresses fitted with removable and/or washable covers.*
3. *The product group shall not comprise inflatable mattresses and water mattresses, as well as mattresses classified under Council Directive 93/42/EEC (medical devices).*

This definition targets the inclusion of the most commonly available types of mattress for common use both domestically and commercially. Products which are specifically identified as being included are spring mattresses, defined as upholstered bed bases consisting of springs, topped with fillings, as well as mattresses fitted with removable and/or washable covers. Wood-based supports that are specifically designed to provide extra supports for the mattress are also included. However this is interpreted to not include standard wooden bed frames or bedsteads, but rather allow 'Scandinavian' type mattress systems. These consist of a wooden frame housing a spring system with an attached mattress, often covered by a thin, replaceable mattress pad. The mattress units are sold as single, non-separable units, therefore have been included within the bed mattress product group.

Products specifically excluded are: inflatable mattresses, as they are not commonly used for as permanent mattresses, water beds, as previous revisions and data in Section 3 indicate that they comprise a very minor part of the market, and mattresses which fall under the medical equipment category, according to Council Directive 93/42/EEC. These devices are specifically designed to provide medical or therapeutic effects and therefore have different functions and technical specifications than a typical bed mattress. For example, this includes products with pressure relieving systems (for example adjustable air pockets) and bed and mattress systems which are designed to work together to provide therapeutic benefit such as preventing bed sores. However, even if excluded from the scope of the EU Ecolabel, these mattresses could be relevant within the GPP scheme.

It should also be noted that, within the EU Ecolabel scheme, specific criteria are applied to latex, polyurethane foam, springs and wood. Therefore, the product group scope and the criteria are written in a way that recognises these different mattress types. Indeed, these criteria directly map onto the different types of mattress and wooden mattress support available on the market. This distinction, based on construction material, is also commonly used to differentiate between mattress types by other ecolabel schemes, industry and trade data.

2.2.2 Other mattress classification systems

Other sources for the definition and classification of mattress types include other ecolabel schemes, industrial statistical classifications and the mattress and bedding industry itself. Each is described below.

Other environmental labelling schemes with specific product groups for mattresses
In addition to the EU Ecolabel, three other environmental labelling schemes have been identified as having a specific product group for bed mattresses. The definitions used are summarized in Table 2.

The core definition provided in these three schemes appears consistent with the one used for the EU Ecolabel and common agreement on the exclusion of inflatable (or air) and water mattresses can be observed. Nevertheless, no mention of medical or therapeutic products is explicitly made and some variation is present in the types of products considered and in the terminology used.

Both Austrian and German environmental labels state to include mattresses with an integrated frame, which can be put on a bed frame or designed for free standing. While upholstered bed are also included within the EU Ecolabel scope, the terms "bed base" is here used, without referring explicitly to the

possibility of integrating the function provided by a bed frame. Moreover, it should be noted that this type of products could also be included within the category of "mattress supports" (see below). In contrast, the Green Mark scheme specifically excludes any mattress support type products. Head rest pillows instead appears to be considered only by Blue Angel, at least where they form part of the mattress and are made of the same materials. Further clarification seems necessary and input from the stakeholders about these issues would be much appreciated.

Table 2: Definitions of bed mattresses used by other Ecolabel schemes

Scheme	Definition
Austrian Ecolabel (Austria)[a]	**A surface to sleep or rest on consisting of a strong cloth cover filled with material that can be placed on a bed frame.** **Includes mattresses with an integrated frame, i.e. upholstered bases, which may be put on a bed frame or designed for free standing.** **Excludes inflatable and water mattresses.**
Blue Angel (Germany)[b]	**A surface to sleep or rest on consisting of a strong cloth cover filled with material that can be placed on a bed frame.** **Includes mattresses with an integrated frame, i.e. upholstered bases, which may be put on a bed frame or designed for free standing. Head rest pillows included where they form part of the mattress and are made of the same materials.** **Excludes inflatable and water mattresses.**
Green Mark (Taiwan)[c]	**Includes the cushioning core and the upholstery layers, but exclude the bed-frame and the mattress foundation.** **Excludes inflatable mattresses and water mattresses.**

Though not specifically outlined in any of the definitions of these schemes, the criteria themselves also provide an indication of a *de facto* classification based on the different core materials. Each scheme has specific criteria targeting each of the common core materials (e.g. latex, polyurethane foam, and springs). Though materials are not specifically outlined within the product group definition, the EU Ecolabel categorization is thus acknowledged within the criteria themselves.

The Nordic Swan scheme is not considered within this comparison since mattresses fall under its criteria for furniture, and no specific criteria for mattresses are provided there.

Production and trade classifications

Within the EU-27 the most comprehensive production and trade data is produced by Eurostat, the statistical office of the European Union.[d] The data provided is separated using the PRODCOM categories and Combined Nomenclature (CN) codes for production and trade respectively. Within the bed mattress product group, PRODCOM categories and CN codes match almost exactly.[e] Table 3 lists the relevant categories for this product group from both classifications, providing a summary description for each. An abbreviation has been assigned to each category and used throughout the report, particularly in the market survey.

a Austrian Ecolabel – Bed Mattresses, UZ55, Austrian Ecolabel, January 2011
b Basic Criteria for Award of the Environmental Label – Mattresses, RAL-UZ 119, Blue Angel, April 2010
c http://greenliving.epa.gov.tw/GreenLife/eng/E_Criteria.aspx, April 2010 revision, accessed 6/9/2012
d http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home
e Note – this is not true for all PRODCOM and CN codes.

PRODCOM and CN categorization fits quite well with the existing EU Ecolabel with respect to mattresses based on latex, PUR, springs or other materials (though the technical descriptions used are slightly different). A significant portion of products falling in the "mattress supports" category falls instead outside the scope of the EU Ecolabel for bed mattresses and should be more appropriately considered as furniture (for example wooden or metal frames or divans). However, certain Scandinavian mattresses which are wood-based fall within the support categorisation and form a part of the entire mattress support category. These mattress supports are included explicitly by point 2 of the EU Ecolabel categorisation, though they can be considered a kind of "hybrid product". Bed bases are indeed composed of a mattress, which perfectly fits within the scope of the EU Ecolabel for bed mattresses, plus a support which seems technically similar to the products belonging to the "wooden furniture" category. The same may be extended also to other products belonging to the group of "mattress supports", e.g. sofa-beds. This is an issue that could be opened for discussion and further investigated also with the beneficial contribution from the stakeholders.

Table 3: Mattresses - 2010 CN and corresponding PRODCOM codes

Database	Codes	Description	Abbre-viation
PRODCOM	**31031100**	Mattress supports (including wooden or metal frames fitted with springs or steel wire mesh, upholstered mattress bases, with wooden slats, divans)	**Supports**
CN	**94041000**	Mattress supports for bed frames (excl. spring interiors for seats)	
PRODCOM	**31031230**	Mattresses of cellular rubber (including with a metal frame; excluding water-mattresses, pneumatic mattresses)	**Latex**
CN	**94042110**	Mattresses of cellular rubber	
PRODCOM	**31031250**	Mattresses of cellular plastics (including with a metal frame; excluding water-mattresses, pneumatic mattresses)	**PUR**
CN	**94042190**	Mattresses of cellular plastics	
PRODCOM	**31031270**	Mattresses with spring interiors (excluding of cellular rubber or plastics)	**Spring**
CN	**94042910**	Mattresses with spring interiors	
PRODCOM	**31031290**	Other mattresses (excluding with spring interiors, of cellular rubber or plastics)	**Other**
CN	**94042990**	Mattresses, stuffed or internally filled with any material (excl. cellular rubber or plastics, with spring interior, and pneumatic or water mattresses and pillows)	

Source: Eurostat, PRODCOM/COMEXT

The 'Other mattresses' category includes mattresses with fillings not accounted for by the other categories. For example, this includes mattresses where the primary filling is cotton or coconut fibres. It is useful to note that these materials may be present in other mattress types as padding/wadding; however, they may not form the major component of the filling.

Based on the definitions provided above, it is understood that air-filled mattresses and water mattresses are not included within the overall mattress grouping. As they are already excluded from the EU Ecolabel, their classification has not been pursued further.

Organisational classifications

Several relevant industry organisations exist specifically related to mattresses. These may be EU based, such as the European Bedding Industries Association (EBIA), or based in a specific country, such as the UK's National Bed Federation (NBF).

Technical classification of mattress types across these industry organisations is relatively consistent with the ones described above. The EBIA represents eight EU national federations and three multinational organisations, the definitions used are therefore taken as a good industrial reference within the EU.

Within the EBIA classifications, five different mattress categories are identified: PUR, latex, sprung, waterbeds and air mattresses.[a] The first three of these categories represent the major mattress types as identified within the EU criteria, and further sub-categories for each technology are defined, shown in Table 4. The differences between each of these are described above in Section 2.1, with each technology defined in the sub-classifications bring slightly a different function or performance to the mattress, thus appealing to different markets.

Table 4: Classifications and sub-classifications used by the EBIA

Main technology	Distinguishing factor	Sub-classifications
PUR	**Foam type**	Polyether PU foam, highly resilient foam, visco-elastic (memory) foam
Latex	**Material source**	Natural, synthetic
Sprung	**Spring design**	Bonnel, LFK springs and pocket sprung systems

Source: European Bedding Industries Association

The NBF operates a similar but slightly different categorisation, based partly on technology and partly on performance. The key groupings used are shown in Table 5.[b]

Table 5: Mattress groupings used by the NBF

Grouping	Description
Sprung mattresses	**All mattresses containing springs**
Non-sprung mattresses	**PU Foam, Latex, hair, gel, feather, viscose (memory) foam, wool, water/flotation, air, fibre**
Special feature mattresses	**Lumbar zones, his and hers zoning, waterproof, 'no need to turn', non turn/one-sided, climate control**

Source: National Bed Federation

The first two of these groups are exclusive of each other, i.e. non-sprung includes latex, PUR and other filings groups, as defined by other classifications, and sprung accounts for all spring based mattresses. The special feature mattress group is based on function, and may contain mattresses from the other two categories. Therefore, whilst useful as a guide to the performance and utility of a mattress, it is less relevant as a grouping for this study.

Mattress supports, including wooden bed bases, fall outside the scope of the definitions for mattresses used by both of these organisations. This indicates some discrepancy between the EU Ecolabel and the industry definition of mattresses, as the definition extends slightly further for the EU Ecolabel. However, this is not viewed as a major issue as the different types of mattress are still well aligned.

Additional classifications

Other mattress groupings also exist, providing an indication of size and firmness.[c] For example, mattresses are often rated at various graduations from 'soft' up to 'firm' to provide an indication of their performance. However, no precise standard exists and the rating varies between manufacturers, making direct comparison difficult. Therefore this can be viewed as providing guidance to the purchaser rather than offering a useful classification system for the EU Ecolabel.

Various mattresses sizes exist corresponding to different bed sizes. Standard sizes exist both in dimensions and terminology.[d] However, the precise dimensions and designations vary from territory to

a http://www.europeanbedding.eu/technologies.html, accessed 08/12/2011
b http://www.bedfed.org.uk, accessed 09/01/2012
c http://www.bedfed.org.uk/, accessed 8/12/2011
d For examples a single mattress is about 0.9m by 1.9m across the EU. However a double mattress is 1.4m by 1.9m in most of the EU, but 1.2m by 1.9m in the UK

territory, and even from manufacturer to manufacturer.[a] Again this does not provide a suitable alternative classification for mattresses; however, it does demonstrate that criteria should be applicable equally to all mattress sizes.

Therefore, whilst these groupings are useful for purchasers and the industry, they are not of practical use for distinguishing between mattress types for the purposes of the EU Ecolabel.

2.3 Revision of the product scope definition

The appropriateness of the scope definition for this product group was discussed with the stakeholders of the project. In general it was apparent that the definition of bed mattress used for the EU Ecolabel could be improved. Main points of discussion focused on:

- Appropriateness of the general definition provided for product and materials
- Appropriateness of the inclusion of wooden bed bases and hybrid type mattresses
- Appropriateness of the inclusion of other products (e.g. futons and soft seating)

Appropriateness of the general definition provided for product and materials

The definition of the EU Ecolabel scope for bed mattresses is considered to be appropriately based on the function provided by the product. Nevertheless, it seems that the current definition of "mattress" needs to be improved. For instance, the definition seems to be open to the inclusion of both products and components. The feeling is that the EU Ecolabel should clearly refer to the mattress as a whole and not to single components. The following change was proposed to section 1 under the definition to better shape the scope.

1 *The product group 'bed mattresses' shall comprise products providing a surface to sleep or rest upon for indoor use that consist of a cloth cover that is filled with materials and that can be placed on an existing supporting bed structure or designed for free standing. Materials filling and covering the bed mattresses may include latex and polyurethane foam, metal parts, fibres and fabrics.*

Appropriateness of the inclusion of wooden bed bases and hybrid type mattresses

The current definition provided for wooden bed bases does not explain that these products are known even as "Scandinavian mattresses" and that they consist of a mattress with the frame directly included on it. However, it was generally agreed that the current inclusion of wooden bed bases should be removed from this product group, as they are more appropriate to the furniture group. This could be achieved by removing section 1c from the Commission Decision 2009/598/EC.

Even if bed bases can be considered a "hybrid product" because of their material composition, the function provided fits within the current EU Ecolabel definition of bed mattresses. In this case, the issue would be to understand if criteria specifically related to the wooden base are sufficiently aligned with the criteria for wooden furniture, which are about to be revised at the time this report is written. The inclusion of bed systems (i.e. mattresses with bed frame, integrated or not) within the furniture product group could be considered an effective solution to overcome this problem.

Mixed views were expressed over the continued inclusion of upholstered bed bases, which are defined in section 2 of the definition. Wording needs to be clarified if this type of mattress is kept within the

a http://www.preciousbedding.com/common-mattress-dimensions-a-9.html, accessed 8/12/2011

product scope. One proposal could be to include a similar definition to that used by the German Blue Angel scheme:[a]

"This also includes all types of mattresses with an integrated frame, i.e. upholstered bed bases with a flexible core surrounded by filling material which may be put on a bed frame or designed for free standing, including a specifically designed mattress. Included are head rest pillows forming part of mattress which are made of the same material.

However, it was pointed out that at present there are no licence holders for these special products not even under the Blue Angel scheme. Moreover, as previously discussed for wooden bed based, all the hybrid systems could be considered for inclusion within the furniture product group.

Appropriateness of the inclusion of other products (e.g. futons and soft seating)

It is agreed that medical mattresses are out of the EU Ecolabel scope, as well as other special mattress types (e.g. water beds). These mattresses often shows very different properties and compositions than standard, commercial and domestic mattresses because of the specific function they have to provide, for example the prevention of bed sores, resistance to fluids or hygiene specifications. These special mattresses are not considered "fit for purpose" with the existing EU Ecolabel criteria.

It was suggested to ensure that futons are included within the product scope. The rewording of the definition shown above should be sufficient for this aim.

It was moreover discussed if soft seats could be even included or not. However, their inclusion was not recommended since they can be considered a completely different product from a functional and technical point of view.

2.3.1 Proposed Changes

Based on the above feedback it is recommended that the proposed wording is adopted to provide clarification over the definition of a bed mattress.

Proposed definition of the product scope

1 The product group 'bed mattresses' shall comprise products that provide a surface to sleep or rest upon for indoor use. The product consists of a cloth cover that is filled with materials and that can be placed on an existing supporting bed structure or designed for free standing. Materials filling and covering the bed mattresses may include latex and polyurethane foam, metal parts and textiles.

2. The product group shall not comprise wooden and upholstered bed bases, inflatable mattresses and water mattresses, as well as mattresses classified under Council Directive 93/42/EEC (medical devices).

[a] Basic Criteria for Award of the Environmental Label – Mattresses, RAL-UZ 119, Blue Angel, April 2010

3 Market Analysis

3.1 Introduction

3.1.1 Aims and methods

The EU-27 market for bed mattresses is analyzed in this section to understand what changes occurred since the last revision of the EU Ecolabel criteria. Moreover, it is investigated whether any such changes need to be reflected in the criteria to ensure they are relevant to the best environmentally performing products. Data and information have also been collated on market structure, public procurement, product innovation and environmental labelling.

The market analysis is based on a variety of available literature and statistical databases. The study is conducted for 2010 (the latest year for which data have been reported by at least half of the Member States) and the preceding two years. In analysing trends of production and trade (Section 3.6), data are collated for the preceding five years. These data principally consist of information from the PRODCOM[a] database, for production, and from the COMEXT[b] database, for trade data.

Nevertheless, it should be noted that:

1. Some gaps exist in these databases. For instance, some countries consider their data to be confidential while some other values are reported as relatively low, or as zero, which may indicate that reporting may not be fully consistent across all EU27 Member States.
2. Mattresses and mattress supports have been preliminarily considered within this work. Mattress supports include Scandinavian bed mattresses and bed bases, which are relevant for this revision, plus other products which are excluded from the scope of the EU Ecolabel for bed mattresses. Scandinavian bed mattresses will only form a portion of this overall figure but no more specific information could be found.

3.2 Market Structure

3.2.1 Small and medium sized enterprises

Whilst the larger mattress suppliers have a comprehensive product list, small and medium-sized enterprises in the mattress industry tend to focus on niche products and national consumer demands in the European market. There is a strong market for premium mattress products often produced by small companies. This is typified by the Italian mattress market, where in 2005 the average manufacturer employed only six people.[c] The vast majority of the mattresses produced at these firms are produced for the domestic Italian market, with some premium exports to other western European countries.

There are often quite significant local differences between consumer mattress preferences across Europe. Different cultures prefer different kinds of mattresses, bed frames and materials. This means that there is a large number of smaller nationally focused brands, all of which are strong within their individual markets.[d] The Italian market, for example, favours rubber-style mattress products and is dominated by local manufacturers. [c]

Due to these varying consumer preferences across Europe, there is significant scope for competition amongst manufacturers and consumer brands. This not only explains the number of brands within the

a PRODCOM, Prodcom annual data, 2005-2010. Available at http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/introduction
b COMEXT, EU27 Trade Since 1988 By CN8, Available at http://epp.eurostat.ec.europa.eu/newxtweb/
c Italian Trade Commission, 2011 available at: http://www.italtrade.com/focus/6728.htm
d Hilding Anders, The bed market. Available at: http://www.hildinganders.se/en/markets-brands/bed-market

market, but also the large number of smaller producers. There are, for example, over 400 mattress manufacturers in Italy alone. [c] A similar situation can be seen in other EU countries. Table 6 outlines the estimated turnover and employment size band for mattresses manufacturers in the UK. Assuming the European Commission definition for an SME[a], of the 115 mattress manufacturers in the UK, an estimated 78% are defined as SMEs by turnover band and 90% by employment size band. This highlights the importance of SMEs within the mattress market in the UK.

Table 6: Estimated turnover and size employment band for mattress manufacturers in the UK (2008)

Turnover size band (thousands of GBP)	0-49	50-99	100-249	250-499	500-999	1 000-4 999	5 000+	Total
Number of mattress manufacturers	5	10	10	20	10	35	25	115

Employment size band (nr. of employees)	0-4	5-9	10-19	20-49	50-99	100-249	500+	Total
Number of mattress manufacturers	25	20	15	25	10	10	10	115

Source: Adapted from FIRA, Competitiveness of the UK furniture manufacturing industry, 2010. Original Source; ONS2008. UK Business: Activity, Size and Location – 2008. Figures collated using SIC (03) categories.

3.2.2 Drivers in the mattress industry

The mattress industry is influenced by a large number of factors that essentially impact on consumers' willingness to invest in these relatively high value products: GDP, consumer confidence, household savings and unemployment.[b] The currently weak economy across Europe is therefore likely to have had an impact on the mattress market. Consumers have become more cautious or unable to make large purchases: this may especially affect sales of mattresses, which may be used beyond their recommended ten year life span[c]. There is also a tendency to replace mattresses in the year of new home purchases; fewer people buying homes means less demand for mattresses. It may also be that moving into new rented accommodation has the same effect, i.e. encourages the replacement of some furniture items, including mattresses.

In recent years there has, however, been an increasing focus on interior design and associated home furnishings where beds - and therefore mattresses - play a part. An increase in demand for high-end mattresses, in particular niche products such as organic mattresses, can be identified as another industry driver. An ageing population may also prove to be a positive influence on the mattress market as the health benefits of mattresses may become more important. This could result in increasing demand especially in high end, high quality mattresses.

3.3 Production [d]

Table 7 presents figures on the production of mattresses across the EU-27 Member States in 2010. Figures are expressed both in terms of sold volume (i.e. product units) and in terms of production value. EU production of mattresses in 2010 totalled EUR 5 billion (EUR 3.8 billion excluding mattress supports), or 67.6 million units (48 million units excluding mattress supports), although it is important to note that data are not reported for some countries due to confidentiality issues.[e]

a European Commission, SME definition, 2003 Available at: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm
b Hilding Anders, Driving forces in the market, Available at: http://www.hildinganders.se/en/markets-brands/bed-market/driving-forces-market
c Sealy, FAQ. Available at: http://www.sealy.com/Customer-Service/FAQs.aspx
d Throughout this report, production is measured in terms of values and volumes of sold production. Sold production refers to products manufactured by the enterprise and sold outside the enterprise during the reference period. This variable corresponds most closely to the part of the production that is put on the market.
e Data for 2009-2005 can be found in Appendix II

Sold volume of mattresses in 2010 across the EU-27 comprises, in terms of sold volume:

- 29% mattress supports
- 26% spring mattresses (37% excluding mattress supports)
- 23% PUR mattresses (32% excluding mattress supports)
- 9% Latex mattresses (13% excluding mattress supports)
- 13% other mattresses (18% excluding mattress supports)

For comparison, the market analysis carried out for the previous revision of the EU Ecolabel criteria for mattresses estimated that:

- The total sold volume of mattresses in 2005 was 33.1 million units (excluding mattress supports). This consisted of 64% spring mattresses, 22% PUR, 7% latex and 7% other mattress types.
- The 2010 market would have been still dominated by spring mattresses (65% of total sold volume), followed by PUR mattresses (20%), latex mattresses and the other mattress types (7% share each).

Differences are apparent between the market composition provided in this report and in the previous revision. It should be noted that a 5 year gap exists between the two analyses and it may be that the changes have occurred due to preference changes over time (for example, the estimated volume of spring mattresses is significantly lower in this study, increasing the share of other mattress types within the market). Different data sources are also used, which may contribute to these differences.

In terms of value, the production of mattresses across EU-27 can be broken down as follows:

- 34% spring mattresses (45% excluding mattress supports)
- 25% mattress supports
- 24% PUR mattresses (31% excluding mattress supports)
- 10% Latex mattresses (13% excluding mattress supports)
- 8% other mattresses (11% excluding mattress supports)

Table 8 further analyses the figures above to show which countries have the largest production shares for each mattress type:

- For mattress supports, Germany has the highest percentage of sold volume (25%), followed by Italy (15%). In terms of production value, Germany also represented the greatest share (19%) followed by France (18%).
- For latex mattresses, Italy has the largest production share by sold volume (58%), followed by France (24%). Looking at the production value, Italy similarly led (39%), followed by France (33%).
- For PUR mattresses, Germany has the highest sold volume share (23%), followed by Poland (20%). Looking at the production value, however, Germany led (28%) followed by France (17%).
- For spring mattresses, the United Kingdom has the highest production share based on sold volume (24%), followed by Germany (18%). The UK also represented the largest share (24%) in terms of production value, followed by Germany (13%).
- For the other mattress types, Italy has the highest production share by sold volume (35%), followed by Poland (13%). However, in terms of the value of production Italy led (40%), followed by Spain (14%).

Table 7: Production of bed mattresses in EU-27, Sold volume in thousand units / Production value in EUR million (2010)

Country	SUPPORTS		LATEX		PUR		SPRINGS		OTHERS		TOTAL	
	Volume (1000 units)	Value (M€)	**Volume (1000 units)**	Value (M€)	**Volume (1000 units)**	Value (M€)	**Volume (1000 units)**	Value (M€)	**Volume (1000 units)**	Value (M€)	**Volume (1000 units)**	Value (M€)
Austria	**193**	19.03	**51**	9.30	**626**	74.07	**56**	5.23	**158**	10.97	**1 084**	119
Belgium	**476**	53.91	**:C**	-	**1 395**	89.36	**933**	75.96	**:C**	-	**2 804**	219
Bulgaria	**:C**	5.71	**:C**	-	**24**	1.99	**87**	4.43	**:C**	-	**111**	12
Cyprus	**-**	0	**-**	0	**-**	-	**-**	0	**-**	0	**-**	0
Czech Republic	**:C**	1.85	**225**	17.99	**41**	5.03	**13**	1.05	**:C**	22.34	**279**	48
Denmark	**8**	1.70	**18**	0.70	**792**	98.42	**158**	19.63	**8**	0.13	**984**	121
Estonia	**95**	1.86	**2**	0.44	**-**	-	**58**	4.17	**21**	0.57	**176**	7
Finland	**108**	13.59	**7**	0.58	**388**	18.14	**176**	17.92	**4**	0.04	**683**	50
France	**2 454**	221.47	**1 467**	160.53	**1 886**	203.83	**1 192**	197.64	**:E**	-	**6 999**	783
Germany	**4 979**	231.25	**68**	11.74	**3 513**	331.11	**3 220**	220.51	**250**	11.84	**12 030**	806
Greece	**:C**	-	**:C**	-	**-**	-	**228**	30.31	**25**	7.03	**253**	37
Hungary	**51**	3.02	**12**	1.17	**95**	3.95	**13**	2.13	**:C**	-	**171**	10
Ireland	**106**	7.23	**-**	0	**:C**	:C	**174**	34.46	**:C**	-	**280**	42
Italy	**2 884**	164.03	**3 526**	189.35	**341**	48.82	**1 954**	193.88	**3 045**	163.62	**11 750**	760
Latvia	**:C**	-	**:C**	-	**-**	-	**13**	1.84	**:C**	-	**13**	2
Lithuania	**17**	0.59	**-**	0	**92**	0.84	**98**	5.55	**332**	7.86	**539**	15
Luxembourg	**-**	0	**-**	0	**-**	-	**-**	0	**-**	0	**-**	0
Malta	**-**	0	**-**	0	**-**	-	**-**	0	**-**	0	**-**	0
Netherlands	**122**	30.58	**29**	4.74	**21**	3.67	**175**	131.31	**:E**	31.66	**347**	202
Poland	**:C**	0.01	**74**	11.15	**3 030**	171.00	**2 423**	50.47	**1 630**	18.15	**7 157**	251
Portugal	**1**	-	**64**	0	**18**	1.13	**699**	20.61	**187**	-	**969**	22
Romania	**:C**	-	**-**	-	**-**	-	**402**	-	**:C**	4.22	**402**	4
Slovakia	**:C**	-	**:C**	-	**:C**	:C	**:C**	-	**86**	-	**86**	-
Slovenia	**:C**	165.67	**:C**	22.04	**-**	-	**:C**	193.29	**:C**	57.05	**-**	438
Spain	**2 069**	92.59	**109**	-	**457**	47.85	**1 349**	37.55	**519**	13.76	**4 503**	486
Sweden	**886**	38.6	**:C**	7.95	**:C**	:C	**130**	56.63	**197**	-	**1 213**	103
United Kingdom	**2 272**	174.78	**:C**	7.41	**1 487**	45.19	**4 228**	408.21	**881**	22.64	**8 868**	658
Confidential Data	**2 876**	7.40	**381**	35.09	**1 192**	37.66	**88**	9.76	**1 407**	37.66	**5 944**	127.58
EU27 TOTAL	19 596	**1 235**	6 033	**480**	15 397	**1 182**	17 866	**1 723**	8 750	**410**	67 642	**5 029**

Source: Eurostat, PRODCOM; (:C)= Confidential, (:CE)= Confidential Estimated, (:E)=Estimated

Table 8: Production, % Sold volume in units across EU-27 for each mattress category (2010)

Country	SUPPORTS (% sold volume)	LATEX (% sold volume)	PUR (% sold volume)	SPRING (% sold volume)	OTHER (% sold volume)
Austria	1%	1%	4%	0%	2%
Belgium	2%	:C	9%	5%	:C
Bulgaria	:C	:C	0%	0%	:C
Cyprus	0%	0%	0%	0%	0%
Czech Republic	:C	4%	0%	0%	:C
Denmark	0%	0%	5%	1%	0%
Estonia	0%	0%	0%	0%	0%
Finland	1%	0%	3%	1%	0%
France	13%	24%	12%	7%	:E
Germany	25%	1%	23%	18%	3%
Greece	:C	:C	0%	1%	0%
Hungary	0%	0%	1%	0%	:C
Ireland	1%	0%	:C	1%	:C
Italy	15%	58%	2%	11%	35%
Latvia	:C	:C	0%	0%	:C
Lithuania	0%	0%	1%	1%	4%
Luxembourg	0%	0%	0%	0%	0%
Malta	0%	0%	0%	0%	0%
Netherlands	1%	0%	0%	1%	:E
Poland	:C	1%	20%	14%	19%
Portugal	0%	1%	0%	4%	2%
Romania	:C	0%	0%	2%	:C
Slovakia	:C	:C	:C	:C	1%
Slovenia	:C	:C	0%	:C	:C
Spain	11%	2%	3%	8%	6%
Sweden	5%	:C	:C	1%	2%
United Kingdom	12%	:C	10%	24%	10%

(:C)= Confidential, (:CE)= Confidential Estimated, (:E)=Estimated

Source: Eurostat, PRODCOM

Legend:	< 5%	5-10%	10-20%	20-50%	> 50%

There are widespread differences between the unit values (i.e. the ratio of production value to sold volume) of the mattresses produced across EU27 States. Table 9 reports these values for the different mattress types and the different EU-27 countries with reference 2010. Mattresses with spring interiors sold across all EU-27 Member States show the highest average values per unit (96.34 €), followed by PUR mattresses (80.56 €), latex mattresses (77.43 €), mattress supports (71.84 €) and other mattress types (47.60 €). Moreover, the analysis highlights that some States appear to be producing more expensive products than others. For example, the Netherlands' production of spring interior mattresses is only 1% above that of Ireland in terms of *units* of products; however, the Netherlands production *value* is 64% higher. The Netherlands show the highest unit value for all the products for which data are available (i.e. excluding 'other mattress types')

Table 9: Unit value across EU-27 for each mattress category (2010)

Country	SUPPORTS (€/unit)	LATEX (€/unit)	PUR (€/unit)	SPRING (€/unit)	OTHER (€/unit)
Austria	98.69	182.39	118.32	94.11	69.41
Belgium	113.37	:C	64.06	81.46	:C
Bulgaria	-	:C	82.98	50.95	:C
Cyprus	-	-	-	-	-
Czech Republic	:C	79.88	122.78	81.08	:C
Denmark	212.75	38.67	124.32	124.24	16.75
Estonia	19.61	220.00	-	71.95	27.24
Finland	126.26	83.14	46.76	101.81	10.75
France	90.26	109.42	108.10	165.80	:C
Germany	46.45	172.62	94.25	68.48	47.36
Greece	:C	:C	-	133.19	281.08
Hungary	59.16	97.42	41.62	163.46	:C
Ireland	68.30	-	:C	198.05	:C
Italy	56.88	53.70	143.17	99.21	53.73
Latvia	:C	:C		141.69	:C
Lithuania	34.64		9.16	56.61	23.66
Luxembourg	-	-	-	-	-
Malta	:C	-	-	-	-
Netherlands	315.21	274.00	174.57	322.95	:C
Poland	:C	63.99	56.43	54.19	19.42
Portugal	19.64	174.16	62.56	72.21	97.07
Romania	:C	-	-	51.28	:C
Slovakia	:C	:C	:C	:C	49.05
Slovenia	:C	:C	-	:C	:C
Spain	80.06	202.16	104.71	143.32	109.92
Sweden	104.51	:C	:C	288.88	69.85
United Kingdom	76.93	:C	30.39	96.55	25.70
EU Average	71.14	77.43	80.56	96.34	47.60

(:C)= Confidential, (:CE)= Confidential Estimated, (:E)=Estimated
Source: Eurostat, PRODCOM

3.3.1 Production of mattresses by country

Table 10 presents the value and the volume of total mattress production across EU-27 for 2010. The top five countries with the largest market share, accounting for 71% of the total sales value of production of manufactured goods, are:

- Germany (16%)
- France (16%)
- Italy (15%)
- United Kingdom (13%)
- Spain (10%)

In terms of sold volume of production the top five countries with the largest market share across the EU-27 for 2010 are:

- Germany (18%)
- Italy (17%)
- United Kingdom (13%)
- Poland (11%)
- France (10%)

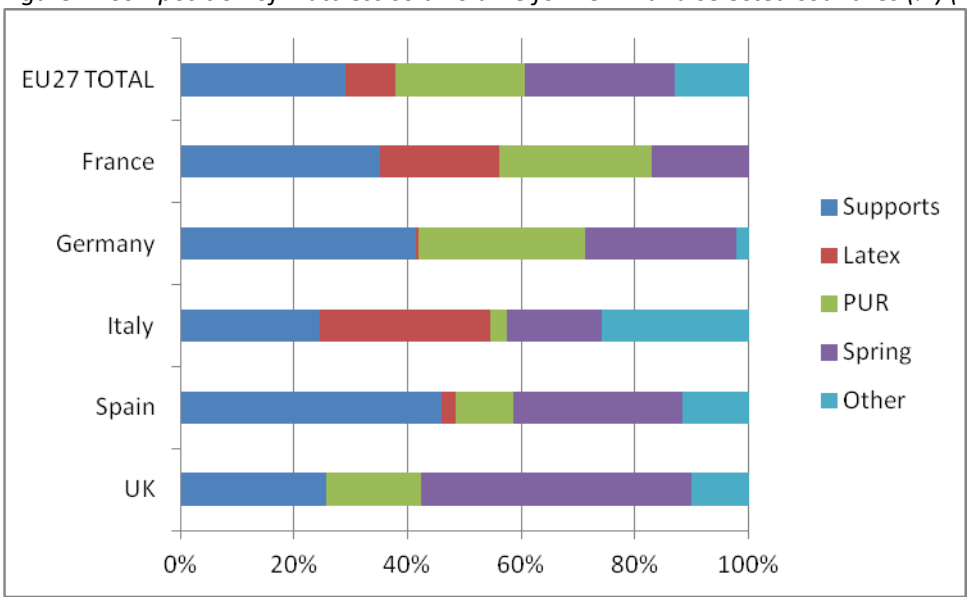
Table 10: Total production of mattresses across EU-27 (2010)

Country	Sold volume (thousand units)	% of total	Total value (EUR million)	% of total
Austria	1 084	1.6%	119	2.4%
Belgium	2 804	4.1%	219	4.4%
Bulgaria	111	0.2%	12	0.2%
Cyprus	-	-	0	-
Czech Republic	279	0.4%	48	1.0%
Denmark	984	1.5%	121	2.4%
Estonia	176	0.3%	7	0.1%
Finland	683	1.0%	50	1.0%
France	6 999	10.3%	783	15.6%
Germany	12 030	17.8%	806	16.0%
Greece	253	0.4%	37	0.7%
Hungary	171	0.3%	10	0.2%
Ireland	280	0.4%	42	0.8%
Italy	11 750	17.4%	760	15.1%
Latvia	13	0.0%	2	0.0%
Lithuania	539	0.8%	15	0.3%
Luxembourg	-	-	0	-
Malta	-	-	0	-
Netherlands	347	0.5%	202	4.0%
Poland	7 157	10.6%	251	5.0%
Portugal	969	1.4%	22	0.4%
Romania	402	0.6%	4	0.1%
Slovakia	86	0.1%	-	-
Slovenia	-	-	438	8.7%
Spain	4 503	6.7%	486	9.7%
Sweden	1 213	1.8%	103	2.0%
United Kingdom	8 868	13.1%	658	13.1%
Confidential data	5 944	8.8%	127.58	2.5%
EU27 TOTAL	67 642		5 029	

Source: Eurostat, PRODCOM

Figure 1 analyzes this information further to determine the composition of the mattress sold volume in 2010 for EU-27 and a selection of countries which show the highest values of production.

Figure 1: Composition of mattress sold volume for EU-27 and selected countries (%) (2010)



Source: Eurostat, PRODCOM

Looking at the composition of mattress production across the EU-27, mattress supports and spring interiors are the most represented products. The composition of mattress products produced by each country in 2010 is outlined below:

- Production in Spain consists predominantly of mattress supports (46%), that is followed by spring mattress (30%). The share of spring mattresses is 55% without taking into account for mattress supports. The production volume of latex mattresses is not shown for Spain.
- The United Kingdom also produces a high proportion of one mattress type; spring mattresses (48%). The share of spring mattresses is 64% without taking into account for mattress supports. The production volume of latex mattresses is not shown for UK.
- Italy shows a relatively consistent spread across proportion of mattress types produced, but latex represents the highest proportion of the overall production (30%). This corresponds with Italy being the market leader for production of this type of mattress across the EU-27. Italy also displays higher proportion of 'other mattress types' (26%) than other top producing countries. Previous figures increase to 40% and 36%, respectively, without taking into account for mattress supports. Production of PUR mattresses appears marginal in Italy.
- Production data for France also present a generally consistent spread across all mattress types, but mattress supports have the greatest production volume (35%), followed by PUR mattresses (27%). The share of PUR mattresses is 41% without taking into account for mattress supports. The production volume of other mattresses is not shown for France.
- Germany, like France, also shows mattress supports as the highest produced products (41%). Significant market share are also covered by PUR and spring mattresses (29% and 27%, respectively). On the contrary, production of latex mattresses appears marginal while the production volume of other mattresses is not shown for Germany. The share of PUR and spring mattresses is 49% and 46%, respectively, without taking into account for mattress supports.

3.4 Trade

3.4.1 Relative weight of trade compared to production[a]

In 2010, total value of all mattresses produced across the EU-27 was EUR 5 billion, while total imports of mattresses across the EU-27 amounted to EUR 1.4 billion and exports to EUR 1.7 billion. Table 11 summarises total sold production values and trade values across all mattress types in the EU-27. The percentage of total value that represents trade is also reported.[b]

Table 11: Total values of sold production and trade (2010)[c]

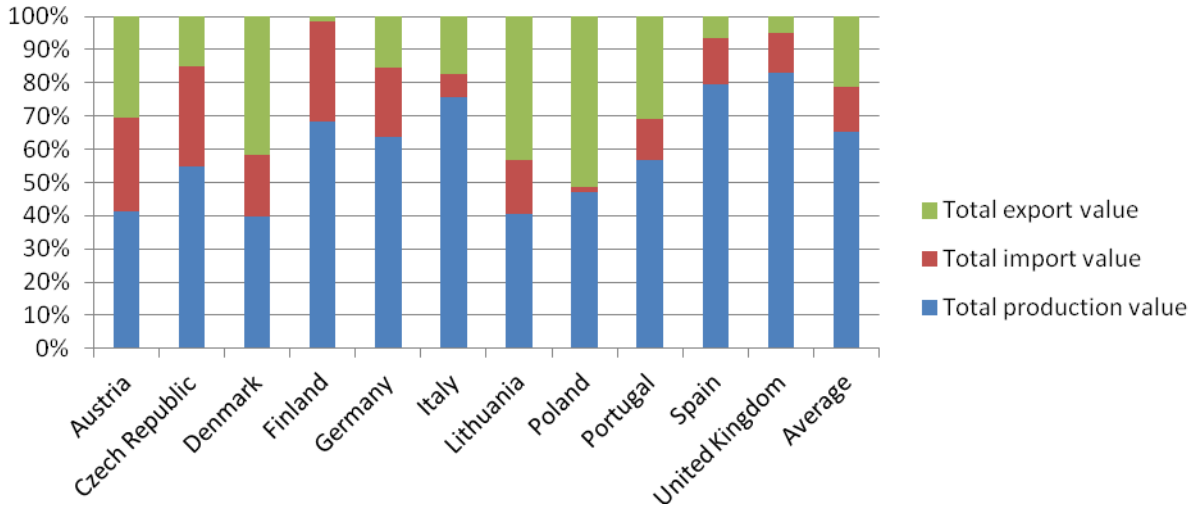
Country	Total production (EUR million)	Total import (EUR million)	Ratio import to prod.	Total export value (EUR million)	Ration export to prod.
Austria	119	82	0.69	87	0.73
Belgium	219	70	0.32	197	0.90
Bulgaria	12	4	0.31	4	0.31
Cyprus	0	4	-	1	-
Czech Republic	48	27	0.55	13	0.28
Denmark	121	56	0.46	127	1.05
Estonia	7	4	0.60	13	1.83
Finland	50	22	0.44	1	0.02
France	783	200	0.25	74	0.09
Germany	806	265	0.33	194	0.24
Greece	37	17	0.44	4	0.11
Hungary	10	10	1.00	10	0.97
Ireland	42	12	0.29	12	0.30
Italy	760	69	0.09	176	0.23
Latvia	2	3	1.70	2	0.84
Lithuania	15	6	0.41	16	1.06
Luxembourg	0	10	-	0	-
Malta	0	1	-	0	-
Netherlands	107	143	1.33	91	0.86
Poland	369	13	0.03	404	1.09
Portugal	81	18	0.22	44	0.55
Romania	21	8	0.41	2	0.08
Slovakia	4	14	3.29	8	1.99
Slovenia	0	31	-	32	-
Spain	**486**	83	**0.17**	41	**0.08**
Sweden	**144**	93	**0.64**	69	**0.48**
United Kingdom	**658**	96	**0.15**	38	**0.06**
EU27	**4 902**	1 359	**0.28**	1 659	**0.34**

Source: Production data from Eurostat, PRODCOM (2010); Trade data from COMEXT (2010)

a Note: Value data has been used for comparison of trade relative to production. Volume data has not been used as production volume is reported in units and trade volume in tonnes. This limits accurate comparisons of production and trade volumes.
b From this data it is also possible to estimate apparent consumption in terms of value, as production value + import value – export value. However, this is not addressed in this report because data quality would not allow for an accurate calculation of the apparent consumption for a significant portion of countries
c See Appendix VII for breakdown by mattress type

It is important to note that the PRODCOM trade value data are not complete for all countries. Since some confidential values are included, in some cases total production value may be different than stated. To account for this, Figure 2 shows the value that is apportioned to production and trade for a selection of EU-27 Member States. These States have been selected because they have complete data across production and trade for 2010 and as such give a more accurate representation of the relative weight of trade compared to production.

Figure 2: Percentage weight of trade values and sold production values for selected countries (2010)



Source: Production data from Eurostat, PRODCOM (2010); Trade data from COMEXT (2010)

3.4.2 Total EU27 Trade

Table 12 and Table 13 show the Eurostat statistics on imports and exports, presenting the sum of the EU-27 intra- and extra-Europe trade data for 2010.[a]

Across the EU27, the largest importer in terms of value is Germany with a value of about EUR 0.3 billion which accounts for 19% of the total EU-27 import. The largest exporter is Poland with a value of EUR 0.4 billion (24% of the total EU-27 export). In 2010, total imports to the EU-27 States were 267 tonnes, with a value of EUR 1.4 billion. Total exports were 57 tonnes, with a value of EUR 1.7 billion.

For mattress supports:

- The value of imports is EUR 271 million, i.e. 20% of the overall trade. This also corresponds to 22% of the production value of mattress supports in EU-27 in 2010. The largest importers in terms of volume in 2010 were the Netherlands (14%) and Germany (12%). In terms of value this was reversed, with Germany the largest importer (15%) followed by the Netherlands (14%).
- The value of exports is EUR 319 million, i.e.19% of the overall trade. This also corresponds to 26% of the production value of mattress supports in EU-27 in 2010. The largest exporter was Germany (29%) followed by Poland (17%). In terms of monetary value Germany also had the greatest export value (28%), followed by Belgium (13%).

a Data for 2005-2009 can be found in Appendix III

For latex mattresses:

- The value of imports is EUR 112 million, i.e. 8% of the overall trade (10% with the exclusion of mattress supports). This also corresponds to 23% of the production value of mattress supports in EU-27 in 2010. The largest importer in terms of volume was Austria (21%) followed by France (18%). This was reversed in terms of value, with France being the largest importer (18%) followed by Austria (12%).
- The value of exports is EUR 181 million, i.e. 11% of the overall trade (14% with the exclusion of mattress supports). This also corresponds to 38% of the production value of mattress supports in EU-27 in 2010. The largest exporters in volume terms were Italy (52%) followed by Poland (15%). In monetary value, Italy (51%) and Poland (12%) were also the largest exporters.

For PUR mattresses:

- The value of imports is EUR 456 million, i.e. 34% of the overall trade (42% with the exclusion of mattress supports). This also corresponds to 39% of the production value of mattress supports in EU-27 in 2010. The largest importers in terms of both volume and value were Germany (38% and 32% respectively) and France (14% volume and value).
- The value of exports is EUR 619 million, i.e. 37% of the overall trade (46% with the exclusion of mattress supports). This also corresponds to 52% of the production value of mattress supports in EU-27 in 2010. The largest exporters in volume were Poland (53%) and Belgium (12%). Poland was also the largest exporter by value (37%), followed by Denmark (16%).

For mattresses with spring interiors:

- The value of imports is EUR 238 million, 18% of the overall trade (i.e. 22% with the exclusion of mattress supports). This also corresponds to 14% of the production value of mattress supports in EU-27 in 2010. The largest importers in terms of volume and value were Sweden (18% and 15% respectively), followed by the UK (17% and 14% respectively).
- The value of exports is EUR 242 million, 15% of the overall trade (i.e. 19% with the exclusion of mattress supports). This also corresponds to 14% of the production value of mattress supports in EU-27 in 2010. The largest exporters by volume were Portugal (26%) followed by Poland (19%). In monetary value, however, the largest exporters were Belgium (21%) followed by Poland (16%).

For 'other' mattress types:

- The value of imports is EUR 282 million, i.e. 21% of the overall trade (26% with the exclusion of mattress supports). This also corresponds to 69% of the production value of mattress supports in EU-27 in 2010. The largest importers in terms of volume were France (18%) followed by Spain (14%). In terms of monetary value, France had the greatest value (22%), followed by Germany (16%).
- The value of exports is EUR 298 million, i.e. 18% of the overall trade (22% with the exclusion of mattress supports). This also corresponds to 73% of the production value of mattress supports in EU-27 in 2010. The largest exporters in terms of volume were Poland (39%) followed by Italy (17%). Poland and Italy also led in terms of value (29% and 17% respectively).

Table 12: EU-27 total trade in mattresses, value of imports and exports expressed in terms of EUR millions (2010)

Country	SUPPORTS		LATEX		PUR		SPRING		OTHER		TOTAL	
	Import value (M€)	Export value (M€)	Import value (M€)	Export value (M€)	Import value (M€)	Export value (M€)	Import value (M€)	Export value (M€)	Import value (M€)	Export value (M€)	Import value (M€)	Export Value (M€)
Austria	24.49	13.48	26.65	8.35	8.87	25.26	5.77	31.98	3.25	20.92	81.84	87.17
Belgium	28.27	3.55	18.39	13.33	6.60	41.31	13.48	80.51	49.91	11.55	70.15	196.77
Bulgaria	0.24	1.61	0.92	0.36	0.58	0.12	1.53	0.16	1.66	0.26	3.72	3.74
Cyprus	0.40	0.22	0.86	1.08	1.62	0.01	-	0.07	0.51	-	4.18	0.59
Czech Republic	4.40	4.32	8.82	5.94	3.05	2.71	0.26	4.71	4.21	1.39	26.53	13.28
Denmark	9.94	9.95	8.20	11.78	15.72	12.51	3.64	100.10	6.14	4.39	55.60	126.79
Estonia	0.12	0.10	1.82	1.10	1.08	1.05	0.78	2.83	7.38	0.84	4.22	12.88
Finland	3.63	1.09	5.21	8.90	3.14	0.02	0.01	0.37	0.55	0.16	21.98	1.12
France	34.18	20.36	63.33	19.29	62.59	15.97	20.25	5.87	10.14	21.81	199.74	74.05
Germany	39.35	10.74	147.97	21.63	44.84	88.61	6.49	45.02	24.97	29.35	264.53	194.44
Greece	2.62	2.15	3.89	4.00	3.86	0.06	2.66	0.12	0.66	0.54	16.51	4.04
Hungary	1.16	2.33	2.88	2.97	0.88	7.29	0.01	0.42	2.17	0.06	10.22	9.95
Ireland	1.41	0.18	1.61	3.84	4.90	11.40	0.01	0.27	0.01	0.81	11.95	12.50
Italy	9.85	10.42	21.19	6.53	20.99	17.40	92.69	7.01	8.20	50.36	68.98	175.67
Latvia	0.19	0.15	1.43	0.94	0.42	0.32	0.14	0.20	0.45	0.44	3.13	1.56
Lithuania	0.26	0.12	3.71	0.88	1.05	2.91	0.04	0.77	2.34	9.73	6.03	15.79
Luxembourg	2.70	2.01	1.34	1.65	2.76	0.01	0.00	0.02	0.00	0.01	10.47	0.05
Malta	0.15	0.15	0.24	0.25	0.35	0.00	-	0.00	0.00	-	1.14	0.00
Netherlands	37.45	7.39	51.35	29.61	16.73	8.90	0.65	53.88	9.08	18.98	142.52	91.50
Poland	4.34	2.22	2.58	0.74	2.74	26.31	21.50	230.95	38.61	86.17	12.61	403.54
Portugal	1.47	2.15	3.69	7.08	3.40	1.46	4.47	0.32	30.05	7.97	17.79	44.27
Romania	0.65	0.72	3.84	1.33	1.95	0.02	0.00	0.02	1.18	0.38	8.49	1.61
Slovakia	1.79	2.93	3.87	1.88	3.41	2.63	0.01	0.25	0.59	4.93	13.88	8.40
Slovenia	10.02	1.12	15.76	2.81	1.04	9.92	0.86	16.75	1.96	2.68	30.75	32.16
Spain	24.52	8.39	15.03	11.83	23.54	6.70	4.11	9.97	11.55	8.21	83.30	40.54
Sweden	13.04	2.49	20.16	35.43	21.67	29.27	0.93	17.89	13.21	7.59	92.79	68.89
United Kingdom	14.36	1.81	21.11	34.39	24.05	6.49	1.18	8.54	13.58	8.21	95.73	38.01
EU27	271.00	112.15	455.85	237.93	281.84	318.69	181.47	619.02	242.37	297.75	1 358.76	1 659.29

Source: E*urostat, COMEXT, (2010)*

Table 13: EU-27 total trade in mattresses, volume of imports and exports in terms of tonnes (2010)

Country	SUPPORTS		RUBBER		PUR		SPRING		OTHER		TOTAL	
	Import Vol. (tonnes)	Export Vol. (tonnes)	Import Vol. (tonnes)	Export Vol. (tonnes)	Import Vol. (tonnes)	Export Vol. (tonnes)	Import Vol. (tonnes)	Export Vol. (tonnes)	Import Vol. (tonnes)	Export Vol. (tonnes)	Import Vol. (tonnes)	Export Vol. (tonnes)
Austria	7 606	4 515	4 855	815	3 696	2 865	1 483	504	1 173	1 843	18 813	10 542
Belgium	7 817	8 572	484	1 529	2 620	12 885	2 359	8 057	1 466	2 095	14 746	33 137
Bulgaria	75	41	238	407	132	26	106	774	164	41	715	1 289
Cyprus	84	4	36	-	136	10	369	128	496	-	1 120	-
Czech Republic	2 164	1 336	842	32	1 718	839	1 778	1 657	520	123	7 021	3 988
Denmark	3 197	3 911	1 671	669	981	7 793	2 999	964	2 325	1 055	11 173	14 391
Estonia	38	520	15	153	388	458	417	1 866	165	188	1 023	3 184
Finland	1 077	5	146	-	809	25	2 185	115	435	8	4 651	152
France	9 836	3 423	3 995	4 619	11 571	554	4 748	916	8 555	2 770	38 704	12 282
Germany	10 237	26 405	1 969	890	30 475	7 572	5 795	6 195	4 798	3 346	53 274	44 407
Greece	932	20	272	176	611	13	1 061	155	783	89	3 660	452
Hungary	480	2 204	517	3	518	72	954	395	148	8	2 617	2 682
Ireland	535	1 110	22	1	291	14	1 263	2	1 387	24	3 498	1 150
Italy	4 572	3 880	2 029	17 895	3 750	1 341	1 697	1 652	2 690	9 276	14 738	34 045
Latvia	60	347	21	21	192	32	291	100	95	97	660	596
Lithuania	89	2 035	17	8	459	244	227	621	230	2 141	1 021	5 048
Luxembourg	298	3	141	0	117	3	173	1	167	1	896	8
Malta	40	4	20	-	23	3	89	0	93	-	264	-
Netherlands	12 105	1 681	1 264	70	7 612	9 182	6 720	1 079	4 221	2 279	31 922	14 291
Poland	2 091	15 421	469	5 092	353	58 248	108	10 806	519	20 702	3 540	110 269
Portugal	709	478	330	902	554	34	1 446	15 047	469	1 342	3 508	17 802
Romania	315	7	123	1	591	1	493	261	498	126	2 019	396
Slovakia	627	590	318	-	758	24	539	130	546	629	2 788	1 374
Slovenia	4 031	3 817	213	126	2 885	2 143	843	573	200	585	8 172	7 245
Spain	7 797	2 505	1 695	569	3 454	2 453	3 962	2 188	6 591	3 030	23 499	10 745
Sweden	5 031	6 621	414	118	2 804	2 379	11 244	1 127	3 702	510	23 195	10 755
United Kingdom	6 151	877	510	112	3 581	668	10 614	2 522	5 833	1 027	26 689	5 208
EU27	87 993	90 332	22 627	34 207	81 079	109 879	63 959	57 833	48 268	53 335	303 925	345 586

Source: Eurostat, COMEXT, (2010

Table 14 further analyses the overall trade volumes. Net exports are calculated as total export volume less total import volume. Volumes include both intra and extra trade. Negative figures are found where the calculation provided higher values for total imports than for than total exports.

Table 14: Net export volumes of mattress across the EU-27 in terms of tonnes (2010)

Country	Total import volume (tonnes)	Total export volume (tonnes)	Net export volume (tonnes)
Austria	18 813	10 542	-8 271
Belgium	14 746	33 137	18 391
Bulgaria	715	1 289	574
Cyprus	1 120	142	-978
Czech Republic	7 021	3 988	-3 034
Denmark	11,173	14 391	3 218
Estonia	1 023	3 184	2 161
Finland	4 651	152	-4 499
France	38 704	12 282	-26 422
Germany	53 274	44 407	-8 867
Greece	3 660	452	-3 207
Hungary	2 617	2 682	66
Ireland	3 498	1,150	-2 348
Italy	14 738	34 045	19 307
Latvia	660	596	-64
Lithuania	1 021	5 048	4 027
Luxembourg	896	8	-888
Malta	264	7	-257
Netherlands	31 922	14 291	-17 631
Poland	3 540	110 269	106 729
Portugal	3 508	17 802	14 294
Romania	2 019	396	-1 623
Slovakia	2 788	1 374	-1 414
Slovenia	8 172	7 245	-927
Spain	23 499	10 745	-12 754
Sweden	23 195	10 755	-12 440
United Kingdom	26 689	5 208	-21 481
EU27 total	303 925	345 586	41 661

Source: calculated from COMEXT (2010)

3.4.3 Intra-EU trade

Table 16 presents the composition of intra-EU trade volumes by mattress type. In terms of weight, 45% of total intra-EU trade is imports and 55% exports. In contrast to production, PUR mattresses represent the greatest traded mattress type, with 32% of total intra-EU imports and 34% of total intra-EU exports.

Table 15: Intra-EU trade volume by mattress type in terms of tonnes (2010)

Mattress type	Volume of imports (tonnes)	% share of imports	Volume of exports (tonnes)	% share of imports
SUPPORTS	127 178	27%	146 430	25%
LATEX	40 094	9%	59 335	10%
PUR	148 319	32%	196 895	34%
SPRING	96 871	21%	96 756	17%
OTHER	54 549	12%	81 753	14%
TOTAL	**467 011**		**581 169**	

Table 16 presents Intra-EU trade volumes across the EU-27 by mattress types.

Intra-EU imports

In 2010 intra-EU imports represented nearly 79% of all mattress imports by weight. The largest importers were:

- Germany, representing 19% of total intra-EU mattress imports. Its main trading partners were Poland (61%) and Italy (24%).
- France, accounting for 14% of total intra-EU mattress imports. Its main trading partners were Belgium (30%) and Poland (27%).
- The Netherlands, accounting for 10% of total intra-EU mattress imports. Its main trading partners were Belgium (41%) and Poland (23%).

Intra-EU exports

In 2010 intra-EU exports represented nearly 85% of all mattress exports by weight. The largest exporters were:

- Poland, representing 35% of total intra-EU mattress exports. Its main trading partners were Germany (34%) and Sweden (12%).
- Germany, accounting for 13% of total intra-EU exports. Its main trading partners were the Netherlands (33%) and Austria (22%).
- Belgium, accounting for 11% of total intra-EU exports. Its main trading partners were the Netherlands (50%) and France (42%).

Table 16: Intra-EU trade in mattresses, volumes of imports and exports in terms of tonnes (2010)

Country	SUPPORTS		LATEX		PUR		SPRING		OTHER		TOTAL	
	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)
Austria	5 226	3 867	4 846	655	3603	1 863	1 171	353	956	1 573	15 802	8 311
Belgium	7 475	8 509	366	1 503	2157	12 365	2 046	7 991	721	1 968	12 764	32 336
Bulgaria	66	40	238	394	114	23	20	752	119	34	557	1 243
Cyprus	75	0	32	0	120	10	309	119	334	0	870	129
Czech Republic	2 160	1 306	837	31	1677	836	1 748	1 656	438	117	6 860	3 946
Denmark	3 102	1 286	1 394	388	929	5 524	2 533	171	1 011	340	8 968	7 708
Estonia	38	520	11	153	387	438	139	1 344	129	150	703	2 604
Finland	1 021	2	146	0	798	6	2 180	28	351	2	4 495	37
France	7 494	1 970	3 977	3 816	11167	335	4 513	801	6 235	2 151	33 385	9 073
Germany	6 699	22 372	1 678	552	28948	6 348	3 745	4 905	3 425	2 448	44 495	36 624
Greece	896	15	259	172	571	13	801	144	123	36	2 649	380
Hungary	479	2 158	509	0	498	56	728	390	139	3	2 354	2 607
Ireland	372	1 110	22	1	255	12	1 102	2	520	12	2 270	1 136
Italy	1 986	3 251	1 972	15 395	3 375	891	1 442	1 010	915	5 682	9 690	26 229
Latvia	58	346	5	21	181	32	170	93	59	88	475	579
Lithuania	89	1 498	17	3	447	241	179	235	208	1 816	939	3 792
Luxembourg	298	3	141	0	117	3	173	1	167	1	895	7
Malta	36	0	19	0	22	0	11	0	20	0	108	-
Netherlands	8 641	1 597	880	14	7 304	9 115	6 199	874	1 760	2 137	24 783	13 736
Poland	1 693	14 551	76	5 049	303	55 796	96	8 611	293	17 225	2 461	101 232
Portugal	651	459	330	891	553	1	1 397	14 535	448	989	3 379	16 876
Romania	275	7	119	1	585	1	420	217	298	65	1 696	291
Slovakia	625	23	306	0	752	13	454	130	515	616	2 653	781
Slovenia	276	3 541	208	51	2 859	1 223	236	186	120	491	3 698	5 491
Spain	7 530	1 867	1 284	454	3 105	1 808	3 910	2 086	4 384	2 258	20 213	8 473
Sweden	4 639	2 549	254	94	2 143	1 271	10 087	585	3 208	278	20 331	4777
UK	3 380	738	250	68	2 379	451	5 261	2 321	759	799	12 028	4 376
EU27	**65 279**	**73 584**	**20 172**	**29 701**	**75 349**	**98 673**	**51 066**	**49 538**	**27 654**	**41 276**	**239 520**	**292 773**

Source: Eurostat, COMEXT, (2010)

3.4.4 Extra-EU trade

In terms of weight, 55% of total extra-EU trade is imports and 45% exports. Within this total, mattress supports and 'other mattress types' were the largest traded volumes, respectively accounting for 35% and 32% of total extra-EU imports and for 32% and 23% of total extra-EU exports. This is shown in Table 18, which breaks down extra-EU trade by mattress type. Table 18 presents extra-EU trade volumes by mattress types across the EU-27. By comparing intra- and extra-EU trade data it is possible to observe that mattresses are mainly traded within the EU-27 borders. In terms of overall amounts, extra-EU imports account indeed for 14% of the intra-EU imports, while extra-EU exports account for 9% of the intra-EU exports.

Extra-EU imports

In terms of weight, the largest extra-EU importers of goods in 2010 were:

- The United Kingdom with 23%. Its main trading partners were China (57%) and Turkey (37%).
- Germany with 14%. Its main trading partners were Turkey (27%) and Switzerland (26%).
- The Netherlands with 11%. Its main trading partners were China (42%) and Turkey (32%).

Extra-EU exports

In terms of weight, the largest extra-EU exporters of goods in 2010 were:

- Poland with 17%. Its main trading partners were Norway (29%) and Switzerland (17%).
- Italy with 15%. Its main trading partners were Switzerland (17%) and Japan (15%).
- Germany, also with 15%. Its main trading partner was Switzerland (64%).

Table 17: Extra-EU trade volume by mattress type in terms of tonnes (2010)

Mattress type	Volume of imports (tonnes)	% share of imports	Volume of exports (tonnes)	% share of imports
SUPPORTS	22 713	35%	16 748	32%
LATEX	2 455	4%	4 505	9%
PUR	5 730	9%	11 206	21%
SPRING	12 893	20%	8 295	16%
OTHER	20 614	32%	12 059	23%
TOTAL	**64 405**		**52 813**	

Source: Eurostat, COMEXT, (2010)

Table 18: *Extra-EU trade in mattresses, volume of imports and exports in tonnes (2010)*

Country	SUPPORTS		LATEX		PUR		SPRING		OTHER		TOTAL	
	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)	Import volume (tonnes)	Export volume (tonnes)
Austria	2 380	648	9	160	93	1 003	312	151	216	270	3 011	2 231
Belgium	342	63	118	26	463	520	313	66	745	127	1 982	801
Bulgaria	9	1	0	13	18	3	87	21	45	7	159	45
Cyprus	9	4	4	0	16	0	60	9	162	0	251	13
Czech Republic	4	30	5	2	41	4	31	1	82	6	162	42
Denmark	96	2 625	278	281	52	2 269	466	793	1 314	715	2 205	6 683
Estonia	0	0	4	0	1	19	278	522	37	38	320	580
Finland	56	3	0	0	11	19	5	87	84	6	156	115
France	2 342	1 453	18	803	404	219	235	116	2 320	619	5 319	3 209
Germany	3 538	4 033	291	339	1 527	1 223	2 050	1 290	1 374	898	8 780	7 783
Greece	36	5	14	4	40	0	261	11	660	52	1 010	73
Hungary	0	46	8	3	20	16	226	4	9	6	263	76
Ireland	163	0	1	0	36	3	161	0	867	12	1 228	15
Italy	2 586	630	57	2 500	375	450	255	642	1 775	3 595	5 049	7 816
Latvia	2	1	16	0	11	1	121	6	36	9	185	16
Lithuania	0	537	0	5	12	3	48	386	22	325	82	1 256
Luxembourg	0	0	0	0	0	0	0	0	1	0	1	0
Malta	4	4	1	0	0	3	78	0	73	0	157	7
Netherlands	3 464	84	385	56	309	67	521	205	2 461	142	7 139	555
Poland	399	871	393	42	50	2 452	12	2 195	225	3 477	1 079	9 037
Portugal	58	19	0	11	1	33	49	512	21	353	129	927
Romania	40	0	4	0	7	0	73	44	200	61	323	105
Slovakia	2	568	12	0	6	11	85	0	31	14	135	593
Slovenia	3 755	276	5	75	27	920	607	388	81	95	4 474	1 754
Spain	267	638	411	115	349	645	53	103	2 207	772	3 287	2 272
Sweden	392	4 072	161	25	661	1 108	1 156	542	493	232	2 863	5 978
UK	2 770	140	260	45	1 202	218	5 353	202	5 075	228	14 660	832
EU27	**22 713**	**16 748**	**2 455**	**4 505**	**5 730**	**11 206**	**12 893**	**8 295**	**20 614**	**12 059**	**64 405**	**52 813**

Source: COMEXT trade data (2010)

3.5 Market Trends

3.5.1 Production

Trends in mattress production volume

The recent trend that can be observed in EU mattress production volumes is that of a stagnating industry, declining by an average compound annual growth rate (CAGR) of 6% per year between 2005 and 2010, as shown in Table 19. Figure 3 outlines the trends in production graphically.

In general, volumes have remained steady across all mattress types and the declining average CAGR could be partly attributed to the changes seen in mattresses of PUR. This mattress category has shown a large decrease in volume (-52%) between 2005 and 2006, but has remaining relatively steady since. Total production units show a sharp decrease between 2005 and 2006 (again, predominantly due to the drop in production volume of mattresses of PUR) and show a more steady decrease continuing into 2010.

Total production volume across all mattress types in the EU-27 decreased by 27% between 2005 and 2010. The only increase in volume of production is seen within the category 'other mattresses' (31%). Mattress supports (-8%), spring mattresses (-23%) and latex mattresses (-24%) have all shown a decrease, with mattresses of PUR representing the largest decrease in volume of production (-54%).

These changes represent the CAGR between 2005 and 2010 of:

- + 5.6% per year for other mattresses
- - 1.7% per year for mattress supports
- - 5.0% per year for spring mattresses
- - 5.3% per year for latex mattresses
- - 14.5% per year for 'PUR mattresses
- - 6.1% per year on overall (-7.6% excluding mattress supports)

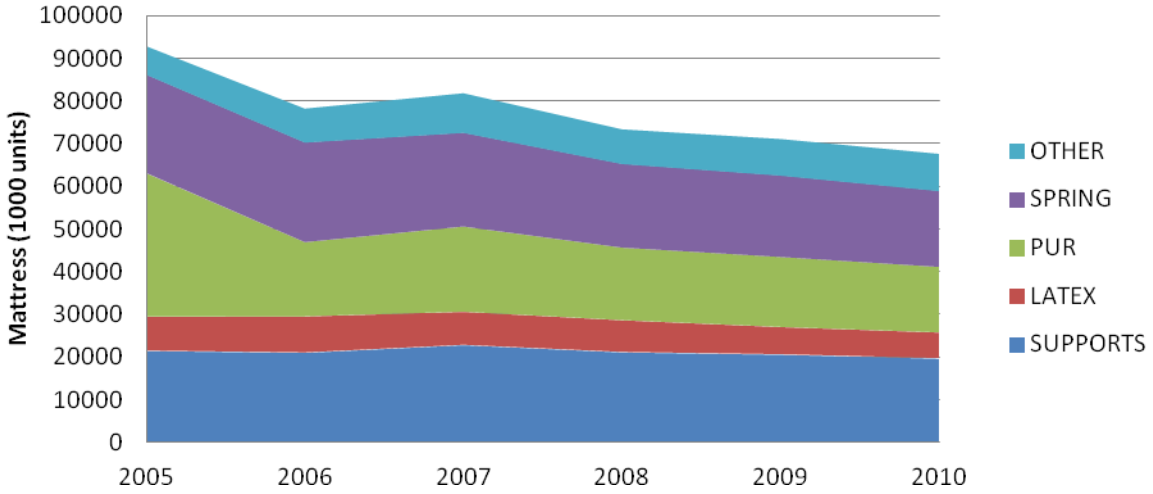
The three year CAGR identifies growth trends of mattress production between 2008 and 2010. In general terms, production across all mattress types has shown an overall decrease of -4.0% per year. As before, positive CAGR can be seen with 'other mattress types' (3.7%). All other mattress categories show a negative growth rate.

Table 19: *Trends in mattress production, sold volumes in terms of units (2005-2010)*

Mattress type	2005 (1000 units)	2006 (1000 units)	2007 (1000 units)	2008 (1000 units)	2009 (1000 units)	2010 (1000 units)	% change 2005-2010	5 year CAGR (%)	3 year CAGR (%)
SUPPORTS	21 392	20 951	22 745	21 063	20 530	19 596	-8%	-1.7%	-3.5%
LATEX	7 941	8 461	7 759	7 460	6 388	6 033	-24%	-5.3%	-10.1%
PUR	33 687	17 431	20 000	17 038	16 454	15 397	-54%	-14.5%	-4.9%
SPRING	23 077	23 400	22 000	19 673	19 145	17 866	-23%	-5.0%	-4.7%
OTHER	6 676	7 955	9 293	8 130	8 593	8 750	31%	5.6%	3.7%
TOTAL	**92 774**	**78 198**	**81 797**	**73 364**	**71 110**	**67 642**	**-27%**	**-6.1%**	**-4.0%**

Source: own calculations based on Eurostat PRODCOM database, 2010

Figure 3: *Trends in mattress production, sold volumes across EU27 by mattress type (2005-2010)*



Source: Eurostat PRODCOM database, 2010

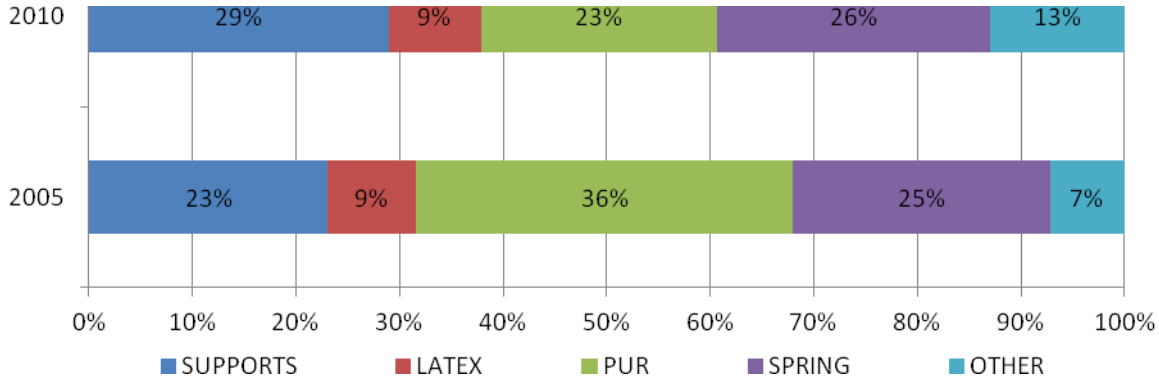
Composition of mattress production 2005-2010

Figure 4 further illustrates how the composition of mattress production changed from 2005 to 2010. PUR mattresses registered the largest decrease in terms of sold volume across the EU27, from 36% to 23%. While the proportion of latex mattresses maintains stationary at 9%, a market share increase is instead observed for mattress supports (6% points), spring mattresses (1% points) and other mattress types (6% points). Nevertheless, sold volume increased only for this last category (+31% from 2005 to 2010).

Trends in mattress production value

A comparable analysis of the sold production trends can be conducted in terms of production value. Table 20 shows the changes in values of each mattress type from 2005 to 2010. Total EU production of mattresses grew by an average 0.5% CAGR between 2005 and 2010 (1.2% excluding mattress supports). Production values apparently increase for 'other mattress types' (64%) and PUR mattresses (42%). Decreasing values are instead registered for mattress supports, latex mattresses and mattresses with spring interiors.

Figure 4: *Changes in the composition of the sold volume of mattresses (2005-2010)*



Source: Eurostat PRODCOM database, 2010

These changes translate to the following average CAGRs across the mattress types:

- The category 'other mattresses' shows the highest CAGR with a 10.3% increase year-on-year
- PUR mattresses grew with a CAGR of 7.3%
- All other mattress categories show negative growth rates between -2.5% and -1.5% year-on-year

The three year CAGR identifies growth trends of mattress production between 2008 and 2010. The value across all mattress types produced in the EU-27 has shown an overall decrease of -3.2% year-on-year (-2.4% excluding mattress supports). Positive CAGR can be seen with PUR (0.9%) and other mattress types (0.3%). Mattress supports show the greatest decrease in value between 2008 and 2010 with a -5.4% CAGR.

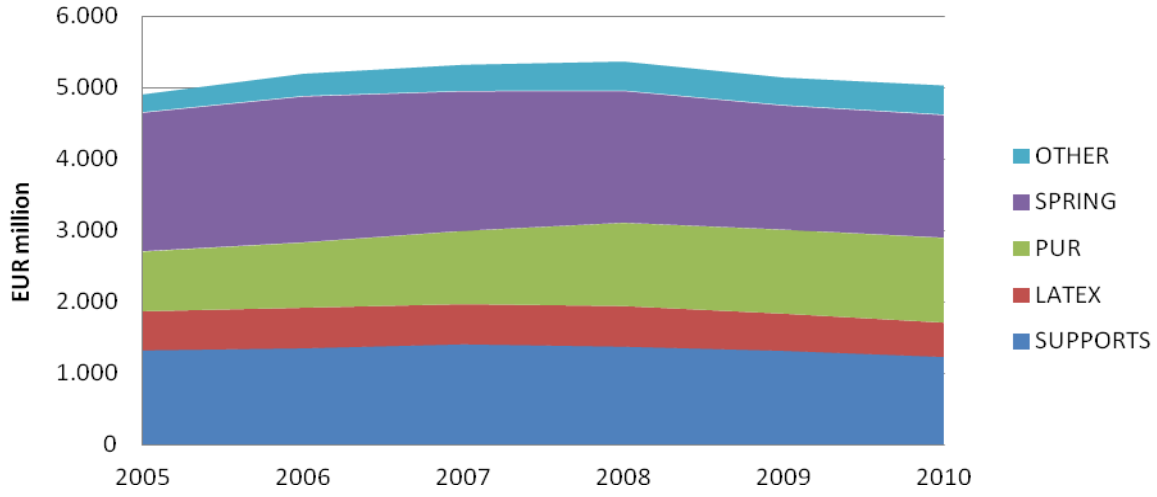
Table 20: *Trends in mattress production values (2005-2010)*

Mattress type	2005 (€million)	2006 (€million)	2007 (€million)	2008 (€million)	2009 (€million)	2010 (€million)	% change 2005-2010	5 year CAGR (%)	3 year CAGR (%)
SUPPORTS	1 327	1 357	1 413	1 380	1 321	1 235	-7%	-1.4%	-5.4%
LATEX	546	566	560	567	519	480	-12%	-2.5%	-8.0%
PUR	832	908	1 020	1 160	1 170	1 182	42%	7.3%	0.9%
SPRING	1 948	2 050	1 960	1 852	1 744	1 723	-12%	-2.4%	-3.6%
OTHER	250	313	367	407	387	410	64%	10.3%	0.3%
TOTAL	**4 904**	**5 194**	**5 321**	**5 366**	**5 141**	**5 029**	**3%**	**0.5%**	**-3.2%**

Source: own calculations based on Eurostat PRODCOM database, 2010

Figure *5* outlines the trends in value of various mattress types produced in the EU-27 between 2005 and 2010. In general terms, production values remain relatively steady, with spring interior mattresses and 'other mattresses category' being characterized by the highest and the lowest turnover, respectively. The total production value in the EU-27 has increased by 3% from 2005 to 2010 (6% excluding mattress supports). However, it has decreased by 6% from 2008 to 2010 (-5% excluding mattress supports). This is predominantly due to a significant decrease in the total value of PUR mattresses, mattress supports and spring mattresses, which decreased in value by 15%, 10% and 7%, respectively, from 2008 to 2010.

Figure 5: Trends in mattress production, value across EU27 by mattress type (2005-2010)



Source: Eurostat PRODCOM database, 2010

Production forecasts

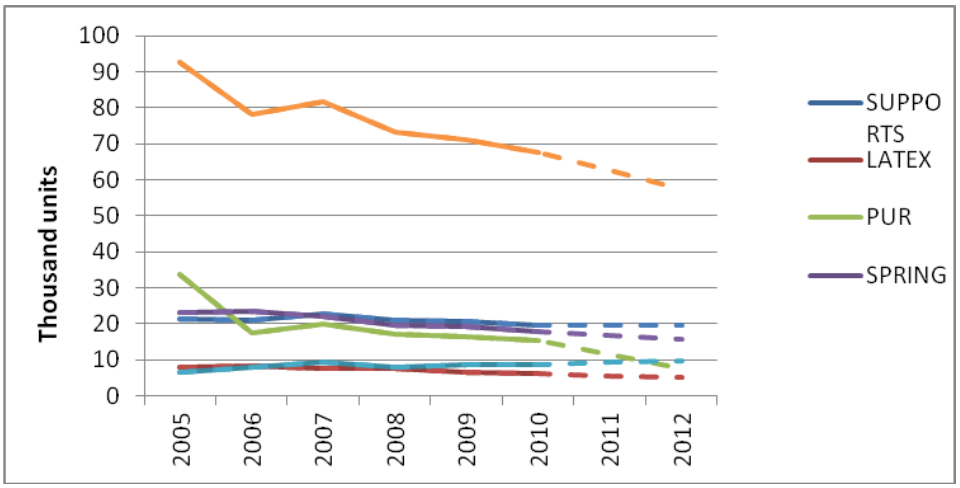
Overall, assuming a continuation of current trends (from 2005-2010) in the sold volumes of mattresses, it is likely to expect a further decrease by 2012. Figure 6 outlines the expected trends in the sold volumes of mattresses, both across the EU-27 and for individual mattress types. This decrease can be seen across most of the mattress types:

- Mattress supports seem to remain relatively steady across 2005-2012, with only a slight decrease
- Mattresses of latex also appear to remain relatively steady, although again a slight decrease by 2012 has been projected.
- Mattresses of PUR show the largest projected decrease in volume sold by 2012. Volume sales across these mattress types appear to be the most volatile between 2005 and 2012 showing both the largest year-on-year increase and decrease between these time periods.
- Mattresses with spring interiors show a steady decrease by 2012.
- Other mattress types appear to be the only category that may show a slight increase in volume by 2012. This increase is, however, small and does not have a large impact on the overall decline in mattress volumes.

On the contrary, more optimistic forecast may be obtained focusing on value. Global Research & Data Services, for instance, consider that it is possible a growth in value of 2.7% per year until 2015, which was qualitatively confirmed in the previous trend analysis[a] Future growth in the market is dependent on a wide range of factors, and the choice of forecast would seem to depend upon the view about these factors, including EU GDP.

As outlined above, these trends can be affected by a wide range of factors within the market. Figure 7 shows EU27 GDP growth (%) against mattress production value growth (%) from 2006 to 2010. Although a direct correlation between the two is not apparent, it seems as though production value growth in the mattress market does somewhat follow GDP growth. This is especially clear with the large drop in 2009 and the subsequent rise that follows. This demonstrates that the trends and projections are subject to a wide variety of factors, including GDP, that may have an impact on the mattress market in the future.

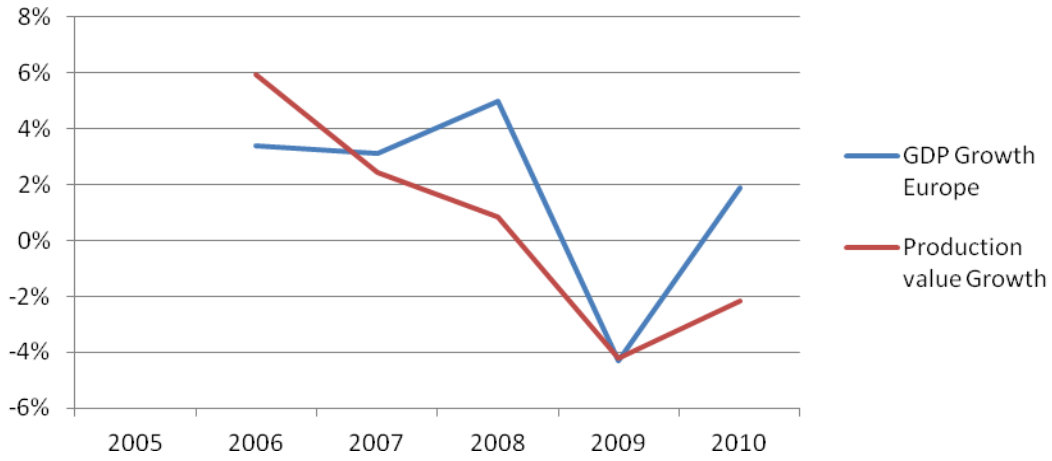
Figure 6: Total sold volumes of mattresses, trends and forecasts *across the EU-27 and by mattress type (2005-2012)*



Source: own calculations based on Eurostat PRODCOM database, 2010

a Global Research & Data Services (2010), Mattresses - Europe

Figure 7: *EU-27 GDP growth and mattress production value growth (2005-2010)*



Source: own calculations based on Eurostat PRODCOM database, 2010

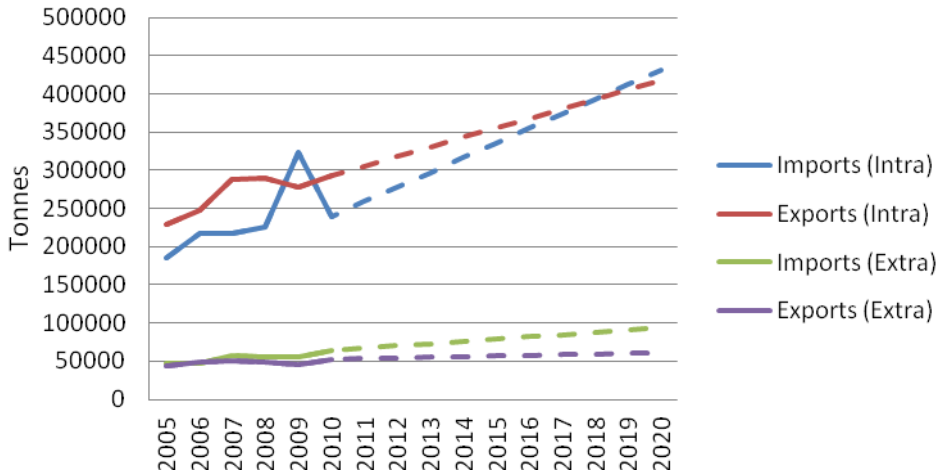
3.5.2 Trade

Figure 8 outlines the trend in mattresses trade in the EU-27 in terms of tonnes. Imports and exports are shown for both intra and extra EU-27 trade. Trends are calculated based on import and export quantities of the previous years. As such, data to 2010 is based on COMEXT data and projections have been made to 2020 based on this historic data (2005-2010). Assuming current trends of trade:

- Intra-EU exports are likely to see a steady increase.
- Intra-EU imports, continuing with the current trends, may see a steeper increase than exports. In 2014, it is projected that imports and exports may reach the same level of volume.
- Extra- EU exports show a steady increase.
- Extra-EU imports also show a steady increase, but at a faster rate than imports. According to these projections, the gap between extra-EU imports and exports is likely to increase.

Both import and export values are expected to increase, following current trends. It should be noted, however, that these trends are assuming few changes in the mattress market. As noted earlier, the mattress market is influenced by a variety of factors including GDP, consumer confidence, household savings and unemployment.

Figure 8 : *Forecast of intra and extra-EU trade quantity for mattresses across EU27 (2005-2020)*



Source: Calculated from Eurostat, COMEXT, (2010)

3.6 Public Procurement

3.6.1 Mattresses for public use

The mattress market is predominantly focused around production for domestic use. Mattresses for institutional use often have extra requirements that apply, compared to mattresses for household use. The composition of these mattresses might also differ because of this. In this section of the report, an estimation of the total number of mattresses publically procured across the EU-27 is provided. This figure can be used to determine what percentage of volume of total sold mattresses across the EU-27 could be represented by purchases of public interest.

Materials and methods

In terms of public procurement, the main areas for mattress purchases are: hospitals, nursing care homes, prisons and army accommodation. This is not an exhaustive list, but analysis of these sectors aims to capture most of the public expenditure on mattresses across the EU-27.

In order to estimate the public procurement levels of mattresses, data have been gathered for all of the facilities mentioned above. Specific data on public purchase of mattresses are not readily available and so, where necessary, alternative information have been used to produce indicative values. Where data are available, such as for prisons and army accommodation, actual figures for mattress purchased have been extrapolated from individual Member States to give an estimation across the whole EU-27. Where assumptions have been made or alternative information used, this has been stated in the workings.

Mattresses in use in the public sector

Hospital mattresses producers are often specialists in health products, and mattresses are supplied alongside other medical equipment. There are, however, examples of domestic suppliers producing mattresses for hospital use. For example, Elite - a Swiss bedding manufacturer - produces two types of medical mattresses, both with a foam core and a PVC mattress cover. All are sanitised and conform to European fire safety standards.[a]

Hospital mattresses appear predominantly to be made of a polyether foam or latex foam core with a PVC cover as a protective layer. Foam mattresses for domestic use are often more expensive than inner sprung mattresses, but for hospital use they are deemed to be more comfortable. Foam mattresses can also be made to conform to different lying and sitting positions by bending with adjustable bed frames. There is a variety of different standard mattresses in use throughout Europe and a set of grades within these, dependent on the patient's risk level. Due to constant use, a considerably higher turnover rate than mattresses for other uses.[b] In UK it is for instance estimated that the life of a UK standard hospital mattress is only 9-18 months,

Mattresses for nursing care homes can vary by type, as with hospital mattresses. The use and required functionality of the mattresses is similar to that for hospital use. For this section of the report, care home mattresses are assumed to have the same life span as hospital mattresses.

As with hospitals, prisons show a tendency to use foam mattresses for reasons of functionality. These are purchased in large quantities, and have a relatively short life span. In the UK, for instance, 53 000 foam mattresses and 48 000 pillows are purchase by the UK's Prison Service annually. In total 40 000 of these items are disposed of yearly due to soiling, misuse or wear and tear.[c]

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a Elite Beds, 2011 Available at: http://www.elitebeds.ch/en/hopitaux/viscopedic.html
b Available at: http://www.judy-waterlow.co.uk/pressure_ulcer_preventative_aids.htm
c BIS/Ministry of Justice, 2009. Forward Commitment Procurement Demonstration Project: HM Prison Service Zero Waste Prison Mattress System. Available at http://www.bis.gov.uk/assets/biscore/corporate/migratedd/publications/c/cs02_hmps.pdf

Prison mattresses differ from domestic mattresses in a variety of ways. As with hospitals mattresses, they are predominantly made with a foam core and provided with a protective PVC layer. High on the list of regulating factors for prison mattress production is flammability: mattresses must conform to strict fire regulation standards.

For instance, the 2008-09 procurement initiative to introduce the *Zero Waste Wipe Clean Mattress and Pillow Solution* (UK) has increased the life span of a mattress to an average of 22 months. It has also reduced the cost and environmental impact of disposing of the mattress. This contract is for the supply, collection and recycling of highly flame retardant, robust, wipe clean prison mattresses and pillows.

In the following section the volume of mattresses that are purchased annually by each public sector across the EU-27 is estimated. Information are then collated to enable a comparison of sector-by-sector mattress procurement across the EU-27. Data for 2008 are used as this is the most recent year for which the most complete data are available.

Hospitals

In estimating the number of mattresses purchased for hospital beds, data on available hospital beds have been used as an alternative source of data. It is assumed that the number of beds equals the number of mattresses. It is likely that, within these figures, there are a number of different mattress types due to the variety of mattresses used within the healthcare industry. Final figures should therefore be regarded with caution.

The turnover of mattresses in hospital is assumed to be one mattress every 18 months. Table 21 shows the number of hospital beds and the estimated number of mattresses purchased annually by EU-27 Member State. The total number of hospital mattresses purchased across the EU27 is therefore estimated to be around 1.8 million units in 2008.

Table 21: Estimate of hospital mattresses purchased annually (2008)

Country	Available hospital beds (1000 units)	Estimate of mattresses purchased annually (1000 units)	Country	Available hospital beds (1000 units)	Estimate of mattresses purchased annually (1000 units)
Austria	64	43	Latvia	17	11
Belgium	70	47	Lithuania	23	15
Bulgaria	50	33	Luxembourg	3	2
Cyprus	3	2	Malta	3	2
Czech Republic	75	50	Netherlands	77	52
Denmark	20	13	Poland	252	168
Estonia	8	5	Portugal	36	24
Finland	35	23	Romania	141	94
France	441	294	Slovakia	35	24
Germany	674	450	Slovenia	10	6
Greece	54	36	Spain	147	98
Hungary	71	48	Sweden	26	17
Ireland	22	15	United Kingdom	206	137
Italy	223	149	EU27 total	2 786	1 858

Source: Eurostat, hospital beds by type of care, available beds in hospitals (HP.1) (2008)

Nursing and residential care facilities

The number of mattresses purchased for nursing and residential care facilities was roughly estimated from data available on the use of nursing care beds. It is assumed that one bed requires one mattress. As with hospitals, 18 months was assumed to be the life span of a mattress in use.

Table 22 provides an estimate of the number of mattresses purchased annually for nursing and residential care facilities and the available number of beds. In order to provide an estimate for gaps in the data, the following methodology has been used:

- It has been assumed that the number of beds is proportional to population in that country. This assumption enables us to estimate figures for countries for data were previously unavailable.
- The average ratio of mattresses purchased annually per person has been calculated (this is given by the average, weighted by the population) for the countries where this information is available.
- The ratio of mattresses purchased to population in Table 22 has then been used to calculate an estimate of the number of mattresses purchased for the countries where data were previously unavailable (average ratio of mattresses purchased annually per person across EU27 x population per country).

Prisons

The estimation is based on UK data. Table 23 shows the quantity of mattresses purchased for use by prisoners from 2008-2010 in the UK. It should be noted that these figures do not include private prisons, as they source items independently. From the data provided, it is possible to calculate the average expenditure for one mattress for 2010, which is approximately £44.[a] This is calculated by dividing total value in 2008 by total quantity of mattresses ordered in 2010 (data are reported in Table 23).

Using prison population data as an indicator and assuming one mattress per person, the above data for the UK were extrapolated to provide estimates of the number of mattresses purchased annually across the EU-27. UK prison population was 93 000 in 2008 and in the same year nearly 46 000 mattresses were purchased. This equates to mattresses being purchased for 50% of the prison population on an annual basis. This is equal to assume a constant prisoner population and a mattresses life span of two years. Table 24 uses this information to estimate the number of mattresses purchased annually across the EU-27. The estimated volume of mattresses purchased for prisons across the EU-27 in 2008 is estimated to be 303 000 units.

a UK Parliament website, Prisons: furniture. Available at:
http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm110301/text/110301w0004.htm#1103022002766

Table 22: Estimate of nursing care mattresses purchased annually / Ratio of beds to population (2008)

Country	Available nursing care beds (1000 units)	Estimate of mattresses purchased annually (1000 units)	Population in 2008 (million people)	Ratio of mattresses purchased per population (thousand mattresses/million people)
Austria	*:*	*34*	*8.32*	-
Belgium	129	*86*	10.67	8.06
Bulgaria	4	*3*	7.64	0.39
Cyprus	*:*	*3*	*0.79*	-
Czech Republic	69	*46*	10.38	4.43
Denmark	46	*31*	5.48	5.66
Estonia	8	*5*	1.34	3.73
Finland	54	*36*	5.30	6.79
France	535	*357*	62.13	5.75
Germany	*:*	*338*	*82.22*	-
Greece	*:*	*46*	*11.21*	-
Hungary	81	*54*	10.05	5.38
Ireland	23	*15*	4.40	3.41
Italy	191	*128*	59.62	2.15
Latvia	5	*3*	2.27	1.32
Lithuania	*:*	*14*	*3.37*	-
Luxembourg	*:*	*2*	*0.48*	-
Malta	3	*2*	0.41	4.87
Netherlands	169	*113*	16.41	6.89
Poland	88	*59*	38.12	1.55
Portugal	*:*	*44*	*10.62*	-
Romania	21	*14*	21.53	0.65
Slovakia	31	*20*	5.40	3.70
Slovenia	*:*	*8*	*2.01*	-
Spain	199	*133*	45.28	2.94
Sweden	137	*91*	9.18	9.91
United Kingdom	527	*351*	61.19	5.74
EU27 Total	**2 320**	**2 037**	**495.82**	**4.11**

**(:) = data not available, estimation provided in italics are based on average EU-27 figures*
Source: Eurostat, hospital beds by type of care, available beds in hospitals (HP.2) (2008)
Population data sourced from Eurostat, Population on 1 January by age and sex

Table 23: Mattress order quantity for UK Prisons 2008-2010

Item and Description	2008		2009		2010		Last three years	
	Quantity (units)	Value (k£)	Quantity (units)	Value (k£)	Quantity (units)	Value (k£)	Quantity (units)	Total value (k£)
Mattress, F/R Foam, STD 1.9m long	41 357	1 794	39 074	1 695	38 277	1 660	118 708	5 149
Mattress, F/R Foam, 7 feet, 2.2m long	799	43	952	51	550	29	2 301	123
Mattress, Hospital, F/R Foam	180	10	234	13	153	8	567	31
Mattress, Narrow, F/R Foam, 1.9m long	3 395	156	4 190	193	5 955	275	13 540	625
Sub-total	**45 731**	**2 003**	**44 450**	**1 952**	**44 935**	**1 973**	**135 116**	**5 930**

Source: http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm110301/text/110301w0004.htm#1103022002766

*Table 24: Estimate of prison mattresses purchased annually (2008)**

Country	Prison population (1000 people)	Estimate of mattresses purchased annually (1000 units)
Austria	8	4
Belgium	10	5
Bulgaria	10	5
Cyprus	1	0
Czech Republic	20	10
Denmark	4	2
Estonia	4	2
Finland	3	2
France	64	32
Germany	73	37
Greece	:	:
Hungary	15	7
Ireland	3	1
Italy	58	29
Latvia	7	3
Lithuania	8	4
Luxembourg	1	0
Malta	0	0
Netherlands	15	7
Poland	85	42
Portugal	11	5
Romania	26	13
Slovakia	8	4
Slovenia	1	1
Spain	74	37
Sweden	7	3
United Kingdom	93	44
EU27	**609**	**299**

**(:) = data not available; Source: Eurostat, prison population (2008)*

Army accommodation

To calculate the number of mattresses purchased for army accommodation, army personnel data were used. However, unlike other sectors, it cannot be assumed that one person equals one mattress, as army accommodation varies greatly.

Within the UK, for instance, army personnel either live in private accommodation or single family accommodation housing (SFA) or make use of single living accommodation (SLA) which provides individual bed spaces. Private accommodation can be excluded from the data, as furniture, including mattresses, is purchased by individuals not by the public body. Similarly, SFA housing is often provided unfurnished and so is excluded from the data. The number of SLA bed spaces is therefore used as a indicator of the number of army mattresses in use in the UK. Table 25 indentifies the number of SLA bed spaces for UK army personnel both in the UK and overseas.

Table 25: number of SLA bed spaces for UK army personnel.

Location	Global purchase of mattresses for UK army personnel (1000 units)	UK SLA bed spaces (1000 units)	Estimate of UK SLA mattresses purchased (1000 units)
UK	**-**	129	40
Overseas	**-**	18	5
Total	**45**	**147**	**45**

Source: Global purchase of mattresses data available at: http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm100913/text/100913w0002.htm
SLA data available at: http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm110304/text/110304w0002.htm

Also included in Table 25 is the number of mattresses purchased for UK army personnel globally in 2008. It is assumed that these mattresses are for SLA bed spaces. The number of mattresses purchased in the UK can be thus calculated as: Global mattress purchase / total number of SLA bed spaces x number of SLA bed spaces in UK.

Hence, 40 000 mattresses are estimated being purchased in 2008 in the UK for army personnel. Since there are 194 000 army personnel in the UK; 40 000 equates to mattresses being purchased for an estimated 20% of the army personnel population in 2008.

This figure is extrapolated across each of the EU27 countries in

Table 26. Across the EU27, an estimated 365,000 mattresses was supposed being purchased in 2008 for army personnel in SLA.

Table 26: Estimate of army mattresses purchased annually (2008)

Country	Army personnel (1000 people)	Estimate of mattresses purchased annually (1000 units)
Austria	27	5
Belgium	37	7
Bulgaria	34	7
Cyprus	13	3
Czech Republic	24	5
Denmark*	26	5
Estonia	3	1
Finland	35	7
France	347	69
Germany	252	50
Greece	134	27
Hungary	21	4
Ireland	10	2
Italy	187	37
Latvia	5	1
Lithuania	9	2
Luxembourg	1	0
Malta	2	0
Netherlands	46	9
Poland	130	26
Portugal	37	7
Romania	75	15
Slovakia	15	3
Slovenia	7	1
Spain	138	28
Sweden	17	3
United Kingdom	194	40
EU27	**1 826**	**364**

Source: European Defence Agency, Defence Data of EDA participating Member States in 2009
**sourced separately from: Danish Defence, facts and figures (2011)*

Results and discussion

Data regarding the annual volume of mattresses purchased for hospitals, nursing care, prisons and army personnel are presented in Table 27. The relative significance of mattresses procurement in public activities can be estimated by comparing the global figure of Table 27 with the sold volume of mattresses in the EU-27.

Mattresses for nursing and residential care homes and hospital mattresses accounted for the greatest proportion of total estimated public procurement (an estimated 45% and 41% respectively). Army mattresses accounted for an estimated 8% and prison mattresses 7%. Overall, army and prison mattress public procurement is much lower than for hospitals and nursing care homes. This is perhaps to be expected as the overall number of beds in these sectors is much lower than the number that is required in care-giving facilities. Moreover, it also implicitly indicates that the weight of the uncertainties involved in the estimation of the number of beds for prisons and army can be considered of secondary importance. In other words, a refinement of the estimation should focus mainly on the health care sector.

For the purposes of comparison, in 2008, the total sold volume of production across all mattress types in the EU-27 was 73 million units (52 million units excluding mattress supports). An estimated 4.6 million units, or 6% of this (9% excluding mattress supports), can be thus attributed to public procurement, according to the estimation provided in this analysis.

Table 27: Estimate of total public procurement of mattresses purchased annually (2008)

Country	Hospital mattresses est. (1000 units)	Nursing care mattresses est. (1000 units)	Prison mattresses est. (1000 units)	Army mattresses est. (1000 units)	Total est. (1000 units)
Austria	43	34	4	5	86
Belgium	47	86	5	7	145
Bulgaria	33	3	5	7	48
Cyprus	2	3	0	3	8
Czech Republic	50	46	10	5	111
Denmark	13	31	2	5	51
Estonia	5	5	2	1	13
Finland	23	36	2	7	68
France	294	357	32	69	752
Germany	450	338	37	50	875
Greece	36	46	:	27	109
Hungary	48	54	7	4	113
Ireland	15	15	1	2	33
Italy	149	128	29	37	343
Latvia	11	3	3	1	18
Lithuania	15	14	4	2	35
Luxembourg	2	2	0	0	4
Malta	2	2	0	0	4
Netherlands	52	113	7	9	181
Poland	168	59	42	26	295
Portugal	24	44	5	7	80
Romania	94	14	13	15	136
Slovakia	24	20	4	3	51
Slovenia	6	8	1	1	16
Spain	98	133	37	28	296
Sweden	17	91	3	3	114
United Kingdom	137	351	44	40	572
EU27	**1 858**	**2 037**	**299**	**364**	**4 558**

3.7 Technical Innovation in the Mattress Market

New product types in the mattress market are currently focussed around the development of foam technologies, including the use of nanotechnologies.

There is a variety of ways in which innovations in nanotechnology have been applied to mattresses. The introduction of 'nanofoams' produces a foam mattress that responds much in the same way as memory foam, although it has not penetrated the market in the way that memory foam has. Nanotechnology can also produce a 'self cleaning' effect when applied to mattress coverings by preventing dirt and liquids

from sticking to the mattress surface.[a] This not only reduces the need for mattress replacement, but also minimises the need to wash mattress covers. This technology is currently mostly in use in North America. The *Magniflex* brand has also released a new technology in the US that allows nanotechnology to deliver the benefits of essential oils in its 'aromatherapy' collection.[b]

An increase in 'eco-friendly' beds is also apparent, both within SMEs who often specialise in these technologies or within the larger mattress manufacturers who have begun to produce ranges for this market.[c] Although there is no universal standard for what is considered an 'eco-friendly' bed, this term usually refers to the use of natural, organic materials such as soy-based foam or organic rubber. These mattresses are currently more costly than traditional mattresses, although it is conceivable that, as the demand for these products increases, costs could fall.[c]

As well as new products, new processes - mainly in terms of reducing waste to landfill - are becoming more common for example materials recycling or reuse. However, there may be limitations on the quantity of mattresses which can be formally reused. The typical lifespan of a domestic mattress is roughly 8-10 years[d], and legislation on mattress safety is regularly revised so that old mattresses quickly fall outside the safety boundaries set for fire, health and other factors. These considerations and others, such as reduced performance, mean that recycling of materials is generally more suitable than reuse.

It is possible that the drive to purchase more eco-friendly products will also reduce household mattress turnover through by encouraging longer life-spans. Although eco-mattresses often represent the high end of the mattress market, the purchase of these means that mattresses will need to be replaced less frequently and they are often of higher quality than cheap mattresses which need to be replaced more regularly.

Mattress collection by companies and local governments is becoming more prevalent. Problems occur as mattresses are bulky and so collection has to be done locally (often when a new mattress is delivered) or the mattress will be taken straight to landfill. In the US, there are a variety of innovative processes that reduce mattress waste to landfill. SVDP located in Oregon, for example, run a mattress recycling programme termed D3: "divert, reduce, reuse, recycle".[e] Many of the mattresses are collected from city or council waste transfer sites, although mattresses from hotels are also collected.[f]

Mattress components can also be recycled, and RECYC Mattress Europe estimate that up 95% of the materials in a mattress can be recycled in some way.[g] For example, PU foam can be remanufactured into carpet pads. This innovative process has been as for a model in several areas, including a similar mattress repurposing scheme in Aberdeen, Scotland. Also in Scotland, the *SpringBack* programme was established in 2005 and is the first UK-based scheme to deconstruct used mattresses and sell or reuse the components. Again, the mattresses are collected which reduces the need for transportation of heavy mattresses to another site. It is estimated that 7 000 mattresses were processed in 2005, increasing to an annual figure of nearly 70 000 currently.[h] This is perhaps indicative of the growing recognition of the need for processes to divert mattresses from landfill. Similar schemes exist across the EU, mainly on a

a Solutions for the mattress industry, Nanotechnology. Available at: http://www.quality-fabrics.com/mattress-ticking/mattress-nanosphere.php
b Furniture world magazine, Magniflex Introduces Bed Bug Repelling Mattress, (2010). Available at: http://www.furninfo.com/absolutenm/templates/NewsFeed.asp?articleid=12128
c Hilding Anders Trendspotting, Green is the new black, 2010. Available at: http://www.hildinganders.com/en/innovation/trends-tendencies/hilding-anders-trend-spotting
dSealy, FAQ. Available at: http://www.sealy.com/Customer-Service/FAQs.aspx
e Environmental News Network, California facility proves that mattress recycling can work, 2007. Available at: http://www.enn.com/pollution/article/28112

g http://www.recyc-matelas.fr/index.html, accessed 09/02/2012
h SpringBack group, Mattress Recycling. Available at: http://www.springbackgroup.org.uk/mattress-recycling

small, but growing scale. Examples of companies involved in this process include ARES Recycling, (Germany), RECYC Mattress Europe (France), Matt UK (UK),

Within the UK, the Ministry of Justice has implemented a programme in prisons with the outcome of producing a zero waste mattress and pillow solution, essentially reducing mattress waste to landfills. Through market engagement, the UK's Prison Service outlined a strategy that enabled mattresses and pillows not classified as hazardous waste to be recycled, repurposed and reused. This not only reduces the quantity of mattresses sent to landfill, but also reduces costs within the prison service that are incurred through supply and disposal, estimated to be £2.8 million annually.[a]

3.8 Environmental Labelling

Since the establishment of the EU Ecolabel, the number of mattress manufacturers producing Ecolabel products has been relatively low. There are currently only three manufacturers with Ecolabel products, outlined in Table 28:

Table 28: holders of Ecolabel products, by country and mattress type

Manufacturer	Origin	Number of Ecolabel products	Ecolabel product type
Carpenter APS	Denmark	2	-
Elite SA	Switzerland	Estimated 23	Variety of inner sprung mattresses and mattresses made from natural soy foam.
André-Renault	France	1	Elastorem – High density PUR foam

Source: Adapted from eco-label.com

To have a rough indication on the market penetration of the EU Ecolabel for bed mattresses, the following ratio was calculated: 'number of EU Ecolabel licenses' / 'apparent consumption (in EUR billion)'. Considering bed mattresses having 25 products which have been awarded the EU Ecolabel (133 products according to the Ecolabel workplan for 2011-2015[b]) and an apparent consumption of EUR 3.5 billion, the value of the two indicators would be equal to 7.14 (38.00 considering the information provided in the Ecolabel workplan). For the sake of comparison, textiles, which is one of the most successful product groups within the EU Ecolabel scheme, scores 37.62 with 4665 products awarded EU. Similar considerations could be extended also to the number of licence holders. Nevertheless, further data on the market volume of products awarded EU Ecolabel would be necessary to provide more refined statistics.

As well as the EU Ecolabel, which operates on a European basis, there is a variety of national labels that can be applied to mattresses, including 'Nordic Swan' (Norway), 'The Blue Angel' (Germany), 'Green Mark' (Taiwan) and the Austrian Ecolabel (Österreichisches Umweltzeichen) launched in 1991. A lack of harmonization between some of these labels may result in a lack of incentive for producers to acquire both a regional label and the EU Ecolabel. For many smaller producers of mattresses, it may be that the local market is more vital than the global or even European market and so national labels may be more familiar and accepted.

Despite this relatively low uptake of environmental labels, 'green' product lines are seeing an increase. Hilding Anders has, for example, developed 'Green bed mattresses' in which the fabrics are 58% manufactured from bamboo (renewable material) and with a high proportion of recycled polyester.[c] The current use of biodegradable materials in mattress production also demonstrates a commitment to eco-

a BIS/Ministry of Justice, Forward commitment procurement: practical pathways to delivering innovation, 2009. Available at http://www.bis.gov.uk/assets/biscore/corporate/migratedd/publications/c/cs02_hmps.pdf
b http://ec.europa.eu/environment/ecolabel/about_ecolabel/pdf/work_plan.pdf
c Hilding Anders, 2011 Available at: http://www.hildinganders.se/en/innovation/latest-innovations/family-green

friendly production. Simmons, for example, developed a collection in 2008 with the base latex layer made from materials which are biodegradable (e.g. sap from the rubber tree).

This trend in 'green' mattress lines is predominantly market-led, as consumers of higher end products create a demand for more environmentally-friendly or organic products. Not all producers utilise labelling schemes. For example, IKEA opt to improve the environmental impacts produced by their whole range of products rather than focusing on a limited number of eco-friendly products. IKEA monitor this internally by using product score cards which provide data against 11 criteria[a] which affect the sustainability of a product. This scoring is used to improve the impact of products over time.[b] However, these scores are not made available to consumers.

3.9 The 'Eco-mattress' Market

The increase in 'green' mattress product lines has resulted in the production of a variety of mattress types that can be considered eco-mattresses. These mattresses can be broken down into four broad mattress types:

- *Organic cotton:* farmed and processed without the use of pesticides, chemicals or toxic additives. Organic mattresses made of natural latex and cotton can, however, present a potential fire hazard and therefore they often need to be treated with fire-retardant chemicals. They may also be coated with plastics to render them waterproof or covered with polyester to make washing easier. 'Green cotton' mattresses are also produced, the fundamental difference being that pesticides and synthetic fertilisers used during farming. The rest of the process is additive-free as with organic cotton.
- *Wool:* a natural material, wool has anti-allergy, -bacterial, -mould and -mildew properties and is also naturally fire resistant. It can be added into mattresses as a filling or used as padding. It is, however, relatively expensive especially compared to synthetic foam mattresses which offer similar benefits. Wool mattresses still require a core made of springs, foam or latex.
- *Latex:* Although latex can be synthetic, natural latex can be derived from rubber tree's sap, which is both a natural and renewable material. Latex is often used as a mattress topper but it is more frequently being utilised to replace inner springs as the mattress core. Natural latex is hypo-allergenic and mattresses made from it are much more buoyant than those made from cotton or wool. Latex is, however, costly and mattresses made entirely of 100% natural latex are high end products.
- *Hemp.* Hemp mattresses can also be produced, with hemp providing similar benefits to wool. It is, however, a less widespread material and it is only utilised by niche providers.

For example, the mattress and bed manufacturer Hilding Anders offer the "family green" range of mattresses, which is produced from 51% renewable materials such as wood, bamboo, viscose and vegetable oils. This range also bears the Nordic Swan.[c]

In general, 'eco-mattresses' limit the use of chemicals, in particular petrochemicals or polyurethane foam. Synthetic mattresses often have fire resistant treatments added to them during manufacture in order to conform to safety standards. Polybrominated diphenyl ethers (PBDEs) are frequently mentioned as the most typical treatment, and are often associated with poor health.

There is a growing market for 'eco' memory foam mattresses made through the processing of soy or cedar oil in place of petroleum, although the extent to which these ingredients are used varies across

a These are: more from less (using less material in the product), renewable material, recycled material, environmentally better material, separable & recyclable material, product quality, transport efficiency (number of products per container), energy efficient production, renewable energy in production, raw material utilization at suppliers, product use (less use of energy and water, and less waste in customers' homes).
b IKEA Sustainability Report 2010, available at http://www.ikea.com/ms/en_US/about_ikea/pdf/ikea_ser_2010.pdf
c http://www.hildinganders.se/en/innovation/latest-innovations/family-green, accessed 09/02/2012

mattress brands. Often a percentage of the foam will be replaced with these 'eco' materials, meaning that most soy foam mattresses are not 100% eco-mattresses. Essentia, a producer of foam mattresses based in Canada, claims to be the only manufacturer in the world that produces 100% natural memory foam.[a] It is also claimed that other eco-memory foam mattresses may only contain around 2-15% natural foam with the rest made up of petroleum based foam.

3.10 Summary

Summing up, the following points can be highlighted from the market analysis:

- The mattress market in Europe is fragmented, with a few large global manufacturers active in addition to a number of smaller somewhat more nationally-focused players. Small and medium-sized enterprises in the mattress industry focus on niche products and national consumer demands in the European market.
- 48 millions of bed mattresses have been produce in the EU-27 in 2010 (67 million units with the inclusion of mattress supports). The total value of the mattresses produced was EUR 3.8 billion (EUR 5 billion including also mattress supports). Total imports of bed mattresses across the EU-27 amounted to EUR 1 billion (EUR 1.4 billion with mattress supports) and exports to EUR 1.3 billion (EUR 1.6 billion with mattress supports).
- Excluding mattress supports, the sold volume of bed mattresses in the EU-27 is mainly composed of spring mattresses (37%) and PUR mattresses (32%). Latex mattresses and other types of mattresses instead account for 13% and 18%, respectively.
- In terms of production value, top-five countries account for 70% of the total market. These are: Germany (16%), France (16%), Italy, (15%), the United Kingdom (13%) and Spain (10%). In terms of sold volume of production, top-five countries account for 69% of total market. These are: Germany (18%), Italy (17%), The United Kingdom (13%), Poland (11%) and France (10%). The main producers of spring mattresses are the UK and Germany. The main producers of PUR mattresses are Germany, Poland and France. The main producer of latex and other mattress types is Italy, followed by France and Poland.
- In terms of trade, bed mattresses are a product which appears principally traded between neighbour countries. Trade with extra-EU countries is approximately one tenth of the overall trade. Import/export figures are significantly higher for PUR mattresses than for other mattress types.
- If current trends in the mattress market continue, there is likely to be an overall decrease in the volume of mattresses sold across the EU-27. Factors such as GDP, consumer confidence, household savings and unemployment will, however, influence the mattress market. Nevertheless, value has appeared to remain relatively steady between 2005-2010, which could represent an increase in the value of each mattress or which could be due to a change in the product mix of mattresses sold.
- The mattress market is predominantly focused around production for domestic use. Mattresses for institutional use often have extra requirements and are sold through different supply chains. In 2008, the total sold volume across all mattress types in the EU-27 was 52 million units (73 million units with mattress supports). An estimated 9% of this (about 6% including also mattress supports), was attributed to public procurement through the purchase of mattresses for use in hospitals, care and residential facilities, prisons and army.
- The number of mattress manufacturers producing EU Ecolabel products has been relatively low. There is, however, a variety of national labels that can be applied to mattresses, including 'Nordic Swan' (Norway), and 'The Blue Angel' (Germany) and 'Green Mark' (Taiwan).These labels currently seem to have a higher uptake than the EU Ecolabel.
- There has been a recent trend towards high-end, 'green' mattress products. This trend is predominantly market led, as consumers of higher end products create a demand for more environmentally friendly or organic products.

a Essentia natural memory foam. Information available at: http://www.myessentia.com/natural-foam

4 Technical Analysis

The aim of this technical analysis is to evaluate the different categories of mattress identified in the previous sections, identifying the most significant sources of environmental impact and use this information to propose how criteria could be changed. The analysis will be based on life cycle assessment (LCA) information related to bed mattresses and which have been gathered and produced as part of this project. These pieces of information are used to identify what are the 'hot-spots' present in the lifecycle of a mattress. Discussion on specific issues of relevance for this revision process will be based on the outcomes of this analysis, the feedback received from stakeholders and additional information on key environmental aspects, such as the use of hazardous substances. This will provide a basis for proposing provisional recommendations for the EU Ecolabel and GPP criteria.

4.1 Survey on Lifecycle Assessment information available for bed mattresses

4.1.1 Review of LCA information

Within the project, a comprehensive analysis was carried out in order to identify the LCA information on bed mattresses which were so far made public. A relatively limited amount of publically available LCA information on bed mattresses has been identified. The most relevant sources of information are reported in Table 29 with each reviewed in more detail below. Relevance of the study within this revision, accomplishment to recognised standards (e.g. ISO 14040 or PAS 2050), quality of the information provided and date of the background study have been used as main criteria of selection. Studies identified within this area, but not deemed relevant are shown in section 4.1.2 below. It should be observed that quantitative information from different studies should not be directly compared because of different methodological assumptions behind each study.

Table 29: Summary of LCA studies and LCA schemes relevant to this criteria revision

Name of the study, author(s) and year	Scope, Functional unit, System boundaries	Environmental parameters considered
EU Eco label for Bed Mattresses. The Greek LCA study - Establishment of ecological criteria[a] **A.D. Boura (HELCANET, Greece)** **2004**[b]	4 types of mattresses (PUR foam, latex foam, spring interior and Scandinavian mattress) 1m^2 of mattress, fit for use Cradle-to-grave	12 impact categories, no information provided on the impact assessment method(s) considered: • Abiotic resource depletion • Greenhouse gas emissions • Human toxicity • Acidification • Ozone depletion • Eutrophication and oxygen demand • Photochemical oxidation (smog) • Ecotoxicity • Landscape demolition • Use of energy • Nuisance (odour) • Solid waste

a http://www.emsc.ch/cost628/assets/Greek_LCA_for-bed_mattresses.pdf
b http://www.emsc.ch/cost628/assets/Minutes_WG1.pdf

Name of the study, author(s) and year	Scope, Functional unit, System boundaries	Environmental parameters considered
Mattresses LCA – Final Presentation **Climact, Vito and Belgian Department for Health, Food Chain Safety and Environment**[a] **2011**	9 mattress value chains representative for 4 different mattress types. 1 adult mattress (2m x 0.9m) Cradle-to-use	ReCiPe's midpoint indicators. Normalized scores reported for 18 indicators[b]: • Agricultural land occupation • Climate change • Fossil depletion • Freshwater ecotoxicity • Freshwater eutrophication • Human toxicity • Ionising radiation • Marine ecotoxicity • Marine eutrophication • Metal depletion • Natural land transformation • Ozone depletion • Particulate matter formation • Photochemical oxidant formation • Terrestrial acidification • Terrestrial ecotoxicity • Urban land occupation • Water depletion
Furniture Carbon Footprinting **FIRA (UK)**[c] **2011**	19 double mattresses, including spring and foam mattresses (more detailed information not provided) A double mattress Cradle to gate	• Greenhouse gases emissions, calculated according to PAS 2050:2008
Rapport de synthese PROPILAE (PROjet PILote pour l'Affichage Environnemental) des produits d'ameublement **Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME)** **2010**[d]	1 PUR mattress (12 years); 2 spring mattresses (16 and 12 years, respectively); 1 latex mattress (more uncertain information). All single mattresses. 1 single mattress used for 1 year Cradle to grave (even if impacts from transports are not fully taken into account)	15 impact categories (also normalized scores reported): • Non renewable energy • Renewable energy • Depletion of natural resources [CML 2000] • Water usage • Greenhouse effect [IPCC 2007] • Acid rain [CML 2000] • Photochemical oxidant production [CML 2000] • Destruction of the ozone layer [CML 2000] • Eutrophication [CML 2000] • Water toxicity [CML 2000] • Human toxicity [CML 2000] • Terrestrial toxicity [CML 2000] • Total waste • Hazardous waste • Non-hazardous waste

a Mattress LCA – Final Presentation, Climact & Belgian Department for Health, Food Chain Safety and Environment, 6th May 2011
b http://www.lcia-recipe.net/
c Furniture Carbon Footprinting, FIRA, 2011
d Rapport de synthese PROPILAE (PROjet PILote pour l'Affichage Environnemental) des produits d'ameublement, FCBA (France), 2009

Name of the study, author(s) and year	Scope, Functional unit, System boundaries	Environmental parameters considered
Environmental Product Declarations for Beds and Mattresses[a] **EPD Norge - The Norwegian EPD foundation** **2005**	Different kind of mattresses 1m^2 of mattress, fit for use (guaranteed lifetime of 15 years, corresponding to a technical lifetime of at least 25 years). Cradle-to-grave	Parameters to be declared (as prescribed in the specific PCR): • Product content of hazardous substances (formaldehyde, brominated flame retardants, heavy metals). • Emissions to air (Fossil CO2, CH4, N2O, NOx, SOx, NMVOCs, Dioxins, Heavy metals) • Emissions to water (Phosphates, Nitrates, Dioxins, Heavy metals) • Wastes (Material recycling, Incineration with energy recovery, Incineration without energy recovery, Disposal, Hazardous waste) • Impact assessment indicators (Global warming potential (GWP 100 years) [kg CO2-eq.], through CML 2001; Ozone layer depletion potential (ODP, steady state) [kg R11-eq.], through CML 2001; Acidification potential (AP) [kg SO2], through CML 2001; Photochemical ozone creation potential (POCP) [kg ethen-eq.], through CML 2001; Eutrophication potential (EP) [kg phosphate-eq.], through CML 2001; Heavy metals [kg Pb-eq.], through EcoIndicator 95) • Material resources (Virgin renewable resources, Recycled renewable resources, Virgin non-renewable resources, Recycled non-renewable resources) • Land usage • Energy consumption (Fossil fuels, Nuclear fuels, Renewable fuels, Miscellaneous fuels)

a http://www.epd-norge.no/

EU Eco label for Bed Mattresses. The Greek LCA study - Establishment of ecological criteria (Boura, 2004)[a]

A LCA study was carried-out in one of the previous revisions of the EU Ecolabel with the aim of setting and revising environmental criteria area for bed mattresses. As such, it fits well with the present exercise because the mattress types considered in the assessment are representative for the products included within the EU Ecolabel scope.

The functional unit for this study was defined as $1m^2$ of useable mattress and the full life cycle considered in the modelling. The LCA was performed according to the SETAC guidelines and the draft technical standards of the series ISO 14040 series. Life cycle inventory data were gathered both from manufacturers (e.g. for intermediate flows related to production processes) and from secondary sources, such as general databases (e.g. BUWAL, ETH) or related studies. However, the available presentation mainly contains qualitative information and provided an overview of the impact categories measured and of the identified environmental hot-spots. Impact categories and normalisation factors considered in the study are shown in Table 30. Impacts characterized for each category were divided by normalization factors (whenever applicable) and referred to an equivalent basis of comparison. The normalized results are shown in figure 9 and may be used to provide an indication about the relative importance of environmental issues within the life cycle of bed mattresses.

Table 30: Impact categories and normalisation factors considered in the LCA study from Boura

Impact category (No information provided on the impact assessment method considered	Normalization factor
Abiotic resource depletion	1×10^{-10} % of world reserves per capita per day
Greenhouse gas emissions (global warming)	33 kg CO_2 eq per capita per day
Human toxicity	0.3 g per capita per day
Acidification	266 g SO_2 eq per capita per day
Ozone depletion	Not Available
Eutrophication and oxygen demand	145 g PO_4eq per capita per day
Photochemical oxidation (smog)	49 g ethylene eq. per capita per day
Ecotoxicity	3452 m^3 per capita per day
Landscape demolition	Not Available
Use of energy	460 MJ per capita per day
Nuisance (odour)	Not Available
Solid Waste	2.35 kg per capita per day

Source: EU Eco label for Bed Mattresses. The Greek LCA study - Establishment of ecological criteria

Results of the normalization show lower variation between the different mattress types compared with differences between impact categories.

The highest impacts were registered for waste production: this was mostly attributed to disposal of the bed mattress to landfill. Other factors of lower importance were found to be:

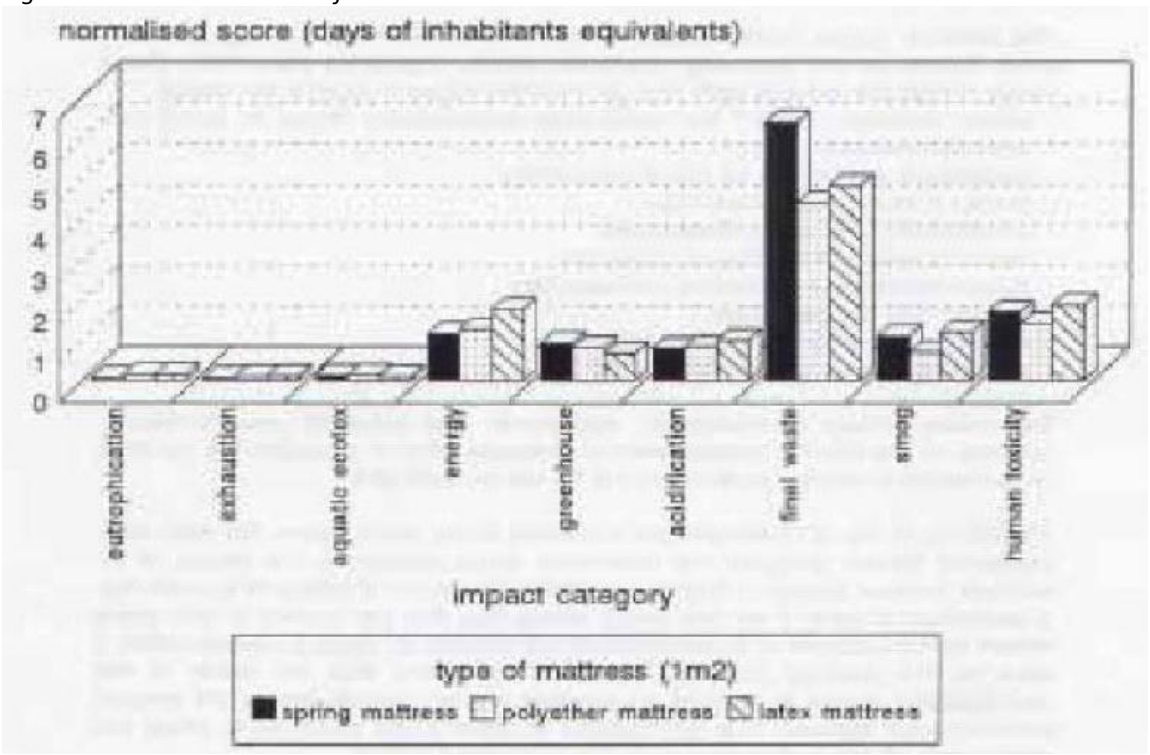
a The Greek LCA study – Establishment of ecological criteria, Boura, A. D., Presentation as part of a previous revision.

- Energy use, GHG emissions, acidification – mainly arising from the production of the main core materials (i.e. PUR foam, latex foam and steel)
- Smog and human toxicity – mainly associated with emissions of CxHy, SO_2 and NOx from the production of steel, synthetic rubber, PUR foam and cotton.

Contribution to the other impact categories also appeared mainly associated with the production of materials used for mattress manufacturing.

These findings suggest that the major impacts of a mattress lifecycle are associated with the potential disposal of old mattresses in landfill and with the production of the components which are then used to manufacture mattresses.

Figure 9: Normalised scores of mattresses



Source: EU Eco label for Bed Mattresses. The Greek LCA study - Establishment of ecological criteria

LCA study from Climact, Vito and Belgian Department for Health, Food Chain Safety and Environment[a]

This study, produced for the Belgian Department for Health, Food Chain Safety and Environment, is one of the most comprehensive studies so far identified. Nevertheless, only the main outcomes of the study have been made publically available, in the form of presentation. The purpose of this study was to identify the environmental hotspots within the life cycle of bed mattresses and to support the Government of Belgium in developing environmental policy.

Within this study, three mattress values chains were assessed, each one comparing the environmental profile of three different bed mattress types. Therefore, nine different lifecycles were modelled overall. PUR and sprung mattresses were assessed for all the three case studies. Latex mattresses were modelled for two supply chains, while bamboo fibre based mattress used in the third. Since the provided information was made anonymous, the three case-studies are indicated as A, B and C in this document.

a Mattress LCA – Final Presentation, Climact & Belgian Department for Health, Food Chain Safety and Environment, 6th May 2011

The study appears to conform to the LCA related ISO standards. The functional unit set the study is the surface provided by one conventional adult mattress (i.e. 2m x 0.9m, indicatively), and the system boundaries exclude the use and disposal of the mattress, but included all impacts from the production of the raw materials to delivery to the user (transport either by the distributor or the consumer themselves). The midpoint categories of the Recipe impact assessment method were considered in the assessment. This corresponds on measuring impacts related to the eighteen different categories shown in Table 31. These impact factors were also normalised to provide an indication of what could be the most critical environmental areas.

The source and quality of data used is acknowledged as being "variable", ranging from primary to secondary data. It is estimated that the uncertainty associated with the data is between 15% and 35%. The study also acknowledges that there is difficulty comparing across different life cycle performances due to incomplete consistence of the data, particularly for production and energy consumption associated with stores and storage.

However, based on the normalized indicators of Recipe, the ranking of the impact categories by environmental relevance was reasonably consistent across the different mattress and value chains.

Water toxicity and eutrophication as well as natural land transformation generally have the highest impacts in all the case-studies, while human toxicity and fossil depletion could be considered as a further group of critical areas. Normalized scores of other impact categories appear consistently much lower along the study.

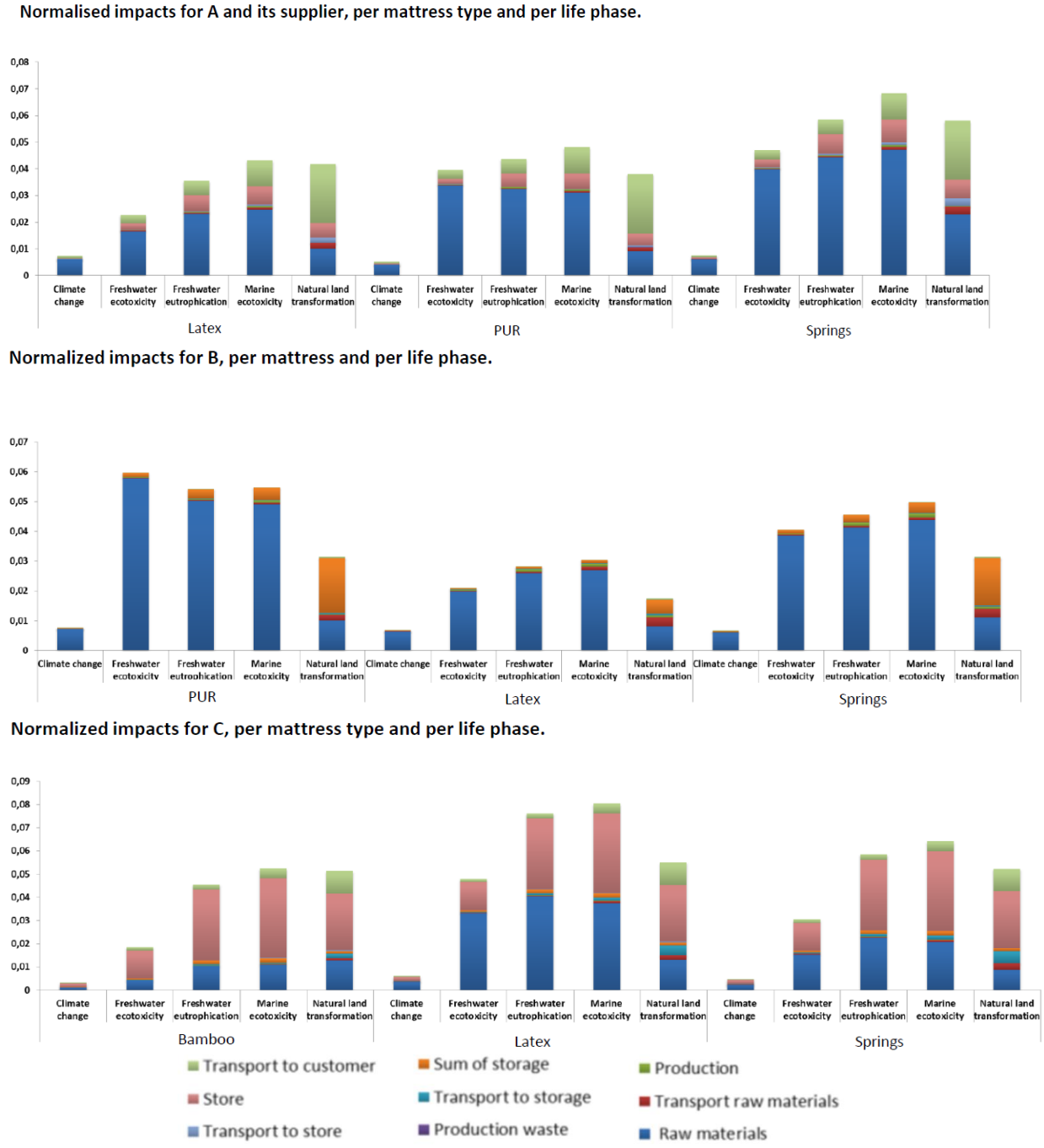
Table 31: Impact categories and normalisation factors considered in the LCA study from Climact et al.

Impact categories	Units	Normalization factor
Agricultural land occupation	m^2a	0.000221
Climate change	kg CO_2 eq	0.000089
Fossil depletion	kg oil eq	0.000526
Freshwater ecotoxicity	kg 1,4-DB eq	0.0924
Freshwater eutrophication	kg P eq	3.97
Human toxicity	kg 1,4-DB eq	0.00165
Ionising radiation	Kg U235 eq	0.00016
Marine ecotoxicity	kg 1,4-DB eq	0.242
Marine eutrophication	kg N eq	0.0806
Metal depletion	kg Fe eq	0.0014
Natural land transformation	m^2	6.18
Ozone depletion	kg CFC-11 eq	45.4
Particulate matter formation	Kg PM10 eq	0.067
Photochemical oxidant formation	Kg NMVOC	0.0177
Terrestrial acidification	kg SO_2 eq	0.029
Terrestrial ecotoxicity	kg 1,4-DB eq	0.122
Urban land occupation	m^2a	0.00245
Water depletion	m^3	Not Available

Source: Climact & Belgian Department for Health, Food Chain Safety and Environment.

Further analysis within the study identified the 'hotspots' within the lifecycle. The most important impacts for each of the modelled lifecycles are shown in Figure 10. This data includes a breakdown of the different lifecycle phases.

Figure 10: Selection of normalised indicators for each mattress type considered in scenarios A, B and C and showing individual impacts per life phase.



Source: Climact & Belgian Department for Health, Food Chain Safety and Environment

Even if a ranking among the different mattress types cannot be drawn, it is apparent that raw materials are the largest contributions in the majority of both scenarios and impact categories. Other factors which under specific conditions could produce significant adverse effects were found to be transport of the final product and energy use at storage site and at retail store, though each varying from scenario to scenario. Factors such as transport of raw materials, production and transport to storage were found to have lower contributions to the overall impacts. No further details are currently available on the main sources contributing to these impacts.

The information provided within this study can be used to qualitatively evaluate the hot-spots of the product group. A broad range of impacts are assessed and, within these, the sourcing and production of

the raw materials was identified as having some of the largest impacts, independent of scenario and mattress type. Moreover, the study suggests that also factors as product delivery and energy use during storage could be significant sources of environmental impacts for this product group. However, it should be also noted that the disposal of the bed mattress was not considered in this study, which can be also considered a critical aspect in the bed mattresses life cycle.

Study on the Furniture Carbon Footprinting from FIRA (UK)[a]

FIRA recently published a study presenting a series of carbon footprints from furniture calculated using LCA methodology. Their aim of this study was to inform business about the carbon emissions associated with the lifecycle of the different items they produce and to indicate where these emissions could be reduced.

Within this study the GHG emissions associated with the cradle-to-gate lifecycle of mattresses has been calculated. This was based on the BSI publication PAS 2050:2008 "Specification for the assessment of the life cycle greenhouse gas emissions of goods and services", but adapted to suit the needs of the furniture sector. Carbon footprint data for 19 different mattresses were produced, with a standard UK double mattresses (2.6 m^2) used as the functional unit. However, no indication is provided about the specific mattress types assessed. The quality of data varies within this study due to the broad scope. Where possible this was obtained directly from manufacturers and relevant organisations, however it is made clear that some information was estimated. However, it is not clear from the document where secondary information has been used or how it might influence the results, specifically for mattresses. As this is a carbon footprint study, only GHG emissions are reported. The overall average impact was found to be 80 kg CO_2 eq per mattress, with values ranging from 41 kg CO_2 eq to 164 kg CO_2 eq.

a Furniture Carbon Footprinting, FIRA, 2011

Table 32 provides an overview of the carbon footprint values calculated.

These data indicate that production of the raw materials have the largest impacts in terms of carbon footprint, as also highlighted in the previous studies. The study also indicates there is large variation in the data, both in overall impact for each mattress and in the separate contributions arising from each phase. It should be however remarked that different case studies have been considered, without stating explicitly the mattress types that were assessed. Within the study various assumptions have been moreover made which could lead to the omission of many of the impacts associated with storage, transport to use and retail. These could be significant sources of impact, as the Belgian study found, though this may be less noticeable for the single GWP measure.

Table 32: Carbon footprint values for mattresses and percentage contribution from different components

Mattress	GHG emissions ($kgCO_2e$)	Contribution to total GHG emissions (%)								
		Timber & Board	Foams & fillings	Textiles	Metal	Plastic	Packaging	Transport	Utilities	Other
1	44	0	56	14	16	0	7	2	5	0
2	66	0	38	26	25	0	5	3	3	0
3	43	0	56	14	16	0	7	2	5	0
4	164	0	79	17	0	0	2	2	1	0
5	61	0	31	16	45	0	2	2	5	0
6	51	0	19	17	54	0	2	2	6	0
7	87	0	46	7	41	0	1	1	4	0
8	83	0	51	13	29	0	1	1	4	1
9	81	0	44	7	41	0	1	1	4	1
10	83	0	82	6	0	1	6	1	4	0
11	71	0	25	29	39	0	1	1	4	0
12	68	0	3	25	45	0	3	1	22	0
13	64	0	14	5	52	0	3	2	24	0
14	102	0	28	36	17	0	2	2	15	0
15	126	0	38	10	38	0	2	1	12	0
16	83	0	56	1	29	4	2	1	6	0
17	105	0	35	3	46	6	3	2	5	1
18	41	0	35	3	40	3	5	3	13	0
19	91	0	55	11	19	5	3	1	5	0
Avg.	**80**	**0**	**44**	**14**	**29**	**1**	**3**	**2**	**7**	**0**

Source: FIRA[a]. Percentage values may not add to 100% due to rounding errors.

Rapport de synthese PROPILAE (PROjet PILote pour l'Affichage Environnemental) des produits d'ameublement

This study, entitled "A pilot study on the environmental labelling of furniture products", was commissioned by ADEME (The French Environment and Energy Agency) and The French Environment Ministry for Sustainability, as a result of the Grenelle Environment Summit.[b] The work was lead by the technological institute FCBA.

The aim of this study was to gather information on methodologies and tools for the environmental labelling of products in the furniture sector. Within this study an LCA of 10 furniture products was conducted, including four mattresses, this information was then analysed to identify the environmental impacts of the products. From this information a labelling specification and format was proposed.

Three mattresses were analysed in detail, these are show in Table 33. Analysis was also produced for a latex type mattress, though the figures supplied are less certain and should be considered as a rough guide rather than fully indicative. The analysis of this latex mattress is included here for completeness.

a Furniture Carbon Footprinting, FIRA, 2011

b A French "roundtable" meeting focussing on the environment and sustainability

Table 33: Mattresses assessed in the ADEME Study

Supplier	Type	Size	Expected Lifespan	Weight
Bultex	PUR	Single	12 years	17kg
Simmons	Pocket Sprung	Single	16 years	29kg
Onrev	Bonnell Spring	Single	12 years	31kg

The functional unit used in this study was a single mattress (assumed to have dimensions of 80cm x 190cm), used daily, for a period of 1 year. This was to provide a figure for a single person using this product for a year. The methodology follows ISO 14040 and 14044 guidelines, using BPX-30-323[a] good practice. According to BPX-30-323 the following inputs were excluded:

- transport of employees,
- transport of customers,
- the environmental impact of R&D, marketing and advertising
- environmental impacts related to distribution platforms and to sales outlets.
- transport of manufacturing waste and product at the end of life.

The system boundaries included the full lifecycle of each product, from resource extraction to end of life. Fifteen impacts were reported to cover a broad range of environmental issues. These are shown in Table 34.

Table 34: Impacts reported in the study from ADEME

Category	Units	Method of evaluation
Non renewable energy	MJ eq.	Non renewable primary energy relates to all the energy resources used in the lifecycle of the chosen product which are not renewable on a human timescale such as natural gas, petrol, carbon and uranium
Renewable energy	MJ eq.	Primary renewable energy relates to all the energy resources used in the lifecycle of the chosen product which are renewable on a human timescale such as solar energy, wind, biomass, hydraulic
Depletion of natural resources	kg eq antimony	CML 2000 – An indicator measuring the rarity and non-renewable nature of a resource
Water usage	Litres	Measure of the direct and indirect water usage in a lifecycle. It does not include water cooling
Greenhouse effect	g eq CO_2	IPCC 2007 – Indication of the warming effect of the emissions of certain greenhouse gases, with reference to CO_2 and a horizon of 100 years
Acid rain	g eq SO_2	CML 2000 – Acidification leads to the problem of 'acid rain' which decreases the productivity of ecosystems. The acid rain potential is calculated from the oxydation-reduction potential of each molecule
Photochemical oxidant production	g eq C_2H_4	The presence of COV in sunlight endangers the formation of tropospheric ozone which can increase the risk of asthma and damage farmland. The model is based on a model developed by the UNECE (United Nations Economic Commission for Europe).
Destruction of the ozone layer	g eq CFC-11	CML 2000 – The destruction of the stratospheric ozone layer by brominated and chlorinated compounds increases the quantity

[a] BPX 30-323 defines main principles for drawing up methodological guides specific to product categories (PCR). These methodological guides are developed by relevant stakeholders of different sectors and are validated by the ADEME / AFNOR platform. 10 methodological guides (PCR) are already available.

Category	Units	Method of evaluation
		of dangerous UV light reaching the surface of the earth. The model used is that of the WMO (World Meteorological Organisation)
Eutrophication	g eq PO4--	Excess nutrients encourage the growth of algae in water which decreases the concentration of oxygen in water and ultimately damage ecosystems. The calculation is based on the model developed by Heijings (1992).
Water toxicity	g eq 1.4 dichlorobenzene	CML 2000 – Certain substances such as heavy metals or pesticides can have an impact on ecosystems. This is calculated using the USES-LCA model which describes the fate, exposure and harmful effects of substances on aquatic non-marine ecosystems on an infinite timescale.
Human toxicity	g eq 1.4 dichlorobenzene	CML 2000 – Certain substances such as heavy metals or dust can have an impact on human health. This is calculated using the USES-LCA model which describes the fate, exposure and toxic effects of substances on humans on an infinite timescale
Terrestrial toxicity	g eq 1.4 dichlorobenzene	CML 2000 - Certain substances such as heavy metals or pesticides can have an impact on ecosystems. This is calculated using the USES-LCA model which describes the fate, exposure, and harmful effects of substances on terrestrial ecosystems on an infinite timescale
Total waste	kg	Sum of hazardous waste, inert waste and non-hazardous waste
Hazardous waste	kg	Amount of hazardous waste generated after decomposition or combustion, during total lifecycle
Non-hazardous waste	kg	Amount of non-hazardous waste generated after decomposition or combustion, during total lifecycle

Impacts were calculated based on data collected from a variety of different sources, including databases as Ecoinvent 2.0 and Ecobilan. The system was modelled using the TEAM model developed by Ecobilan Pricewaterhouse Coopers. The impacts for each mattress type are shown in

Table 35.

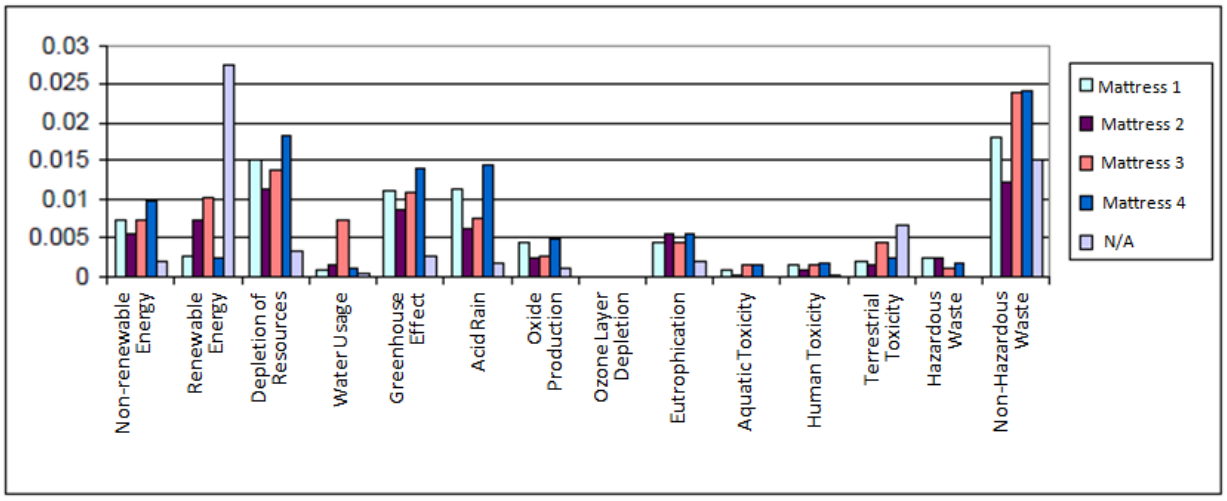
These were normalised for comparison using average values from sets of French (Ecobilan/Wisard) and European (CML 2000) normalization factors. It was noted that within these normalisation factors those relating to toxicity and ecotoxicity had a larger margin of uncertainty, and therefore have a limited reliability. The normalised values for each of the mattresses are shown in Figure 10, though they have not been identified individually within the report.

Table 35: Impacts associated with each mattress.

Impact	Unit	Simmons (Pocket Spring)	Bultex (Bonnell Spring)	Onrev (PUR)	Unnamed (Latex)*
Non-renewable energy	MJ eq.	1251	1231	960	1249
Renewable energy	MJ eq.	22.3	88.3	63.6	16.1
Depletion of natural resources	Kg eq antimony	0.55	0.52	0.42	0.50
Water usage	Litres	585	5000	1027	572
Greenhouse effect	g eq CO_2	88519	82781	65986	82326
Acid rain	g eq SO_2	532	351	293	505
Photochemical oxidant production	g eq C_2H_4	60.1	38.7	34.3	50.9
Destruction of ozone layer	g eq CFC-11	0.0058	0.0045	0.0024	0.0058
Eutrophication	g eq PO4--	64.8	66.8	83.4	63.4
Aquatic toxicity	g eq 1.4 dichlorobenzene	83524	122995	15313	83502
Human toxicity	g eq 1.4 dichlorobenzene	14981	14952	10623	13042
Terrestrial toxicity	g eq 1.4 dichlorobenzene	135	280	90.8	119
Hazardous waste	kg	0.068	0.036	0.068	0.038
Non-hazardous waste	kg	7.2	9.5	4.8	7.2

** Values are indicative, and should be treated with care*

Figure 10: Normalised impacts for four mattress types (N/A refers to a case study not applicable to this case study)



Within this study it was found that the impacts associated with a mattress are often of a similar magnitude between mattress types, and there was greater variation between impact types. The most significant impacts seems generally related to non-hazardous waste, depletion of resources, acid rain, greenhouse effect and energy consumption In addition, water usage is relatively large for one of the mattress types (mattress 3).

A contribution analysis was also conducted in order to identify the life-cycle hot-spots for the bed mattresses assessed. This allows the identification of the lifecycle phases which gives the most significant contributions to each of the impacts. This is shown in Table 36.

Table 36: Contribution to impacts for different lifecycle phases. The phase with the largest contribution to each impact is highlighted.

Impact	Raw materials	Packaging	Transport	Site	Distribution	End of life
Non-renewable energy	97%	3%	1%	5%	1%	-7%
Renewable energy	99%	1%	0%	3%	0%	-4%
Depletion of natural resources	97%	3%	1%	3%	1%	-5%
Water usage	99%	0%	0%	1%	0%	0%
Greenhouse effect	89%	1%	1%	3%	2%	5%
Acid rain	100%	2%	1%	1%	1%	-6%
Photochemical oxidant production	91%	3%	2%	4%	2%	-2%
Destruction of ozone layer	68%	0%	10%	28%	11%	-17%
Eutrophication	60%	1%	1%	1%	3%	34%
Aquatic toxicity	4%	0%	0%	0%	3%	93%
Human toxicity	40%	0%	1%	2%	6%	52%
Terrestrial toxicity	109%	4%	1%	2%	-1%	-14%
Hazardous waste	98%	1%	0%	1%	0%	-1%
Non-hazardous waste	-4%	0%	0%	0%	3%	101%

From the data reported it can be seen that the largest impacts are associated with the raw materials and with the end of life treatments. This is consistent with the conclusions found in the other studies, though different boundaries were sometimes considered. For instance, the importance of storage and transport to consumer within certain impact categories was highlighted in the Belgian LCA. The largest contributors among the raw materials values seems due to textiles, steel and felt from sprung mattresses, foam and wadding.

A sensitivity analysis was also performed for different components of the mattress in order to understand the influence of some parameters on the final results (see

Table 37). The following were investigated:

- Relocating mattress manufacture from France to China,
- Relocating ticking manufacture from France to Belgium, China or Turkey
- Increasing the recycling of steel at the end-of-life

Table 37: Impact variations associated with changes to the French baseline case.

Impact	Relocating mattress manufacture from France to China	Relocating ticking manufacture from France to			Increasing the recycling of steel at the end-of-life
		Belgium	China	Turkey	
Non-renewable energy	**3%**	**-2%**	**0%**	**-1%**	**-14%**
Renewable energy	**15%**	**12%**	**-27%**	**60%**	**5%**
Depletion of natural resources	**11%**	**5%**	**-9%**	**2%**	**-17%**
Water usage	**-3%**	**-4%**	**-3%**	**-2%**	**-13%**
Greenhouse effect	**9%**	**3%**	**-7%**	**2%**	**-23%**
Acid rain	**26%**	**12%**	**-5%**	**-2%**	**-26%**
Photochemical oxidant production	**-7%**	**-14%**	**-15%**	**-1%**	**-27%**
Destruction of ozone layer	**34%**	**2%**	**-1%**	**5%**	**12%**
Eutrophication	**70%**	**56%**	**-2%**	**-1%**	**-9%**
Aquatic toxicity	**2%**	**0%**	**0%**	**0%**	**-88%**
Human toxicity	**10%**	**2%**	**-13%**	**-3%**	**-38%**
Terrestrial toxicity	**16%**	**6%**	**-12%**	**2%**	**-5%**
Hazardous waste	**-42%**	**-43%**	**-44%**	**-9%**	**0%**
Non-hazardous waste	**0%**	**0%**	**0%**	**0%**	**8%**

The study found that for the French market, assembly of the mattress in France was generally more favourable, with the production in China leading to a greater impact in eleven out of fourteen categories, including most of the larger impacts identified above.

Within the primary study the ticking manufacture was modelled as taking place in France. A comparison of this process was made between this baseline case and it the same manufacture occurring in Belgium, China and Turkey was made. Overall, the Belgian manufacture was found to be most favourable, equalling or improving all impacts compared to the baseline case. The Turkish and Chinese scenarios were found to be slightly less favourable compared to the French case.

With the end of life scenario the disposal of the steel springs was investigated. Within the original model the split between recycled and virgin steel was modelled as 17% and 88%. Increasing the proportion of recycled steel to 80% significantly reduced: toxicity indicators, green house effect and acid rain impact.

The study from ADEME participated in the process of definition of Product Categories Rules for bed mattresses in France[a]. The final decision was to evaluate the following impacts along the life cycle of a bed mattress:

- Climate change, according to IPCC 2007
- Acidification, according to Recipe 2008
- Freshwater eutrophication, according to Recipe 2008
- Depletion of natural resources according to EDIP 97 (2004).

[a] BPX 30-323-10: General principles for an environmental communication on mass market products - Part 10: Methodology for the environmental impacts assessment of bedding. AFNOR, 2010

Impacts are to be reported to the reference flow set for the scheme (1 unit of product used every day for 7 years, unless it can be demonstrated that a longer lifespan can be considered).

Norwegian Environmental Product Declaration (EPD) – Product Category Rules for bed mattresses[a]

EPDs are mechanism allowing companies to publish a set of standardised environmental data about their products and allowing customers to get informed about environmental parameters associated with the products they purchase. The data are generated using a LCA approach, with a set of product category rules (PCRs) defining methodological assumptions, data and indicators required for each product group. These PCRs are produced in consultation with industry and government to ensure they fairly depict the environmental performance of the products belonging to the group. Mattresses and beds were included within the Norwegian EPD scheme as a sub-category of furniture.

The PCR document outlining the required scope of the LCA for this product group was defined in 2005[b], and identifies impacts which require calculation. Therefore PCRs provide some insight into the major areas of concern in terms of environmental impact for a mattress. As with other studies, the functional unit is area-based (1m^2 fit for laying), but also specifies a lifetime (guaranteed lifetime of 15 years, corresponding to a technical lifetime of at least 25 years). To be certified, the LCA needs to cover the full lifecycle of the mattress from production of raw materials to final disposal. The required impact assessment categories and calculation methods are shown in Table 38.

A list of EPDs for bed mattresses produced in Norway was kindly provided. However, none of them is in place at present and, apart from providing a general hint on environmental areas of possible concern, it appears difficult to extract more detailed pieces of information which can be used within this revision.

Table 38: Environmental parameters to be declared according to the EPD-Norge's PCR for bed matresses

Product composition	Materials resource	Land usage	Energy consumption	Impact assessments	Emissions and wastes
• Materials used • Content of hazardous substances (formaldehyde, brominated flame retardants, heavy metals).	• Virgin renewable resources • Recycled renewable resources • Virgin non-renewable resources • Recycled non-renewable resources	• Land usage	• Fossil fuels • Nuclear fuels • Renewable fuels • Miscellaneous fuels	• GWP 100 years) [kg CO_2-eq.], CML 2001 • ODP, steady state [kg R11-eq.], CML 2001 • AP [kg SO_2], CML 2001 • POCP [kg ethen-eq.], CML 2001 • EP [kg phosphate-eq.], CML 2001 • Heavy metals [kg Pb-eq.], EcoIndicator 95	• Emissions to air • Emissions to water • Wastes

a http://www.epd-norge.no/
b http://pcr-library.edf.org.tw/data/norway/NPCR04BedsE_2.pdf

4.1.2 Other sources of information not considered

Other LCA studies have been identified, but they are not discussed in detail here because the scope of the study, followed methodology or lack of supporting information make them less useful for this work:

- An academic LCA study comparing alternative production structures for beds in Jamaica.[a] Whilst mattresses are included in the assessment as part of the bedding system, the information provided do not seem detailed enough to be of use here. Moreover, the supply chain and the different scenarios analyzed do appear relevant for this work.
- The Nest Company indicates that an LCA complying with the ISO 14040 standards has been produced to promote their *Eden Eco Mattress* range.[b] However no methodological and calculation details are provided.
- Sleepmaker Australia published a carbon footprint of a full lifecycle for one of their *Forrest Collection* bed range in 2011.[c] This includes a mattress as well as the frame, so is not directly applicable to this work. The aim of this study was to identify the offset GHG emissions required to make their product carbon neutral, as part of the *carbonNZero* programme.[d]
- Furudahls Plast AB produced an LCA of hygiene mattresses used by Swedish healthcare. This was published in 1999 therefore it is not considered relevant to this study.[e]
- GBS Enterprise produced a document studying the carbon impact of mattress protectors in 2009 according to PAS2050.[f,g] However, these products are not representative of the bed mattress product group therefore are excluded from this study.
- FORCE Technology in 2010 produced a study of a Tempur PUR mattress but no information is so far shared publicly.

4.1.3 Summary of LCA findings and definition of environmental criteria areas

The most critical aspects identified in the LCA study from Boura and in the ADEME's report resulted associated with the disposal of the bed mattress itself and with the production and consumption of materials. These issues are not yet included within the current EU Ecolabel approach and could be interesting criteria areas to discuss and address during this revision process.

Climact et al.'s LCA study and FIRA's carbon footprint study confirmed that materials are the element which mainly defines the environmental profile of a bed mattress. Nevertheless, Climact et al.'s LCA also suggests that product distribution and storage may also play a significant role. However, it should be noted that the picture of the environmental impacts depicted in the study is not complete because of the exclusion of the end of life stage from the analysis. This can be considered a sensitive area because of the common practice of mattress disposal in landfill.

The studies suggest that an environmental ranking among the different mattress types cannot be drawn. The analysis also indicates that the identification of environmental areas of prioritization is fuzzy and influenced by materials and methods used in the studies.

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a Environmental evaluation of localising production as a strategy for sustainable development: a case study of two consumer goods in Jamaica, Russell S.N., Allwood J.M., Journal of Cleaner Production, 16 (2008) 1327-1338
b http://www.nest-sleep.co.uk/content/the_science_of_eden_eco_mattress/, accessed 10/01/2012
c Summary of carboNZero certification: Sleepmaker Australia Forrest Collection bed range, www.carbonzero.co.nz/documents/disclosure_Sleepmaker _2011.pdf, accessed 28/9/2011
d http://www.carbonzero.com.au/, accessed 12/12/2011
e Life Cycle Assessment of hygiene mattresses used by the Swedish health care, Furudahls Plast AB, 2009
f Bolwig, S., and Gibbon, P. (2009) 'Emerging product carbon footprint standards and schemes and their possible trade impacts' Riso DTU, National Laboratory for Sustainable Energy
g http://carbonfund.org/site/pages/land/carbonfree_product_index#gbs, accessed 10/01/2012

4.2 Lifecycle Assessment on bed mattresses – case study

4.2.1 Goal

A general overview of the most critical aspects present in the life cycle of a bed mattress was depicted through the review of the LCA studies available in the literature. However, further information is needed in order to confirm these preliminary results and to gather additional insight about the environmental burdens produced along the life cycle of a bed mattress. Based on stakeholders consultation, a streamlined LCA model was built with the aim of:

1. Detect environmental hot-spots in the life cycle of bed mattresses
2. Identify and evaluate alternative technical options

4.2.2 Scope

Three types of bed mattresses have been evaluated within the study:

- A Latex mattress made of synthetic foam;
- A PUR mattress produced from petrochemical polyols and TDI;
- A spring mattress with springs made of primary, unalloyed steel from oxygen converter.

The case-studies intend to gather information on generic products which could be manufactured in Europe. Nevertheless, an environmental ranking among the different types of mattresses cannot be drawn since there are product alternatives on the market that could differ from these base-cases.

The analysis of the following scenarios has been even addressed:

- The use of natural/synthetic latex;
- The use of oil/natural gas as heating source at the manufacture stage;
- The disposal of the mattress in landfill/incineration plants;
- The use of MDI;
- The use of different materials for springs.

4.2.3 Functional Unit

The reference flow used for data collection is one unit of product, i.e. one mattress. However, bed mattresses can provide different sleeping surfaces, depending on the size of the product. In order to take into account for the function fulfilled by a mattress, and to estimate the impacts associated with the product no matter its dimension, information has been referred to $1m^2$ of sleeping surface. A time factor could be even included in the definition of the functional unit. However, this was not considered due to the uncertainty associated with the definition of the lifespan of a bed mattress (indicatively ranging from 7.5 to 16 years depending on product quality and on user behaviour). It should be moreover remarked that the main goal of this LCA study is to identify critical issues associated with the overall life cycle of the product rather than to compare the performance given by alternative product options.

4.2.4 Impact assessment method

Environmental impacts have been assessed through the Recipe impact assessment method (18 midpoint indicators and 3 damage categories for endpoint indicators)[a]. All in all, the indicators considered have been reported in Table 39.

[a] http://www.lcia-recipe.net/

Table 39: Environmental indicators of Recipe considered in this LCA study

Indicator	Unit of Measure
Climate change	**kg CO2 eq**
Ozone depletion	kg CFC-11 eq
Human toxicity	kg 1,4-DB eq
Photochemical oxidant formation	kg NMVOC
Particulate matter formation	kg PM10 eq
Ionising radiation	kg U235 eq
Terrestrial acidification	kg SO2 eq
Freshwater eutrophication	kg P eq
Marine eutrophication	kg N eq
Terrestrial ecotoxicity	kg 1,4-DB eq
Freshwater ecotoxicity	kg 1,4-DB eq
Marine ecotoxicity	kg 1,4-DB eq
Agricultural land occupation	m^2a
Urban land occupation	m^2a
Natural land transformation	m^2
Water depletion	m^3
Metal depletion	kg Fe eq
Fossil depletion	kg oil eq
Human Health	DALY
Ecosystems	species·yr
Resources	$

The following impact categories were considered of particular concern when interpreting the results:

- Climate change, Terrestrial acidification and Freshwater eutrophication, in analogy with other schemes used for reporting the environmental performance of products[a],
- Human health, Ecosystems and Resources, in order to have an overall and more synthetic view of the impacts at the endpoint level.

Life cycle impacts have been calculated also using different assessment methods. Results have been normalized to analyse the relative weight of the impacts within different environmental areas. The following impact assessment methods have been considered for this exercise [b]:

- Recipe – midpoint indicators, Hierarchic perspective, European normalization factors;
- Recipe – endpoint indicators, Hierarchic perspective, European normalization factors;
- CML 2001 – Baseline, European normalization factors;
- Ecoindicator'99 – impact categories, Hierarchic perspective;
- Impact 2002+;
- EDIP 2003.

Priority areas cannot be set through normalization, even because of the subjectivity and uncertainty involved in the normalization step. Nevertheless, this step of the assessment can be useful to identify a list of indicators which could be more sensitive for this product group.

[a] BPX 30-323-10: General principles for an environmental communication on mass market products - Part 10: Methodology for the environmental impacts assessment of bedding. AFNOR, 2010

[b] http://www.pre-sustainability.com/content/manuals/

4.2.5 System Boundaries

The system boundaries of the study consider the cradle-to-grave evolution of the product. All the lifecycle stages of the product and all the processes and the material and energy flows of relevance have been included in the study. The aim is to assess the environmental performance of products which could represent a generic example of mattresses available on the European market.

Figure 11 shows the system boundaries considered in the studies. The models include all the upstream processes which lead to the production and supply of the materials used in the manufacture of a bed mattress. The system even consider electrical and thermal energy consumed during the manufacture and the storage of the mattress and the production of waste at the manufacture site. The mattress is ultimately disposed after the delivery and use of the product.

Figure 11: Stages composing the life cycle of a bed mattress

4.2.6 Data modelling

Different data sources were used in order to model the life cycle of the bed mattresses evaluated within this project.
The information available in the literature on bed mattresses is quite limited. Stakeholders have been consulted in order to collect pieces of information related to:

- Technical parameters of a bed mattress as dimensions and indicative lifespan (see Table 40);
- Generic bill of materials for the different mattress types (cut-off: 1% by weight) and average figures for the production waste (3% of the materials used for the mattress) (see Tables 41, 42, 43);
- Transport of materials (see Tables 41, 42, 43), energy consumption for manufacture and storage (see Table 44), delivery and end of life of the product (see Table 45);
- Identification of scenarios for the sensitivity analysis.

Information were provided by some stakeholders of the project (one for latex, one for PUR and five for spring mattresses) and average parameters calculated by IPTS. Stakeholders were also asked whether they agree on the information forming the input of the model, which generally seems good enough to get a better insight on the environmental impacts due to bed mattresses.

Table 40: Dimensions and lifetime considered for the different bed mattresses considered in the study

Mattress production	Latex (1 mattress)	PUR (1 mattress)	Spring (average of 5 mattresses)
Overall weight (kg)	18.9	16.7	20.18
lifetime (yrs)	10	12	11.1
Overall volume (m3)	0.27	0.30	0.44
Overall surface (m2)	4.47	4.23	5.25
Sleeping surface (m2)	1.80	1.69	1.97

Table 41: Bill of materials for the Latex mattress

Main materials		Amount (kg)	Waste (kg)	Amount (%)	Road transport (km)	End of life (% Recycle; Incineration; Landfill)
Core	Latex, synthetic	14.78	0.44	78.19%	150 average (15-300 range)	33-33-33
Textile	Polyester (34% average)	1.12	0.03	5.94%	500 average (50-1000 range)	60-20-20
Textile	Wool (28% average)	0.92	0.03	4.89%	500 average (50-1000 range)	60-20-20
Textile	Polypropylene (21% average)	0.69	0.02	3.67%	500 average (50-1000 range)	60-20-20
Textile	Cotton (9% average)	0.30	0.01	1.57%	500 average (50-1000 range)	60-20-20
Textile	Viscose (8% average)	0.26	0.01	1.40%	500 average (50-1000 range)	60-20-20
Other	Zinc oxide	0.49	0.01	2.61%	100 average (10-200 range)	70-0-30
Other	Sulphur	0.33	0.01	1.74%	100 average (10-200 range)	70-0-30
Packaging	LD-PE, film (average)	0.54	0.02	2.88%	150 average (15-300 range)	0-50-50
Packaging	Cardboard (average)	0.06	0.00	0.32%	150 average (15-300 range)	0-50-50

Table 42: Bill of materials for the PUR mattress

Material		Amount (kg)	Amount (%)	Waste (kg)	Road transport (km)	End of life (% Recycle; Incineration; Landfill)
Core	PUR foam	13.20	79.04%	0.40	150 average (15-300 range)	70-15-15
Textile	Polyester (34% average)	0.65	3.87%	0.02	500 average (50-1000 range)	60-20-20
Textile	Wool (28% average)	0.53	3.19%	0.02	500 average (50-1000 range)	60-20-20
Textile	Polypropylene (21% average)	0.40	2.39%	0.01	500 average (50-1000 range)	60-20-20
Textile	Cotton (9% average)	0.17	1.02%	0.01	500 average (50-1000	60-20-20

					range)	
Textile	Viscose (8% average)	0.15	0.91%	0.00	500 average (50-1000 range)	60-20-20
Padding	Polyester	1.60	9.58%	0.05	500 average (50-1000 range)	60-20-20
Packaging	LD-PE, film (average)	0.48	2.88%	0.01	150 average (15-300 range)	0-50-50
Packaging	Cardboard (average)	0.05	0.32%	0.00	150 average (15-300 range)	0-50-50

Table 43: Bill of materials for the spring mattress

Material		Amount (kg)	Amount (%)	Waste (kg)	Road transport (km)	End of life (% Recycle; Incineration; Landfill)
Core	Steel	11.46	56.76%	0.34	400 average (40-800 range)	70-0-30
Padding	PUR foam	3.14	15.55%	0.09	150 average (15-300 range)	70-15-15
Padding	Cotton	1.48	7.36%	0.04	500 average (50-1000 range)	60-20-20
Padding	Polyester	0.99	4.90%	0.03	500 average (50-1000 range)	60-20-20
Padding	Wool	0.41	2.03%	0.01	500 average (50-1000 range)	60-20-20
Cover	Polyester (34% average)	0.92	4.56%	0.03	500 average (50-1000 range)	60-20-20
Cover	Wool (28% average)	0.76	3.75%	0.02	500 average (50-1000 range)	60-20-20
Cover	Polypropylene (21% average)	0.57	2.82%	0.02	500 average (50-1000 range)	60-20-20
Cover	Cotton (9% average)	0.24	1.21%	0.01	500 average (50-1000 range)	60-20-20
Cover	Viscose (8% average)	0.22	1.07%	0.01	500 average (50-1000 range)	60-20-20
Packaging	LD-PE, film (average)	0.58	2.88%	0.02	150 average (15-300 range)	0-50-50
Packaging	Cardboard (average)	0.06	0.32%	0.00	150 average (15-300 range)	0-50-50

Table 44: Energy consumption for manufacturing and storing a bed mattress

Energy for production (MJ/mattress)	Latex	PUR	Spring	min	max
Electricity	25.20	14.76	14.36	10%	200%
Heating, NG	40.00	21.60	11.64	10%	200%
Energy for storage (MJ/mattress)	**Latex**	**PUR**	**Spring**	**min**	**max**
Electricity	3.29	3.29	3.29	40%	260%
Heating, NG	3.97	3.97	3.97	40%	210%

Table 45: Transport of the product and end-of-life scenarios

Transport (km)	End of life (Recycle; Incineration; Landfill)
350 average (35-700 range)	0-50-50

LCI background data from the Ecoinvent 2.2 database[a] have been generally used when they were available and considered the most representative source of information. This was generally the case for information on materials, transport processes and production and supply of energy. On the other hand, other databases had to be accessed to complete the model. Data on natural latex were taken from the Franklin database[b]; while information on polyester and polypropylene fibres from the ELCD database[c]. The ELCD database and the Ecoinvent database were even consulted to gather LCI data on incineration and landfilling. Results have been generated through the LCA software SimaPro 7.3.3[d].

4.2.7 Results

Baseline scenarios

Results for the baseline scenarios are reported in Table 46. Results have been obtained through the Recipe method (Midpoint indicators and the three damage categories for the endpoint indicators).

Table 46: Results from the baseline scenario

Impact category	Unit	Latex (100% synth.)	PUR (TDI)	Spring (virgin steel, low alloy)
Climate change	kg CO2 eq	6.7E+01	8.3E+01	7.7E+01
Ozone depletion	kg CFC-11 eq	2.4E-06	3.2E-06	6.7E-06
Human toxicity	kg 1,4-DB eq	1.1E+01	1.3E+01	2.1E+01
Photochemical oxidant formation	kg NMVOC	2.2E-01	2.3E-01	3.0E-01
Particulate matter formation	kg PM10 eq	1.3E-01	1.4E-01	1.7E-01
Ionising radiation	kg U235 eq	7.0E+00	1.0E+01	1.5E+01
Terrestrial acidification	kg SO2 eq	5.5E-01	4.7E-01	6.1E-01
Freshwater eutrophication	kg P eq	1.7E-02	2.2E-02	3.6E-02
Marine eutrophication	kg N eq	8.8E-02	9.7E-02	1.1E-01
Terrestrial ecotoxicity	kg 1,4-DB eq	2.6E-02	2.4E-02	8.8E-02
Freshwater ecotoxicity	kg 1,4-DB eq	3.9E-01	6.8E-01	1.1E+00
Marine ecotoxicity	kg 1,4-DB eq	1.9E-01	2.8E-01	7.3E-01
Agricultural land occupation	m2a	3.6E+01	2.4E+01	4.6E+01
Urban land occupation	m2a	3.9E-01	3.1E-01	9.0E-01
Natural land transformation	m2	5.9E-03	5.2E-03	9.5E-03
Water depletion	m3	1.5E+00	2.0E+00	5.0E+00
Metal depletion	kg Fe eq	3.3E-01	6.2E-01	2.9E+01
Fossil depletion	kg oil eq	2.8E+01	2.9E+01	2.0E+01
Human Health	DALY	1.4E-04	1.3E-04	1.5E-04
Ecosystems	species.yr	1.1E-06	3.8E-06	9.7E-07
Resources	$	4.5E+02	3.7E+02	4.5E+02

The environmental performances reported above are influenced by the assumption made at the stage of defining the model composition of the different mattresses.
The spring mattress registers the higher values of the indicators for most of the impact categories considered in the assessment. On the other hand, lower impacts have been in general calculated for the other two case studies, even if the PUR mattress has obtained the highest scores for climate change, fossil depletion and ecosystems.

[a] http://www.ecoinvent.org/database/
[b] http://www.fal.com/lifecycle-services.html
[c] http://lct.jrc.ec.europa.eu/assessment/data
[d] http://www.pre-sustainability.com/content/simapro-lca-software

However, it should be remarked that the results of the assessment cannot be used to discriminate or promote one type of product over the others. The case studies indeed represent three generic mattresses potentially available on the market, where several design options are available to consumers. The information provided can be rather used to analyse the critical aspects of the product lifecycle for each mattress type and to get further insight on the consequences associated with different technical options.

Contribution analysis

A contribution analysis was carried-out in order to identify hot-spots for the three product options. Results are shown in Table 47 for the Latex mattress, in Table 48 for the PUR mattress and in Table 49 for the spring mattress. Based on the information provided, it is apparent that the main contribution to the environmental impacts is given by raw materials. This is true for all the impact categories and all the mattress type, with contributions higher than 65.6% for all the mattresses within each category. A negative and significant contribution sometimes resulted for the end of life stage, due to the credits associated with recycling and/or incineration of materials. Within raw materials, a key role is played by the materials composing the core of the mattress. A significant source of impacts is also due to textiles. Nevertheless, it should be observed that weight of fibres is relatively low. This highlights that analysis and interpretation of impacts is to be carried-out with care and in order to ensure the coverage and identification of all the most relevant contributions. A more detailed contribution analysis is reported for the following categories: climate change, acidification, freshwater eutrophication, human health, ecosystems and resources.

For the latex mattress, the contributions due to synthetic rubber and to textiles are:

- 40.3% and 57.1% for climate change
- 21.9% and 74.5% for acidification
- 3% and 91.6% for eutrophication
- 38.6% and 58.3% for human health
- 18.3% and 80.4% for ecosystems
- 67.6% and 30.4% for resources.

For the PUR mattress, the contributions due to PUR foam and to textiles are:

- 57.6% and 42.5% for climate change
- 35.2% and 64.8% for acidification
- 36.2% and 63.8% for eutrophication
- 55.5% and43.5% for human health
- 36.3% and 63.7% for ecosystems
- 65.8% and 34.2% for resources.

For the spring mattress, the contributions due to steel, to textiles and PUR foam are:

- 29.4%; 60.1% and 10.5% for climate change
- 11.8%; 79.4 and 8.7% for acidification
- 40.6%; 58.2% and 1.2% for eutrophication
- 33.7%; 57.2% and 9.1% for human health
- 16.2%; 79.2% and 4.5% for ecosystems
- 31.4%; 54.7% and 13.9% for resources.

Secondary sources of impact are represented by energy for production and storage and end-of-life of the product. Energy for production and storage contributes:

- Between 2.5% and 6.3% to climate change
- Between 1.7% and 2.0% to acidification
- Between 3.7% and 14.5% to eutrophication
- Between 2.3% and 5.9% to human health
- Between 1.1% and 3.2% to ecosystems
- Between 3.2% and 5.2% to resources.

The end-of-life stage contributes:

- Between 6.6% and 8.1% to climate change
- Between 0.5% and 0.9% to acidification
- Between 7.8% and 17.2% to eutrophication
- Between 4.9% and 6.1% to human health
- Between 3.1% and 4.1% to ecosystems
- Between 0.3% and 0.5% to resources.

Contributions from packaging; manufacture waste (3% of raw materials) and transport instead appear considerably lower if compared to the other elements present in the life cycle of a mattress.

Table 47: Contribution analysis for the Latex mattress

Impact category	Unit	Raw materials	Packaging	Waste from production	Energy for production	Energy for storage	Transport	EoL
Climate change	%	80.6	2.1	1.7	5.6	0.7	1.2	8.1
Ozone depletion	%	75.6	0.8	1.1	14.6	1.6	5.4	0.9
Human toxicity	%	81.1	1.0	1.6	13.1	1.7	0.9	0.6
Photochemical oxidant formation	%	89.1	1.7	1.7	2.8	0.3	2.3	2.1
Particulate matter formation	%	92.0	0.9	1.5	2.5	0.3	1.1	1.7
Ionising radiation	%	68.6	1.4	1.3	23.9	3.1	1.3	0.4
Terrestrial acidification	%	94.9	0.6	1.4	1.8	0.2	0.6	0.5
Freshwater eutrophication	%	65.6	1.0	1.3	12.8	1.7	0.4	17.2
Marine eutrophication	%	95.4	0.2	1.4	0.7	0.1	0.2	1.9
Terrestrial ecotoxicity	%	97.2	0.1	1.4	0.7	0.1	0.6	-0.1
Freshwater ecotoxicity	%	88.9	0.6	1.5	7.6	1.0	0.5	0.0
Marine ecotoxicity	%	78.6	1.2	1.6	15.4	2.0	1.3	-0.1
Agricultural land occupation	%	98.1	0.4	1.4	0.1	0.0	0.0	0.0
Urban land occupation	%	92.4	0.8	1.5	1.9	0.2	3.2	0.0
Natural land transformation	%	81.1	0.9	1.8	10.0	1.1	5.0	0.0
Water depletion	%	95.4	0.3	1.5	1.2	0.2	0.2	1.4
Metal depletion	%	201.9	2.8	3.5	9.9	1.2	10.0	-129.2
Fossil depletion	%	89.6	2.1	1.7	4.7	0.5	1.1	0.3
Human Health	%	83.5	1.7	1.7	5.3	0.6	1.2	6.1
Ecosystems	%	89.2	1.2	1.6	2.9	0.3	0.7	4.1
Resources	%	89.6	2.1	1.7	4.7	0.5	1.1	0.3

Table 48: Contribution analysis for the PUR mattress

Impact category	Unit	Raw materials	Packaging	Waste from production	Energy for production	Energy for storage	Transport	EoL
Climate change	%	86.0	1.7	1.3	2.9	0.6	1.0	6.6
Ozone depletion	%	85.2	0.6	1.3	6.8	1.3	4.0	0.9
Human toxicity	%	87.3	0.8	1.5	7.4	1.6	0.7	0.6
Photochemical oxidant formation	%	90.0	1.6	1.2	1.7	0.4	2.1	3.1
Particulate matter formation	%	93.4	0.8	1.2	1.4	0.3	0.9	1.9
Ionising radiation	%	83.0	1.0	1.8	10.7	2.4	0.9	0.3
Terrestrial acidification	%	94.8	0.7	1.3	1.4	0.3	0.7	0.9
Freshwater eutrophication	%	77.1	0.7	1.4	6.3	1.4	0.3	12.8
Marine eutrophication	%	96.1	0.1	1.2	0.4	0.1	0.2	1.8
Terrestrial ecotoxicity	%	97.5	0.1	1.2	0.5	0.1	0.6	-0.1
Freshwater ecotoxicity	%	94.5	0.4	1.2	2.9	0.6	0.3	0.0
Marine ecotoxicity	%	88.4	0.8	1.5	6.9	1.5	0.9	-0.1
Agricultural land occupation	%	97.9	0.5	1.4	0.1	0.0	0.0	0.0
Urban land occupation	%	88.4	1.0	1.3	1.5	0.3	4.0	3.4
Natural land transformation	%	88.4	1.0	1.5	7.3	1.4	5.7	-5.3
Water depletion	%	96.5	0.2	1.1	0.6	0.1	0.2	1.3
Metal depletion	%	155.7	1.5	1.8	3.4	0.7	5.3	-68.4
Fossil depletion	%	91.9	2.1	1.1	2.9	0.6	1.0	0.4
Human Health	%	87.7	1.4	1.3	2.8	0.6	1.0	5.2
Ecosystems	%	90.1	1.2	1.3	2.0	0.4	0.7	4.3
Resources	%	91.9	2.1	1.1	2.9	0.6	1.0	0.4

Table 49: Contribution analysis for the spring mattress

Impact category	Unit	Raw materials	Packaging	Waste from production	Energy for production	Energy for storage	Transport	EoL
Climate change	%	86.5	1.8	1.2	2.0	0.5	1.0	7.0
Ozone depletion	%	92.9	0.3	2.3	1.8	0.5	1.9	0.4
Human toxicity	%	93	0.5	1.7	3.4	0.8	0.4	0.3
Photochemical oxidant formation	%	92.2	1.2	1.7	0.9	0.2	1.6	2.2
Particulate matter formation	%	94.8	0.6	1.0	0.9	0.2	0.8	1.6
Ionising radiation	%	89.6	0.6	2.0	5.6	1.3	0.6	0.2
Terrestrial acidification	%	96.3	0.5	1.1	0.8	0.2	0.5	0.6
Freshwater eutrophication	%	86.2	0.4	1.6	3.0	0.7	0.2	7.8
Marine eutrophication	%	96.7	0.1	1.2	0.3	0.1	0.2	1.5
Terrestrial ecotoxicity	%	98.3	0.0	1.4	0.1	0.0	0.2	0.0
Freshwater ecotoxicity	%	96	0.2	1.8	1.5	0.3	0.2	0.0
Marine ecotoxicity	%	94.7	0.3	2.2	2.1	0.5	0.3	0.0
Agricultural land occupation	%	98.5	0.3	1.3	0.0	0.0	0.0	0.0
Urban land occupation	%	95.2	0.3	1.7	0.4	0.1	1.3	0.9
Natural land transformation	%	94	0.6	1.8	2.3	0.6	3.0	-2.3
Water depletion	%	98.1	0.1	1.0	0.2	0.0	0.1	0.5
Metal depletion	%	98.8	0.0	2.4	0.1	0.0	0.1	-1.4
Fossil depletion	%	90.8	2.9	1.2	2.5	0.7	1.4	0.5
Human Health	%	89.3	1.3	1.2	1.8	0.5	0.9	4.9
Ecosystems	%	93.0	0.9	1.3	0.9	0.2	0.5	3.1
Resources	%	90.8	2.9	1.2	2.5	0.7	1.4	0.5

Sensitivity analysis

On the basis of the information collected, a sensitivity analysis has been carried-out to understand the influence of some alternative options on the results of the assessment. The analysis of the following scenarios has been addressed:

- The use of natural/synthetic latex;
- The use of oil/natural gas as heating source at the manufacture stage;
- The disposal of the mattress in landfill/incineration plants;
- The use of TDI/MDI;
- The use of different production materials in springs (i.e. primary - low alloyed steel from oxygen converter; primary – unalloyed steel from oxygen converter; secondary steel from electric arc furnace; primary stainless steel from oxygen converter; mixed stainless steel from electric arc furnace).

Results are reported in table 50 for latex mattresses, table 51 for PUR mattresses and table 52 for spring mattresses.

Results for the latex mattress suggest that:

- Incineration of the bed mattress could lead to environmental benefits, if compared to landfill (recycling is not considered in this analysis because of hygienic and technical limitations associated with this option);
- Energy consumption in the production stage seems to vary significantly between different producers. As a consequence, impact results affected by such variation. The influence due to a change of fuel seems less relevant;
- Some environmental benefits seem associated with the use of natural latex. However, these are offset by an increased impact to ecosystems, due to higher land use and transformation.

Results for the PUR mattress suggest that:

- The use of MDI in place of TDI could decrease slightly almost all the indicators considered in the assessment. However, the information available cannot be used to drawn robust conclusions on this aspect. Rather, it can be interesting to compare the hazard properties of these two substances.

Results for the spring mattress suggest that:

- Stainless steel produces significantly higher impacts per kilogram of material than conventional steel. On the other hand, better eco-profiles are associated with recycled steel and unalloyed steel. Application of these results is however limited by the fact that it has not been possible to take into account for possible variations in the functionality and technical properties of the materials. Results could be adapted accordingly if information were available on the steel needed for different wire and spring systems.

None of the other options can be clearly identified because of its superior performance.

Table 50: Sensitivity analysis on latex mattresses

Impact category	Latex (100% synth.) 100% incineration	Latex (100% synth.) Energy: x2	Latex (100% synth.) Energy: x 1/10	Latex (70% synth)
Climate change	97.0%	106.3%	94.3%	92.5%
Ozone depletion	99.9%	116.2%	85.4%	107.4%
Human toxicity	100.6%	114.8%	86.7%	95.3%
Photochemical oxidant formation	100.0%	103.2%	97.1%	94.9%
Particulate matter formation	98.5%	102.8%	97.5%	96.2%
Ionising radiation	100.0%	127.0%	75.7%	104.4%
Terrestrial acidification	99.9%	102.1%	98.1%	97.0%
Freshwater eutrophication	82.8%	114.4%	87.0%	101.7%
Marine eutrophication	98.3%	100.8%	99.3%	99.4%
Terrestrial ecotoxicity	99.9%	100.8%	99.3%	100.0%
Freshwater ecotoxicity	100.0%	108.6%	92.3%	100.5%
Marine ecotoxicity	99.8%	117.4%	84.3%	102.1%
Agricultural land occupation	100.0%	100.1%	99.9%	779.6%
Urban land occupation	100.0%	102.1%	98.1%	105.9%
Natural land transformation	100.0%	111.2%	90.0%	107.2%
Water depletion	101.2%	101.3%	98.8%	99.4%
Metal depletion	-32.4%	111.1%	90.0%	117.1%
Fossil depletion	99.6%	105.2%	95.3%	83.4%
Human Health	97.6%	105.9%	94.7%	93.6%
Ecosystems	98.5%	103.3%	97.0%	352.2%
Resources	99.6%	105.2%	95.3%	83.4%

Table 51: Sensitivity analysis for PUR mattresses

Impact category	PUR (MDI)	PUR (MDI/TDI)
Climate change	93.2%	98.2%
Ozone depletion	106.0%	101.6%
Human toxicity	101.6%	100.5%
Photochemical oxidant formation	91.6%	97.9%
Particulate matter formation	92.0%	98.3%
Ionising radiation	99.9%	100.0%
Terrestrial acidification	93.9%	98.4%
Freshwater eutrophication	98.7%	100.0%
Marine eutrophication	83.3%	96.3%
Terrestrial ecotoxicity	98.9%	100.2%
Freshwater ecotoxicity	96.4%	100.1%
Marine ecotoxicity	100.5%	100.3%
Agricultural land occupation	100.0%	100.0%
Urban land occupation	100.0%	100.0%
Natural land transformation	99.8%	100.0%
Water depletion	87.2%	96.6%
Metal depletion	99.1%	99.8%
Fossil depletion	98.0%	99.5%
Human Health	93.4%	98.4%
Ecosystems	95.6%	98.9%
Resources	98.0%	99.5%

Table 52: Sensitivity analysis for spring mattresses

Impact category	primary – unalloyed steel (converter)	secondary steel (electric arc furnace)	mixed stainless steel (electric arc furnace)	primary stainless steel (converter)
Climate change	96.6%	87.4%	114.1%	118.6%
Ozone depletion	97.9%	98.2%	114.8%	113.5%
Human toxicity	85.0%	111.5%	169.0%	136.9%
Photochemical oxidant formation	96.7%	89.2%	112.5%	116.1%
Particulate matter formation	90.7%	73.4%	140.1%	149.0%
Ionising radiation	96.3%	99.7%	128.0%	123.0%
Terrestrial acidification	97.7%	94.3%	112.0%	113.3%
Freshwater eutrophication	94.1%	83.2%	107.8%	114.0%
Marine eutrophication	99.4%	98.4%	102.3%	102.7%
Terrestrial ecotoxicity	99.5%	101.5%	105.6%	103.4%
Freshwater ecotoxicity	75.6%	76.4%	262.7%	255.2%
Marine ecotoxicity	63.8%	66.2%	344.9%	332.8%
Agricultural land occupation	99.9%	99.4%	100.6%	100.8%
Urban land occupation	94.3%	88.7%	128.3%	130.8%
Natural land transformation	97.4%	92.6%	111.0%	112.1%
Water depletion	99.7%	98.3%	100.1%	101.0%
Metal depletion	29.8%	3.5%	271.8%	285.6%
Fossil depletion	96.3%	85.5%	115.0%	119.7%
Human Health	94.1%	85.9%	125.8%	128.2%
Ecosystems	98.3%	93.9%	107.0%	109.2%
Resources	95.9%	84.9%	116.0%	120.8%

Normalization

Results have been repeated using different impact assessment methods and normalized to understand the environmental areas where the lifecycle of a mattress could produce more significant pressures. Results are reported in Table 53.

Table 53: Environmental areas where the lifecycle of a mattress could produce more significant pressures

Impact category	Recipe	Recipe - End	CML	Ecoindicator	Impact 2002	EDIP	Frequency
Non renewable energy		X		X	X		60%
Ecotoxicity	X		X			X	50%
Land occupation/ transformation	X	X		X			50%
Respiratory Inorganics/ Particulate		X		X	X		50%
Climate change		X			X		33%
Eutrophication	X					X	33%
Resources						X	17%
Toxicity - humans	X						17%
Toxicity - water						X	17%

Because of the subjectivity and uncertainty involved, priority areas cannot be set through normalization. Nevertheless, this step of the assessment can be useful to identify a list of indicators which could be more sensitive for this product group.

4.2.8 Discussion and conclusion

Energy consumption is one of the most significant areas of concern within the life cycle of bed mattresses. Other environmental issues of concern may for instance include: eco-toxicity, land use, emissions of particulate and inorganic compounds, climate change, eutrophication. The outcomes of this LCA study indicate that the most critical aspects of the life cycle of a mattress are:

1. The materials used in the product itself;
2. The disposal of the product after its useful lifespan.

The study even suggests that energy consumption for manufacture and storage can contribute appreciably to depict the environmental performance of a bed mattress.

All in all, results seem in good accordance with the information reported in other works. These aid to identify areas of environmental improvement for this product group, which can ultimately form the basis for the further development of environmental criteria (see Table 54).

Table 54: Improvement areas and issues of concern for a bed mattress

Areas of environmental improvement	Issues of concern
1. Decreasing the impacts due to the materials composing the mattress	• Appropriate consumption of materials • Selection of more eco-friendly materials (sourcing and production)
2. Decreasing the impacts due to the manufacture and the storage of the mattress	• Improving the energy performance • Promotion of best industrial practices
3. Decreasing the impacts due to the end of life of the mattress	• Diversion from landfill • Design for disassembling and recovery of materials
4. Improving the overall performance of the mattress	• Improving the technical performance • Improving the environmental performance

Impacts due to mattress components could be in first instance decreased through the control of the sourcing and through the application of eco-design principles aimed at selecting more efficient materials and at saving resources whilst preserving the functionality and the quality of the product.

Other actions which could decrease the impacts due to a bed mattress could be, for example: improving the energy performance of manufacturing and storing; promoting best industrial practices for these stages ; decreasing the impacts due to the end of life by diverting from landfilling and promoting product disassembling and material recovery.

Moreover, attention on quality aspects and on the use of the mattress is another important aspect to achieve indirectly environmental benefits. Industry even appears experienced with carbon foot-printing practices and standards already exist on how to report on products GHGs emissions, which is also related to the consumption of fossil energy[a]. Environmental reporting does not mean ensuring that "sustainable" impacts are produced. However, this could be considered the first step of a process leading producers to increase their sensibility towards environmental issues and which should be then continuously improved in the future.

LCA is an effective tool for identifying where criteria should focus. The issues listed above are not yet addressed in the Commission Decision 2009/598/EC. The potential conversion of these issues into criteria is discussed in the next section. Including some of these aspects into the current criteria document would represent a challenging task, which would increase the environmental responsibility of producers and would bring added value to the EU Ecolabel for bed mattresses.

4.3 Hazardous substances and materials

Bed mattresses can consist of a large variety of different materials, depending on the complexity of the product. Health issues associated to the products available on the market can be perceived by consumer as a key factor for the selection of inherently safer articles. This issue is addressed in article 6.6 and 6.7 of the EU Ecolabel Regulation, which intends to limit the content of elements of concern for human health and the environment:

- 6.6: "The EU Ecolabel may not be awarded to goods containing substances or preparations/mixtures meeting the criteria for classification as toxic, hazardous to the environment, carcinogenic, mutagenic or toxic for reproduction (CMR), in accordance with 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, nor to goods containing substances referred to in Article 57 of Regulation (EC) No 1907/2006 of the European Parliament and of the Council of18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency"
- 6.7: "For specific categories of goods containing substances referred to in paragraph 6, and only in the event that it is not technically feasible to substitute them as such, or via the use of alternative materials or designs, or in the case of products which have a significantly higher overall environment performance compared with other goods of the same category, the Commission may adopt measures to grant derogations from paragraph 6. No derogation shall be given concerning substances that meet the criteria of Article 57 of Regulation (EC) No 1907/2006 and that are identified according to the procedure described in Article 59(1) of that Regulation, present in mixtures, in an article or in any homogeneous part of a complex article in concentrations higher than 0,1 % (weight by weight). Those measures, designed to amend non-essential elements of this

a These standards include ISO 14064 (Green house gas emissions inventory), Publically Available Specification 2050 (PAS 2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services), and PAS 2060 (Specification for the demonstration of carbon neutrality).

Regulation, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 16(2)".

This could affect the use of specific groups of substances as, for instance, reactive flame retardants, plasticizers and biocides. An insight into the substances of potential concern contained in bed mattresses and a description of the practical requirements requested within the EU Ecolabel scheme is reported in the next section of the document.

5 Discussion of criteria areas and specific issues

A series of issues of relevance for the criteria development and revision were identified, based on stakeholder consultation, on market and legislation analyses and on the LCA information gathered along the project and described above.

Issues have been grouped by thematic area, as reported in table 55. Proposal of amendments and additions to the Commission Decision 2009/598/EC will be addressed through the discussion of the issues below. EU Ecolabel criteria not discussed within this section are proposed to remain unchanged. From Table 55 it is possible to observe that many of the issues could be proposed as an additional element to form the criteria document for bed mattresses.

Table 55: Issues relevant for the criteria development that are discussed in the present report

Criteria area	Issue	Revision/ New Element	Comment
1. Materials	**Consumption of materials**		
	a. Formulation of the mattress	**New**	**Proposal on eco-design of mattresses withdrawn after the 1st AHWG meeting**
	Sourcing of materials		
	b. Use of renewable-based materials	**New**	**Proposal on promotion of renewable materials withdrawn after the 1st AHWG meeting**
	c. Use of organic materials	**New**	**Proposal on promotion of organic materials withdrawn after the 1st AHWG meeting**
	d. Use of recycled materials	**New**	**Proposal on promotion of recycled materials withdrawn after the 1st AHWG meeting**
	e. Use of certified and sustainable materials	**Revision for wood/ New for others**	**Revised criterion necessary for wood only if wooden bed bases are of relevance (See Section 3.3 in the Technical Report)** **Proposal on sourcing sustainable-certified natural latex for the production of natural latex foams withdrawn after the 2nd AHWG meeting** **Proposal on sourcing sustainable-certified vegetable oils for the production of PUR foams withdrawn**

Criteria area	Issue	Revision/ New Element	Comment
			after the 2nd AHWG meeting
	f. Energy and LCA requirements	New	Proposal of screening materials based on energy or other LCA benchmarks withdrawn after the 1st AHWG meeting
	Production of materials		
	g. Latex and PUR foams	New	Proposal of setting water emission limits for latex production withdrawn after the 2nd AHWG meeting Proposal of avoiding the use of TDI in PUR foam production withdrawn after the 2nd AHWG meeting Proposal of setting emission limits for the production of diisocyanates (precursors of PUR foams) withdrawn after the 2nd AHWG meeting
	h. Springs	New	Proposal of avoiding the use of stainless steel withdrawn after the 2nd AHWG meeting Proposal of sourcing steel in accordance with updated BAT withdrawn after the 2nd AHWG meeting
	i. Textiles	New	New proposal presented after the 2nd AHWG meeting (See Section 3.2 in the Technical Report)
2. Manufacture and storage	a. Energy performance	New	Proposal on requiring energy data for future benchmarking withdrawn after the 1st AHWG meeting
	b. Best industrial practices	New	Proposal on requiring the implementation of measure for storage and distribution of the product withdrawn after the 2nd AHWG meeting
	c. EMS / CSR criteria for the industrial site	New	Proposal on requiring the implementation of EMS/CSR schems withdrawn after the 1st AHWG meeting

Criteria area	Issue	Revision/ New Element	Comment
3. Substances	a. Use of materials and substances of concern		
	- Horizontal approach	New	New proposal presented after the 2nd AHWG meeting (See Section 3.2 in the Technical Report)
	- Raw materials	Revision	New proposal presented for Latex and for PUR foams after the 2nd AHWG meeting (See Section 3.2 in the Technical Report)
	- Flame retardants	Revision	Proposal unchanged (See Section 3.2 in the Technical Report)
	- Biocides	Revision	New proposal presented after the 2nd AHWG meeting (See Section 3.2 in the Technical Report)
	- Plasticizers	New	New proposal presented after the 2nd AHWG meeting (See Section 3.2 in the Technical Report)
4. Fitness for use	a. Quality of the product		
	- Warranty coverage during the lifespan of the mattress	New	New proposal presented after the 2nd AHWG meeting (See Section 3.2 in the Technical Report)
	- Additional requirements on the technical performance	New	New proposal presented after the 2nd AHWG meeting (See Section 3.2 in the Technical Report)
5. Packaging	a. Significance of the criterion on packaging	Revision	Proposal of removing prescription on packaging kept (See Section 3.3 in the Technical Report)
6. End of life	a. Diversion from landfill through a collection system	New	Proposal of diverting from landfill through a collection system withdrawn after the 2nd AHWG meeting

Criteria area	Issue	Revision/ New Element	Comment
	b. Design for disassembling and recovery of materials	New	New proposal on design for disassembling presented (See section 3.3 in the Technical Report)
7. Environmental performance	a. Energy and Life cycle performance of the product	New	Proposal on requiring a LCA study for future benchmarking withdrawn after the 1st AHWG meeting
8. Others	a. Consistency of the criteria	New	Some change applied (See Section 3.3 in the Technical Report)
	b. Information of consumers and on the box 2 of the label	Revision	Proposal unchanged for box 2; nre proposal presented for information of consumers (See Section 3.2 in the Technical Report)
	c. VOCs emissions from the entire mattress	Revision	New proposal presented for testing the criterion (See Section 3.2 in the Technical Report)

5.1 Materials

The technical analysis has highlighted that the largest contributions to the environmental impacts of a mattress are due to the main materials composing the product itself: latex and PUR foams, springs, textiles.

Environmental issues of concern include: energy consumption, climate change, eutrophication, ecotoxicity, land occupation and transformation, particulate emission, toxicity. Reducing the energy embodied in materials would reduce the carbon intensity of the product and would produce indirect benefits even with respect to other impact categories. Impacts due to materials could be even decreased through the application of eco-design fundamentals aimed at selecting more eco-friendly materials and at saving resources whilst preserving the functionality and the quality of the product. The use of different parameters could be explored in order to select more eco-friendly materials. With respect to the sourcing, it can be discussed on the feasibility of promoting materials which can be for instance based on renewables, organic or recycled feedstock. The issue of wood certification was considered worthy of further investigation at the end of the last revision, together with the possibility to align requirements on material production with the prescriptions made within the relative Bref documents. Other technical alternatives could be even favoured because of the positive effects produced at lifecycle level.

The options outlined here are generally valid for the materials composing a bed mattress. Nevertheless, the alignment with the revised EU Ecolabel criteria for textiles should be also ensured.

Based on this introduction, the feasibility of addressing the following options is discussed further:

- **Consumption of materials:**
  a. Formulation of the mattress
- **Sourcing of more eco-friendly materials**
  b. Use of renewable-based materials
  c. Use of organic materials
  d. Use of recycled materials
  e. Use of certified and sustainable materials
  f. Energy and LCA requirements
- **Production of materials**
  g. Latex and PUR foams
  i. Springs
  l. Textiles

5.1.1 Issue 1a. Formulation of the mattress

Influencing the design and materials composition of mattresses using eco-design principles is an option which could improve the environmental performance of mattress production.

This could be achieved by prescribing requirements on the types and amounts of materials which should be used in order to ensure the technical performance of the product for a certain period while minimising the environmental impacts.

The general feedback from stakeholders indicates that it would be very difficult to prescribe eco-design principles without limiting innovation and/or affecting the functionality and quality of the product. For instance, reducing the number and/or quality of materials may reduce the impacts of the mattress referred to single units of product, but may also reduce the technical lifespan, leading on reality to an overall increase in impacts in comparison with a more robust mattress. It is even clear that cradle-to-cradle or closed-loop approach should be followed in order to reduce lifecycle impacts effectively.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, prescriptions on the formulation of the mattress do not seem worthy of consideration for the current revision.

5.1.2 Issue 1b. Use of renewable-based materials

Renewable-based materials may be used in place of materials based on petro-chemicals, for instance in foam production. However, the benefits due to the use of renewable feedstock (e.g. sap of the "rubber tree" for the production of natural latex or palm oil for chemical synthesis) are not clear, on a general basis. For instance the substitution of natural and arable lands for industrial applications could produce negative impacts on local ecosystems, biodiversity and food production.

This point focuses on the possibility of promoting the use of materials based on renewable feedstock, for instance by requiring a certain amount of materials being sourced from renewable sources. Certain renewable materials, such as wool and coconut fibres are present in mattresses. These materials are typically used as layers of padding/wadding to augment the performance of the primary filling type (i.e. latex, PUR or springs). Information gathered from industry and stakeholders indicates that their usage could be increased; however, it is unlikely that these materials can fully replace the primary filling at present for all mattress types and specifications.

In addition to this, some alternatives exist for feedstock materials; for example, natural oils for the production of PUR and natural rubber. Other naturally available materials already in use are considered below. BASF's *Lupranol Balance*, which can be used as a precursor to foams, is made from castor oil.[a] Ford has also begun using soybean oil based foams (up to 25% of the overall foams used) in their vehicles.[b]

BASF indicates that natural sources may reduce certain environmental impacts, such as waste production and GHG emissions. However, trade-offs are possible, as other factors are expected to increase compared to conventional fossil feedstock (e.g. land use).[c] This point was highlighted even in Section 4.2 of the present report, where environmental effects of increasing the amount of natural latex were investigated. The existence of possible environmental trade-offs is even highlighted for polyols in a LCA study from Dow Chemicals[d] [e], where it is shown how the environmental performance much depends on the natural feedstock used in the production chain.

The availability of these materials is also unknown at present. For instance, to cover 20% of the market production should need to be on a large enough scale to support the production of 3 million foam mattresses, based on market survey data above.

The comments received from stakeholders support that data are inconclusive at present:

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a http://www.basf.com/group/corporate/en/sustainability/eco-efficiency-analysis/projects/lupranol-balance-50, accessed 14/12/2011
b http://www.plasticstoday.com/articles/ford-applies-soy-based-foam-head-restraints0901201102, accessed 14/12/2011
c "Lupranol BALANCE 50 High Performance". Naturally, BASF, UTECH Europe 2009 Conference MECC, Maastricht, The Netherlands
d http://www.nt.ntnu.no/users/skoge/prost/proceedings/aiche-2006/data/papers/P60475.pdf
e http://pubs.rsc.org/en/content/articlelanding/2009/gc/b815833a

- Overall there was general agreement that renewable materials could be encouraged, where appropriate, but probably in the future rather than immediately. However, sustainability issues need to be addressed and investigated carefully.
- Concerns were expressed about the lack of information demonstrating the benefits of using some renewable materials compared with 'conventional' materials.
- Linked to the above point was the observation that environmental impacts need to be correctly identified and compared. This can differ case-by-case and it would make the process of defining criteria difficult.
- The use of these materials may present new problems such as the presence of allergens or compromising the performance. Sustainability issues about the sourcing of the materials should be also considered.
- Some of the materials currently used in bed mattresses are already derived from renewable sources, e.g. wool, coconut fibres. However, outcomes from revision of the textiles EU Ecolabel criteria also need to be considered for these materials.
- Different types of mattress have very different compositions, and there is also large variability within mattress types depending on specification. Therefore it is difficult to set precise values.
- Nowadays foams are primarily based on fossil feedstock. Because of differences in properties (e.g. quality and durability, odours), the use of renewable-based products can be limited. With respect to the polyols used to produce PUR, it was for instance said that 20% is the threshold beyond that the content of natural polyols could negatively affect the quality of the product.

Further evidence on the benefits of promoting the use of renewable-based materials would be required before this issue is converted into a criterion and it could be convenient to postpone the issue to the next revision of the product group.

However, sustainable sourcing of renewable-based materials could be an issue to consider here, following the example of wood. This is investigated further for PUR and Latex foams produced from natural resource on the respective point of discussion.

Follow-up:

Based on the information gathered along the project and on the feedback received from stakeholders, promoting the use of renewable-based materials in place of fossil-based ones does not seem worthy of consideration for the current revision. Nevertheless, it could be considered within the next revision.

5.1.3 Issue 1c. Use of organic materials

Organically produced materials may provide suitable and environmentally beneficial alternatives to certain conventionally produced (non-organic) materials in a mattress. It may be thus appropriate to promote the use of organically produced materials or substances and to require their presence in the mattresses for a certain amount.

Mattresses contain a variety of naturally produced materials, including natural latex, cotton, wool, hemp, and bamboo and coconut fibres, which may be produced organically or otherwise.[a] These can either be part of the internal filling of the mattress, or may be part of the covering. Many of these are textiles and can be sourced and produced organically. It even seems that organic natural latex can be now supplied[b].

a For a definition of "organic" and "organic farming" see the International Federation of Organic Movements http://www.ifoam.org/growing_organic/definitions/doa/index.html

b http://www.savvyrest.com/news/2010/09/22/savvy-rest-proud-announce-organic-latex

Overall it was widely acknowledged that organically produced materials have been shown to have some environmental and health benefits. LCA of cotton indicates that organic production are better in term of impacts such as toxicity and waste However, trade-offs could be registered with respect to few other categories, e.g. land use.[a] More significant variations of impact could be even due to the choice of the material itself or to geographical differences associated with the production location.

In terms of existing organic certification schemes, stakeholders indicated that inclusion of organic based criteria may lead to confusion with customers as there are already several separate labelling schemes to certify organically produced goods. Some already applies to mattresses; examples found include:

- No Feathers Please: http://www.nofeathersplease.com/ (wool and cotton)
- Healthy Choice: https://healthychoicemattress.com/organic_cert.htm (latex, various textiles for cover and filling)
- Savvyrest: http://www.savvyrest.com/why-savvy-rest/certifications
- Abaca (UK): http://www.abacaorganic.co.uk/

Considering also the low uptake of the EU Ecolabel for this specific product group, the inclusion of a new criterion specifying the use of some organically produced materials could be unwise. Such action may indeed result in unintended consequences, such as the greater use of synthetic materials or further discouragement of applications due to their greater complexity. Therefore, it could make more sense to refer to sustainable production of materials.

The Commission Decision 2009/567/EC on the EU Ecolabel for textiles specifies that textiles being awarded the EU Ecolabel must contain a minimum of 3% organic cotton[b]. Criteria are currently under revision and the proportion of requested organic cotton is currently under discussion. However, it is felt that this is not an issue to be considered in the present revision.

Issues raised with this latter approach include:

- Textiles are a group in themselves, and copying and pasting requirements would place an unfair burden on this product group
- Setting levels too high may deter applicants, therefore a gradual approach to introduction may be required

Suggestions were made to look at the current version of Nordic Swan Criteria for Furniture and Fitments, where no criterion on organically produced materials is set, not even for textiles.

Follow-up:
Based on the information gathered along the project and on the feedback received from stakeholders, promoting the use of organically produces materials does not seem worthy of consideration for the current revision. Nevertheless, the issue could be considered within the next revision.

5.1.4 Issue 1d. Use of recycled materials

Mattresses can in special cases contain recycled materials, such as:

- Recycled textiles used as part of the mattress filling;
- Springs made of recycled metals.

[a] Beton, A.; Dias, D.; Farrant, L.; Gibon, T.; Le Guern, Y.; Desaxce, M.; Perwueltz, A.and Boufateh, I. 2009. Environmental Improvement Potentials of Textiles. EuropeanCommission, JRC, Seville
[b] 2009/567/EC, criteria 2

Requiring the use of a certain amount of recycled materials could be an option for improving the environmental performance of the product. However, it was reported that:

- Steel is already produced using a significant amount of scraps. Recycling is considered a relevant indicator for materials which are not so much recycled and/or for which the recycling chain is not mature (see additional discussion in the section related to steel).
- Use of other recycled materials is not typical and techno-environmental benefits from their use could be not appreciable.

Stakeholders does not seem to recommend going on with this option.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, promoting the use of recycled materials does not seem worthy of consideration for the current revision.

5.1.5 Issue 1e. Use of certified sustainable materials

Wood

The Commission Decision 2009/598/EC requires that 60% of virgin solid wood must come from forests with certified third party forest certification schemes. Increasing the use of certified wood is a recommendation passed from the last revision of the EU Ecolabel for bed mattresses. It should be remarked that one of the proposals of the current revision is to move bed bases to the furniture product group. This would exclude wood from the materials to consider here, and the issue would become relevant within the upcoming revision of the furniture product group. Nevertheless, the issue was preliminarily addressed below.

Since the last revision of bed mattress criteria other EU Ecolabel product groups have adopted stricter controls on the sourcing of wood; for instance the copying and graphic paper product group, agreed in 2011.[a] The new criteria for this product group specify that 100% of virgin fibres must be sourced from forests which are part of a third party certification scheme for sustainable management such as FSC, PEFC, or equivalent. This indicates that it may be appropriate to increase the 60% level specified in the current criteria. Other environmental labelling schemes are instead less stringent than the EU Ecolabel. The Austrian Ecolabel for bed mattresses specifies at least 50% of wood from sustainable forests, while the Blue Angel for bed mattresses requires that all wood is sourced from forests which are neither boreal nor tropical.

The key features for PEFC and FSC are described below in Table 56. Direct comparison of the two schemes is difficult due to regional variations, particularly for the PEFC scheme. Both address sustainability, social and environmental issues related to the sourcing of wood, however each scheme follows a different approach.

Table 56: Comparison of FSC and PEFC certification schemes

	FSC	PEFC
Title	Forest Stewardship Council	Programme for the Endorsement of Forest Certification Schemes
Scale	International	International
Structure	FSC sets overall standards, e.g.	Umbrella scheme covering various

a 2011/333/EU: Commission Decision of 7 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for copying and graphic paper

	FSC	PEFC
	FSC-STD-30-0110 (supply of wood) FSC-STD-40-005 (chain of custody for purchasing of acceptable wood). These are interpreted regionally, dependant on specific circumstances.	different regional schemes adhering to similar principles (e.g. PEFC Germany and SFI USA). Some variation between different organisations.
3rd Party Verification	Yes	Yes
Annual Audit	Yes	Yes
Mixture of certified and uncertified	Allowed, but uncertified sources must comply with FSC standards	Allowed, but uncertified sources must meet PEFC chain of custody standard

The general feedback gathered from stakeholders indicates that increasing the quantity of certified wood is appropriate, if Scandinavian bed mattresses were kept within this product group. However, there are disagreements over the level. Mixed suggestions were provided, from keeping certified sourcing constant at 60% to raising this to 75-100%.

Information from industry indicated that only 15% of wood-producing forests (by area) in the world are certified as FSC or PEFC (PEFC, the largest certification body, estimates they certify 60% of this 15%)[a]. However, it should be noted that 15% of forest area could not necessarily represent 15% of wood production. In 2008 it was estimated that 25% of the total area of certified forests is located in the EU, with the vast majority of the rest in North America (57%).[b] It also seems that around 60% of timber producing forests are certified in these regions. This indicates that access to certified wood for producers of Scandinavian bed mattresses should not pose a significant issue, although it may do in other territories.

However, one stakeholder indicated that the issue is not related to sourcing; rather it is associated with the traceability of the supplied wood at manufacturing level, as wood may get mixed and used in other non-Ecolabelled products. It was thus proposed to focus on the legality issue only without increasing the 60% threshold.

From early 2013, Regulation (EU) No 995/2010 will make it an offence to place any product containing illegally harvested wood onto the market. Operators shall undergo due diligence to confirm the legality of their sources.[c] Therefore, incorporating a stricter criterion on wood sourcing can be seen a way to raise the EU Ecolabel baseline, as all products will need to meet stricter specification in the future.

A closer comparison with the EU Ecolabel Criteria for Copying and Graphic Paper could be used to solve this issue. The relevant criterion is shown below, which proposes 100% sourcing of virgin fibres from certified sources, along with other conditions on the sourcing of mixed wood streams from outside the scheme, which still need to be verified.[d]

Criterion 3 - Fibres: sustainable forest management.

The fibre raw material in the paper may be recycled or virgin fibre.

Virgin fibres shall be covered by valid sustainable forest management and chain of custody certificates

a PEFC UK – Annual Report 2011, PEFC UK
b Timber Trade Federation, http://www.ttf.co.uk/Environment/Certification.aspx, accessed 12/12/2011
c Regulation (EU) No 995/2010 of the European Parliament and of the Council of 20 October 2010
d 2011/333/EU: Commission Decision of 7 June 2011 on establishing the ecological criteria for the award of the EU Ecolabel for copying and graphic paper

issued by an independent third party certification scheme such as FSC, PEFC or equivalent.

However, where certification schemes allow mixing of certified material and uncertified material in a product or product line, the proportion of uncertified material shall not exceed 50 %. Such uncertified material shall be covered by a verification system which ensures that it is legally sourced and meets any other requirement of the certification scheme with respect to uncertified material.

The certification bodies issuing forest and/or chain of custody certificates shall be accredited/recognised by that certification scheme.

Assessment and verification: the applicant shall provide appropriate documentation indicating the types, quantities and origins of fibres used in the pulp and the paper production.

Where virgin fibres are used, the product shall be covered by valid forest management and chain of custody certificates issued by an independent third party certification scheme, such as PEFC, FSC or equivalent. If the product or product line includes uncertified material, proof should be provided that the uncertified material is less than 50 % and is covered by a verification system which ensures that it is legally sourced and meets any other requirement of the certification scheme with respect to uncertified material.

Where recycled fibres are used, the applicant shall provide a declaration stating the average amount of grades of recovered paper used for the product in accordance with the standard EN 643 or an equivalent standard. The applicant shall provide a declaration that no mill broke (own or purchased) was used.

However, since other stakeholders indicated that 100% certified wood would be impossible to achieve, a more modest increase could be proposed alternatively. A marginal amount of uncertified wood, for instance 5%, could be allowed, and be incorporated into wording above for copying and graphics paper.

Alternatively, a similar approach to wooden furniture could be adopted, which has increased the quantity of certified wood required over time, with the current level at 60% and a 70% level from 1st January 2013.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to move wooden bed bases to the furniture product group and to leave the discussion on certification of wood for the revision of the corresponding EU Ecolabel criteria revision.

This criterion should be revised if wooden bed bases were kept within the scope of bed mattresses. In that case, it is proposed to get inspired from criterion number 3 of the EU Ecolabel for copying and graphic paper.

Natural Latex

In the previous points of discussion it was said that it would make more sense to focus on the sustainability of the materials rather than on their renewability.

It was noted that rubber can be made available from FSC certified forests. At present, 7 licences have been granted worldwide, though the scale of production associated with these producers is unknown

(see table 57). A similar process for rubber does not exist at present under the PEFC scheme. World supply of natural latex is estimated at 12 million tonnes,[a] and it is estimated that sustainably source latex accounts for around 0.2% of world supply of latex, however this only an estimate and no official figures exist.[b]

Table 57: Organizations supplying natural latex from FSC certified forests

Certificate Code	Organization Name	Organization Name	Country
SCS-COC-002535	Sourcetlantique U.K. Ltd., Reqistered Head Office	Sourcetlantique U.K. Ltd., Reqistered Head Office	UK/US
BV-COC-046149	ITI Home Products (Hong Kong) Company Limited	ITI Home Products (Hong Kong) Company Limited	CHINA
SCS-COC-002453	Artemis Rubber Technology	Artemis Rubber Technology	US
SCS-COC-002346	Lalan Rubbers (Pvt) Limited	Lalan Rubbers (Pvt) Limited	SRI LANKA
SCS-FM/COC-00127P	Lalan Rubbers (Pvt) Ltd.	Lalan Rubbers (Pvt) Ltd.	SRI LANKA
SCS-FM/COC-00134G	Pandeniya Thurusaviya Samithiya	Pandeniya Thurusaviya Samithiya	SRI LANKA
Unknown	Gloveman Supplies Ltd (GSL) in Sri Lanka	Gloveman Supplies Ltd (GSL) in Sri Lanka	SRI LANKA

The use of sustainably sourced natural latex is considered worthy of investigation and the FSC scheme may provide a suitable source of sustainable natural latex. However, mixed suggestions were received from stakeholders and it is not clear whether this could be included in the present criteria document or whether it should be postponed for the next revision.

European producers of latex clarified that it is difficult to obtain certified natural latex in economically high volumes. Moreover, the list of organizations above seems providing dry rubber (used for instance for the production of gloves) and not liquid latex for industrial bulk transport.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, this action seems important but difficult to be addressed within the current revision.

Synthetic Latex and PUR foams from renewable feedstock

Synthetic foams are usually produced from crude oil. Alternative production routes are based on the processing of renewable feedstock, e.g. vegetable oils. Sustainable sourcing of these materials is an issue of relevance here.

The use of sustainably sourced vegetable oils could be required. However, figures on the current and future consumption of vegetable oils within the bed mattresses sector are unknown. In order to take into account for this issue, where materials from vegetable based oils are used in the production of PUR foams, it could be asked that a share of them (e.g. 10%) is obtained from sustainable sources.

For the time being, standards have been found for:
- Palm oil (Roundtable on Sustainable Palm Oil - RSPO), and
- Soy bean oil (Round Table on Responsible Soy Association – RTRS).

[a] http://www.rubber-foundation.org/docu/2575natural.pdf

[b] Personal communication with industry

Broader information on additional schemes would be needed to include other vegetable oils (e.g. sunflower oil and rapeseed oil). However, environmental benefits which could be achieved from such prescription are considered uncertain and marginal, given the relatively low weight contribution of renewable materials to the average production of PUR foams in the EU.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, this action seems important but difficult to be fully addressed within the current revision.

5.1.6 Production of materials: Latex and PUR foams

Natural vs. Synthetic latex

Latex used in mattresses can be sourced from natural materials or from synthetic analogues of naturally occurring material. In addition, two different techniques are available for the production of synthetic latex foams; the Dunlop and Talalay processes. Since these options differ significantly, different environmental impacts are likely to be associated with them.

The inclusion of a criterion which encourages the appropriate use of natural and synthetic materials or specific process techniques may be required to ensure the use of the most environmentally friendly option is used.

Natural and synthetic latex are used in variable proportions within mattresses cores, with synthetic latex being used between 5-100% by weight (70% on average). The use of natural latex may appear more environmentally friendly. However, evidence suggests that this is not true for all the indicators, as even highlighted in chapter 4.2. For instance, extending rubber tree plantations to produce natural latex could have negative impacts on local ecosystems, biodiversity and food production.

Moreover, natural and synthetic latex appears to be different in terms of:

- Properties: synthetic latex has more uniform properties and is more durable, natural latex has greater elasticity.
- Consistency: the properties and quality of natural latex can vary, synthetic latex can be produced more consistently.
- Costs: synthetic latex is cheaper to produce than natural latex.

Blends of the materials are usually chosen to provide the optimum performance and price of the mattress. Therefore, natural and synthetic latex can not be considered completely substitutable because they bring different properties to the mattress and because they are both required to provide an appropriate set of choices to the consumer.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, the promotion of natural latex does not seem worthy of consideration for the current revision.

Dunlop vs. Talalay process for the production of synthetic latex

Two processes exist for the production of synthetic latex: the Dunlop process and the Talalay process.[a] Both are used extensively in the production of the latex cores for mattresses; both using natural resources, synthetic materials or a mixture of the two as a feedstock. There was some indication from stakeholders that the Talalay process is more energy intensive. However, both processes are used in industry as they impart different properties to the latex, e.g. Dunlop latex is firmer around the foam edges.[b] Therefore they cannot be considered substitutable, and the preference for a single process would be unreasonable.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, the promotion of specific processes for the production of synthetic latex **does not seem worthy of consideration** for the current revision.

Use of blowing agents for foam production

The current criteria document prescribes that halogenated organic compounds shall not be used as blowing or auxiliary blowing agents. Improvements in production processes, particularly for foam, mean that the existing criteria may be out of date - specifically with reference to emissions during production.

Historically both CFCs and HCFCs have been used in the production of PUR foams, and it is widely known these substances are harmful to the environment, particularly as GHGs and as ozone-depleting substances. The present criterion bans the use of any halogenated organic compounds used as blowing agents or auxiliary blowing agents. This aligned with the more recently revised Blue Angel scheme. Stakeholders commonly agree on a complete ban on halogenated hydrocarbons for this use because these compounds had been commonly replaced by carbon dioxide.

Stakeholders also indicated that latex foam production needs no blowing agent. Based on these pieces of evidence the existing criteria are believed to be appropriate and do not present a barrier to applicants.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, this action does not seem relevant.

Environmental thresholds for Latex production

Setting thresholds on specific environmental aspects related to latex production is another option which could lead to effective environmental benefits. General feedback from stakeholders is that:

- This approach would be reliant on industry data gathering on mattresses, this has not been readily available to date,
- Specific environmental aspects would need to be indentified for specification in the criteria based on the same rules,
- Innovation may be stifled as this option would produce uncertainty for producers in the future,
- Some materials or mattress types could be unfairly penalized depending on the impacts measured.

However, technical information reported in BREF documents and in other labelling schemes could provide useful insight for the selection of more environmental friendly materials.

a Latices: Applications of latices , Blackley D. C., Springer, 1997
b http://www.savvyrest.com/why-savvy-rest/natural-dunlop-talalay, accessed 19/12/2011

With respect to latex foams, the BREF Document on polymers[a] indicates that at present there is no alternative to Emulsion Styrene Butadiene Rubber (ESBR) for the production of synthetic latex. The ESBR process can produce rubbers with different properties, for instance most production is used to produce solid rubbers for tyres, footwear and cables. The BREF document provides an indication on the expected variation level for some emissions and consumptions of the ESBR polymerization process (see Table 58).

Table 58: Emissions and consumptions figures for the ESBR polymerization process

Process consumptions	**Unit**	**Amount**	**20% threshold**	**40% threshold**
Water	m^3/t	5-50	14.0	23.0
Steam	GJ/t	3-8	4.0	5.0
Electricity	GJ/t	1-2	1.2	1.4
Process emissions to atmosphere	**Unit**	**Amount**	**20% threshold**	**40% threshold**
VOCs	g/t	170-540	244.0	318.0
Other waste streams	**Unit**	**Amount**	**20% threshold**	**40% threshold**
Hazardous waste	kg/t	3-5	3.4	3.8
Non-hazardous waste	kg/t	0.24-3.6	0.9	1.6
Rubber	kg/t	1.5-5.2	2.2	3.0
Wastewater	m^3/t	3-5	3.4	3.8
COD	g/m^3	150-200	160.0	170.0

Consumption and emission requirements could be set to select more environmentally friendly polymers. Based on uniform distribution of data, thresholds were estimated (see Table 58) in order to screen the 20% best performing polymers.

The ESBR process is also used for the production of synthetic latex, however the document acknowledges that different processing can be involved there, so different parameters may be required for the production of latex.

It was also indicated that the Blue Angel criteria for Footwear incorporate requirements for origin of rubber and wastewater treatment for rubber processing, which may be applicable.

Requirements for Wastewater Treatment during the Processing of Natural Rubber / Latex and the Manufacturing and Processing of Synthetic Rubber (Blue Angel, Footwear)[b]

The wastewater from the processing of natural rubber and/or manufacturing of synthetic rubber shall not exceed the following values upon discharge into a water body:

- 2 mg/l for zinc,
- 0.5 mg/l for lead,
- 1 mg/l for AOX,
- 0.1 mg/l for benzene and its derivatives,
- COD of 150 mg/l or at least 90% reduction compared with the inflow on a monthly average,
- 20 mg/l for total nitrogen (N_{total}) and 2 mg/l for total phosphorous (P_{total}) as well as a value of 2 for the toxicity in fish eggs (GEi).

This requirement shall not apply to approved discharges into a municipal sewage treatment plant that meets at least the requirements of Council Directive 91/271/EEC concerning urban waste water treatment, dated 21st May 1991.

[a] European Commission Reference Document, Best Available Techniques in the Production of Polymers, August 2007

[b] RAL-UZ 155, Basic Criteria for Award of the Environmental Label – Footwear, Blue Angel, February 2011

Some stakeholders would welcome referring to emission factors (i.e. amount of pollutant emitted per amount of product) rather than to concentrations in the effluents. However, it was reported that limits based on mass per waste water volume or product volume is not common practice.

Since municipal wastewater plants mostly treat domestic wastewater or pre-treated wastewater coming from production plants, it is understood that prescriptions on emission limits into water should be valid for all the production plants. Moreover, according to industry, assessment and verification should take place every 12 months. However, industry explained that rubber is used in footwear.

Rubber is formed from dry natural latex with almost no wastewater. The production of latex foam is instead based on liquid feedstock and results in larger amount of wastewater. Emission range across Europe were provided for some of the parameters:

- COD emissions can vary from 150 mg/L to 3000 mg/L;
- Nitrogen emissions can vary from 0 mg/L to 15 mg/L;
- Zinc emissions can vary from 0.1 mg/L to 5 mg/L.

Setting ambitious emission levels would lead to high waste water treatment investments and are perceived by industry as an unnecessary burden for this label.

Follow-up

Based on the feedback received from stakeholders, it is proposed to postpone this issue to the next revision of the criteria.

PUR production

PUR foams are produced from:

- polyols (hydroxy-polyether or hydroxy-polyesther)
- diisocyanates (TDI/MDI)
- water
- blowing agents (CO_2)
- other additives.

With respect to polyols, polyethers are typically used in the production of PUR foams and usually produced from fossil feedstock. The use of natural polyols is a technical alternative which is currently available on the market. However, as shown in the points of discussion above, the promotion of natural feedstock is not considered an option which could be addressed in the present revision due to market, technical and environmental reasons.

Diisocyanates are the second main precursor for PUR. Toluene diisocyanate (TDI, CAS number: 26471-62-5) and methylene diphenyl diisocyanate (MDI, CAS number: 32055-14-4) are the two technical options currently available on the market. TDI, MDI or a mix of the two chemicals can be used, even if the use of pure TDI seems the most common choice of producers nowadays. TDI and MDI carries a large number of risk phrases (see Table 59).[a] [b]

Table 59: Emissions and consumptions figures for the ESBR polymerization process

Hazard Statement	Ecolabel relevance	TDI	MDI
H315: Causes skin irritation		X	X

[a] ECHA REACH database – CAS 26471-62-5
[b] ECHA REACH database – CAS 32055-14-4

H317: May cause an allergic skin reaction	yes	X	X
H319: Causes serious eye irritation		X	X
H330: Fatal if inhaled	yes	X	
H332: Harmful if inhaled			X
H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled	yes	X	X
H335: May cause respiratory irritation		X	X
H351: Suspected of causing cancer	yes	X	X
H373: May cause damage to organs through prolonged or repeated exposure	yes		X
H402: Harmful to aquatic life		X	
H412: Harmful to aquatic life with long lasting effects	yes	X	

MDI appears less hazardous, particularly with respect to the inhalation of the substance and to the environment. If it is considered that MDI is even less volatile[a], it can be considered that this chemical represents an inherently safer option, whose promotion is one of the principles of the Regulation 66/2010 on the EU Ecolabel. The use of MDI could increase the level of protection of workers and the environment. The lifecycle impacts of 1 kg of foam produced from different diisocyanates seem quite similar, with the presence of trade-offs among some impact categories, even depending on the dataset used for the calculation (see Figure 12 and Figure 13). Thus, the promotion of inherently safer foam precursors could be promoted. Since market information on the penetration of TDI and MDI are not available, it could be for instance proposed to require that all the PUR used in mattresses is manufacture from MDI.

However, industry replied that the use of TDI is safe since workers exposure to TDI is controlled and that TDI forms a significant share of the market in Europe. It was moreover explained that foams produced from MDI need to have a higher density (+30%), thus requiring more material and being more expensive.

a Tury B. and Pemberton D. (2003) Fate and Potential Environmental Effects of Methylenediphenyl Diisocyanate and Toluene Diisocyanate Released into the Atmosphere. J. Air & Waste Manage. Assoc. 53:61–66

Figure 12: Comparison between different PUR foams based on Ecoinvent v2 datasets and on the Recipe impact assessment method.

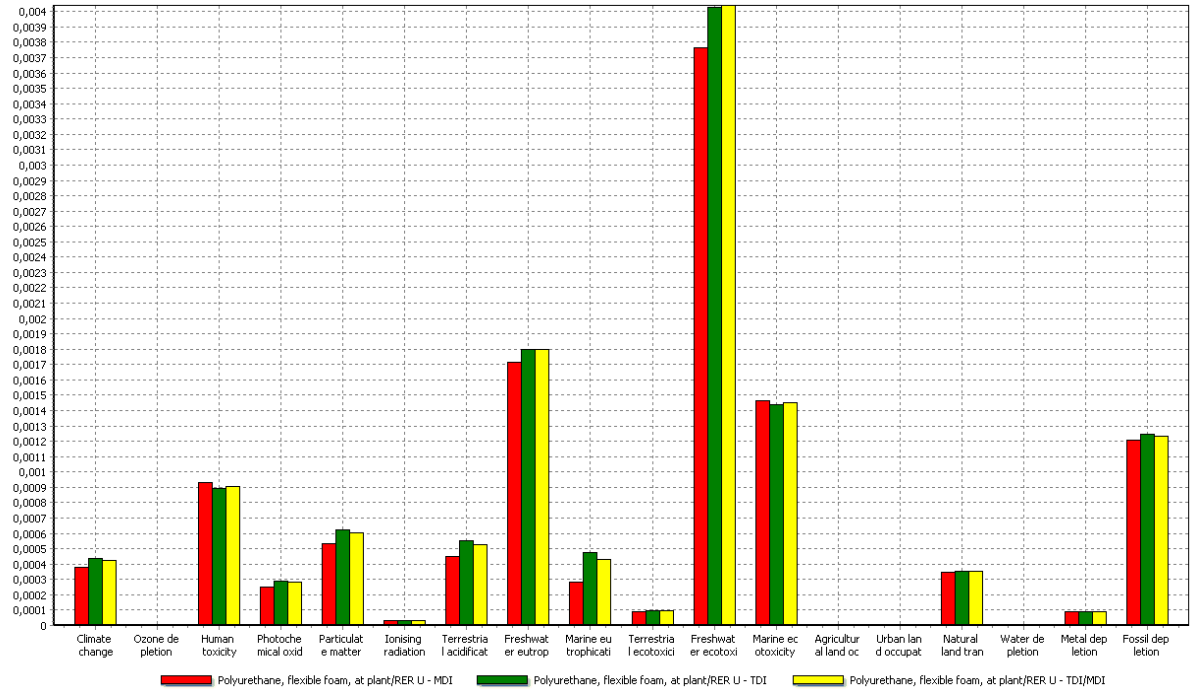
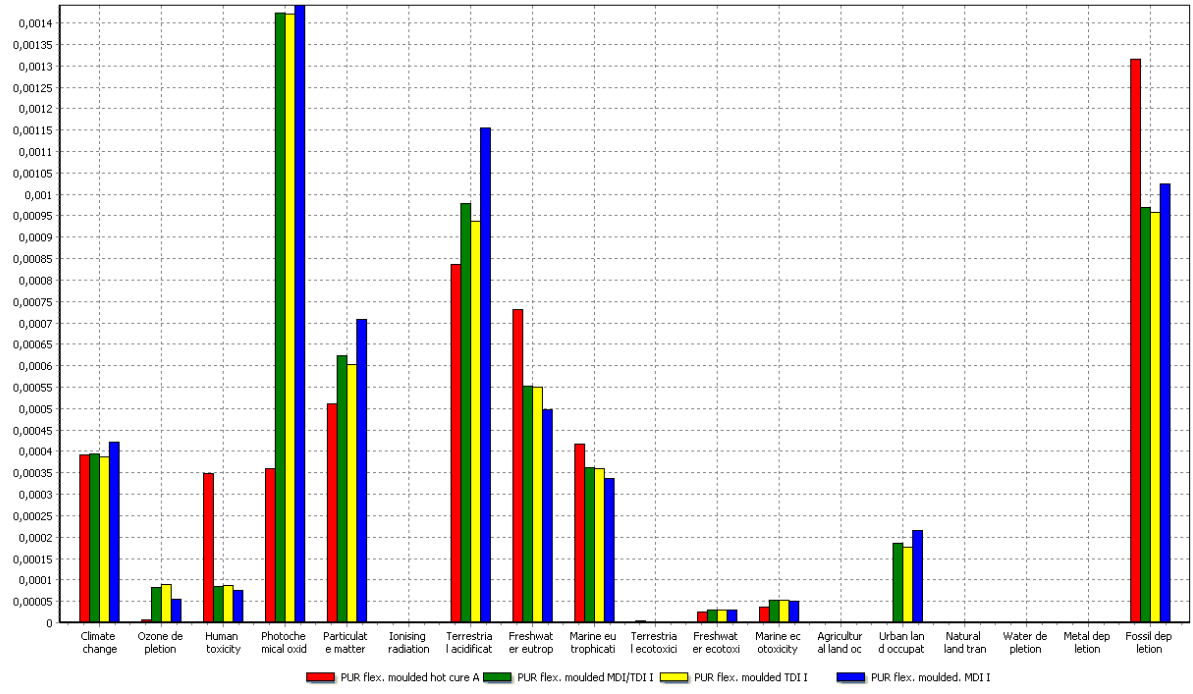


Figure 13: Comparison between different PUR foams based on alternative datasets (IDEMAT 2001 and Industry data) and on the Recipe impact assessment method.



Since hazardous precursors are used for the production of PUR foams, the control of workplace exposure level could be another issue of importance to enhance safety of workers. However, industry replied that foam producers apply very severe safety measures in line with the European legislation.

The quality of a mattress depends strongly on the density of the foam. PUR foams available in the market can present different densities (25-55 kg/m^3). Low level types are thin and have low densities. High quality mattresses consist of two or more layers of different foam types, a sometimes very complex

contour and different zones. The technical lifespan of such a mattress is up to 10 years whereas a low quality product may last 2 years maximum. However, producers do not see the need of requiring prescriptions on the foam density but to rely on performance criteria for firmness and durability.

Similarly to ESBR rubber, process consumption and emission limits are available in the BREF document on Large Volume Organic Chemicals[a] for diisocyanates (see Table 60). These could be used to set limits for some of the precursors of PUR, as indicated in the corresponding tables.

However, concerns were expressed about the representativeness of the presented limit values, which are based on the Bref document on Large Volume Organic Chemicals (2003). Updated values should be used but access to these pieces of information seems unlikely at the moment. Ecoprofiles have been calculated by Plastics Europe but, apart from results on the level of lifecycle indicators, no information on process data is made public. Moreover, types of PUR foams on the market differs in density, composition and properties, which would make comparison between different foams difficult.

Table 60. Emissions and consumptions figures for the production of Diisocyanates

Wastewater	**TDI**	**MDI**	**TDI (20% threshold)**	**MDI (20% threshold)**
Volume (m3/t)	1-10	0.1-1	3	0.3
COD (kg/t)	1-10	< 0.1	3	< 0.1
AOX (g/t)	10-100	0.1-1	30	0.3
Air emissions	**TDI**	**MDI**	**TDI (20% threshold)**	**MDI (20% threshold)**
NOx (mg/m^3)	12-200	NA	49.6	NA
SO_2 (mg/m^3)	<20	NA	<20	NA
CO (mg/m^3)	<2-130	NA	27.6	NA
Total C (mg/m^3)	<1-35	NA	7.8	NA
Dust (mg/m^3)	<1-5	NA	1.8	NA
PCDD/F (mg/m^3)	NA	NA	NA	NA

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, promotion of these actions seems difficult within the current revision.

5.1.7 Production of materials: Springs

<u>Selection of materials for springs</u>

There are several kinds of springs which can be composed of different materials, usually carbon steel, harmonic steel (Si Steel) and polymeric springs (Nylon). Glass fibres and stainless steel are even used.

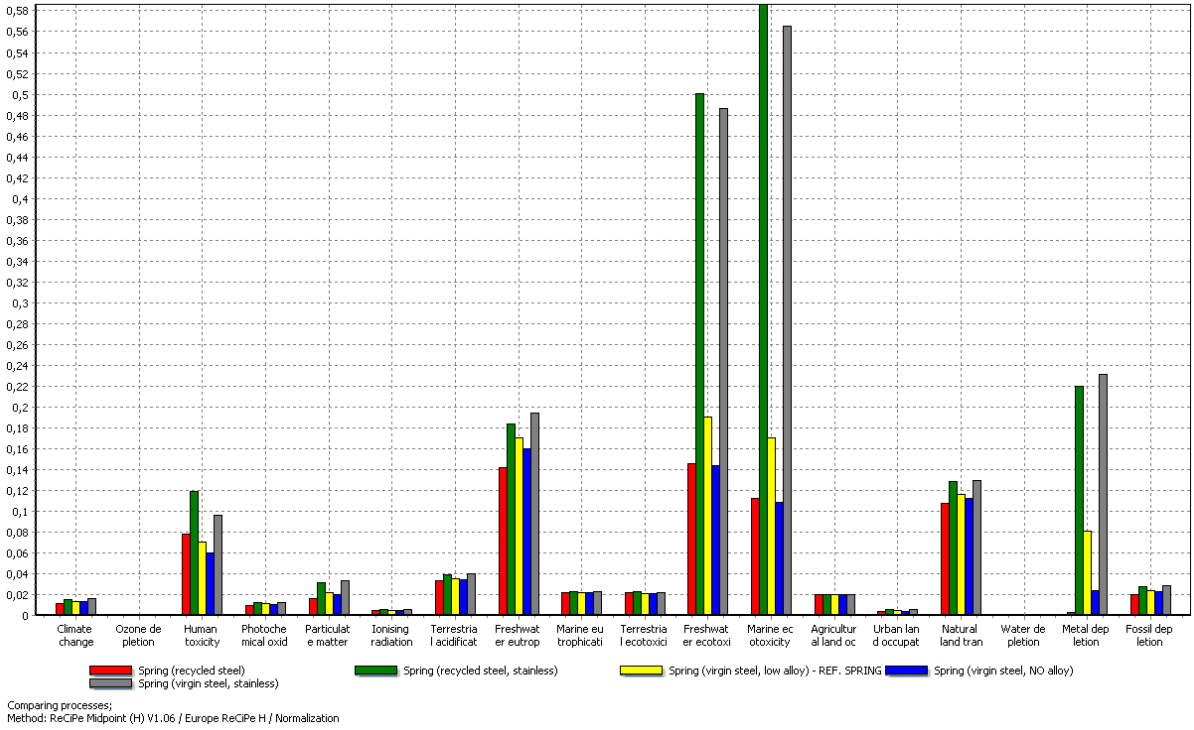
A simplified assessment of the impacts associated with the production and disposal of 1 kg of different materials is reported in figure 14. From the figure it is possible to observe that stainless steel significantly perform worse than the other materials considered in this screening lifecycle assessment. Some trade-offs are registered for the other materials, even if application of these results is limited by the fact that it has not been possible to take into account for possible variations in the functionality and technical properties of the different materials. Results could be adapted accordingly if information were available.

Moreover, Euro-Fer informed the Commission that the Ecoinvent datasets are not considered representative for steel materials. For instance, it was explained that converters are not the technology

[a] http://eippcb.jrc.es/reference/BREF/lvo_bref_0203.pdf

currently used in the EU and that the current production of steel is made in electric arc furnaces using 60% by weight iron scraps as feedstock. Euro-Fer stated they have completed a robust database. However, no environmental information has been shared yet.

Figure 14: Comparison between different materials for springs based on the Ecoinvent v2 dataset and on the Recipe impact assessment method.



The collected elements are not robust enough to discriminate against materials. With respect to the use of plastic springs, it should be noted that the Austrian Ecolabel for bed mattresses prescribes that springs made of plastics must be free of halogenated organic compounds. However, market of plastic springs is considered marginal at the moment and a horizontal approach on chemical substances will be in any case introduced (see section 5.3).

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is considered inappropriate to promote the use of certain materials in the current revision.

Spring production

Process consumption and emission figures on iron and steel production and on plastic production and processing are available within the BREF documents. However, the issue is too complex to handle within this revision. This issue could be shifted to the next revision while it could be required now to demonstrate that materials are produced through the Best Available techniques identified in the BREF documents. However, industry expressed some concerns about the possibilities of verifying that BATs are applied, especially because most of the steel springs consumed in the EU seem to be imported.

Two additional prescriptions from the Nordic Swan criteria for furniture could be even considered for discussion:

1. The metal in the product must be separable from other materials (does not include surface treatment) without the use of specialist tools;

2. At least 20% by weight of the metal in the product must be recycled metal. Alternatively, the smelting plant that supplies the metal must on an annual basis use at least 20% recycled metal in its production.

However, such prescriptions are not considered appropriate by the respective industry association because:

1. Carbon steel springs are very often coated, for instance with copper, for a smoother surface, while stainless steel does not need surface coating to be corrosion resistant, bright and smooth.
2. Steel are already produced using a significant amount of scraps. However, due to the long life time of steel in some markets, the amount of end-of-life steel which is available at a given time is much less than the needs (a half as a proxy). In other terms, promoting recycled content in a product will result in making scraps unavailable for other products and thus voiding the potential environmental benefits. The end-of-life recycling rate is considered a more appropriate performance indicator and it depends on the product (in average it is about 80%). Recycling is relevant for materials, not for products. The recycled content indicator is considered relevant for materials which are not so much recycled and for which the recycling chain is not mature.

Follow-up

Based on the feedback received, it is proposed to withdraw these proposals from the current revision.

5.1.8 Production of materials: Textiles (fabrics and fibres used as cover or filling)

As highlighted in the section 4.2, textile materials can contribute significantly to the impacts of a bed mattress. Textiles therefore represent an important criteria area for the revision. Two main elements are to be considered in doing this:

1. Selection of the most appropriate criteria on textiles of relevance for bed mattresses.
2. Alignment with the current revision of the EU Ecolabel criteria for textiles.

Based on the analysis of the current Nordic Swan criteria on textiles for furniture[a], some recommendations have been drafted (see Table 61).

Table 61:List of potential criteria of interest for the use of textiles in bed mattresses

Issue	Nordic Swan for Furniture	EU Ecolabel for bed mattresses (Commission Decision 2009/567/EC)	Comments/Recommendations	Scope
1	R41. Flame retardants, biocides and surface treatment	**6.1 Biocides**	A reference to specific prescriptions on biocides, flame retardants and other hazardous substances should be sufficient and it could form an introductory criterion X.1 on "general requirement on hazardous substances".	Cover Padding

[a] http://www.svanen.se/en/Svanenmarka/Kriterier/?p=2

Issue	Nordic Swan for Furniture	EU Ecolabel for bed mattresses (Commission Decision 2009/567/EC)	Comments/Recommendations	Scope
2	R45. Auxiliary chemicals	6.2. **Auxiliary chemicals**	This could form a criterion X.2 and should be updated in accordance with the current revision of the EU Ecolabel criteria for textiles.	Cover Wool for filling
3		**6.3. Detergent, fabric softeners and complexing agents**	This could form a criterion X.3 and should be updated in accordance with the current revision of the EU Ecolabel criteria for textiles.	Cover
4		**6.4. Bleaching agents**	This could form a criterion X.4 and should be updated in accordance with the current revision of the EU Ecolabel criteria for textiles.	Cover Filling [a]
5	R42. Dyes, pigments and auxiliary chemicals R43-44. Dyes	**6.5 Impurities in dyes** **6.6 Impurities in pigments** **6.7 Chrome mordant dyeing** **6.8 Metal complex dyes** **6.9 Azo dyes** **6.10 Dyes that are carcinogenic, mutagenic or toxic to reproduction** **6.11 Potentially sensitising dyes**	Criteria on dyeing should be aligned with the current revision of the EU Ecolabel criteria for textiles. Criteria could be somehow merged in a single prescription X.5 on "dyeing". In accordance with Blue Angel criteria for mattresses, also the restriction of metal complex dyes based on cadmium, mercury, lead could be added. List of restricted amines and sensitising dyers should be updated according to Oekotex 100. This would lead to the inclusion of: - 4,4'-methylene-bis-(2-chloroaniline) (101-14-4), - 4-aminoazobenzene (60-09-03) - Disperse Blue 3 and Disperse Yellow 3 (within the sensitising dyes).	Cover Filling [a]
6		**6.8 Metal complex dyes (wastewater**	Prescription on wastewater discharges from dyeing	Cover; Filling [a]

Issue	Nordic Swan for Furniture	EU Ecolabel for bed mattresses (Commission Decision 2009/567/EC)	Comments/Recommendations	Scope
		discharges from dyeing processing)	processes would be moved to form a separate criterion. This would allow latex and PUR foams referencing to textiles criteria on dyes (see point 5)	
7	R47. Wastewater discharges from wet processing		A criterion X.6 could be added which limits COD emissions from wet-processing. This should be aligned with the current revision of the EU Ecolabel criteria for textiles.	Cover Wool for filling
8	R48. Durability		Resistance to abrasion is prescribed within the current Nordic Swan criteria for furniture, while a new criterion X.7 on chemical treatment resistance should be introduced within the set of EU Ecolabel criteria for textiles. However, at this stage, it could be more appropriate to align with the requirements on mechanical resistance outlined in the existing technical standard BS EN 14976 "Textiles – Mattress ticking – Specifications and test methods".	Cover
9	R50. Dimensional change		A criterion X.8 on dimensional changes during washing and drying could be added, in accordance with existing EU Ecolabel criteria for textile. The existing technical standard EN 14976 "Textiles – Mattress ticking – Specifications and test methods" should be also satisfied.	Cover, only if removable
NA	R46. Formaldehyde		Nordic Swan criteria for furniture prescribe that emissions of formaldehyde must not exceed 20 ppm or that, alternatively, evaporation must not exceed 0.005 mg/m3.	Not applied

Issue	Nordic Swan for Furniture	EU Ecolabel for bed mattresses (Commission Decision 2009/567/EC)	Comments/Recommendations	Scope
			However, this criterion is not considered relevant since VOCs and SVOCs emission from the whole mattress are regulated.	
NA	R49. Pilling		Not considered an issue of relevance here	Not applied
NA	R51. Colour fastness to washing		Not considered an issue of relevance here	Not applied
NA		6.12. **Colour fastness to perspiration (acid, alkaline)**	Not considered an issue of relevance here. This criterion should be removed.	Not applied
NA	R52. Colour fastness – Wet rubbing	6.13. **Colour fastness to web rubbing**	Not considered an issue of relevance here. This criterion should be removed.	Not applied
NA	R53. Colour fastness – Dry rubbing	6.14. **Colour fastness to dry rubbing**	Not considered an issue of relevance here. This criterion should be removed.	Not applied
NA	R54. Colour fastness to light		Not an issue of relevance here	Not applied
a. The relevance of this area for the filling materials is uncertain. However, unless demonstrated that these substances are not used in filling materials, it is recommended to have such restrictions both for cover and filling.				

Criteria on sustainable sourcing and production of fibres could be even added to the list of criteria, at least for cotton, wool, viscose, polyester and polypropylene, which seems to be the most commonly used fibres. In accordance with the existing EU Ecolabel criteria for textiles and in alignment with the ongoing revision, criteria proposals could include prescriptions on:

1. Sourcing of cotton and other cellulosic seed fibres in order to avoid the use and presence of pesticides
2. Scouring of wool and keratin fibres
3. Sustainable certified sourcing of man-made cellulose fibres and emission limits for the production process
4. Sourcing of recycled polyester (which seems feasible for mattress systems[a,b,c,d]), VOCs emissions during the production process and antimony content.
5. Prescriptions on the production of polypropylene.

However, based on the feedback received from stakeholders, it generally seems that stricter criteria on textiles could create a barrier for applicants. These issues could be reconsidered during the next revision.

[a] http://bedtimesmagazine.com/recycling-mattress-components/
[b] http://www.indratech-us.com/mattresses.html
[c] http://www.socalstudentmattress.com/pages/sleep-school-10
[d] http://steplight.com.au/2012/08/15/mattress-recycling-and-low-cost-beds-mattresses/

Moreover, it should be remarked that the EU Ecolabel criteria for textiles are currently under revision. Thus, it is possible that this will have an influence on the final criteria proposal for bed mattresses.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to make some structural change to the list of criteria for textiles (see above). Criteria on sourcing and production of textiles could be addressed during the next revision. The EU Ecolabel criteria for textiles are currently under revision. Thus, it is possible that this will have an influence on the final criteria proposal for bed mattresses.

5.2 Manufacture and storage

Manufacture, storage and transport of the product to the customers is source of additional environmental concern. Three points are further addressed within this area of discussion:
1. Improving the energy performance of manufacture and storage
2. Promoting best industrial practices
3. Requiring EMS and CSR for the production site

5.2.1 Improvement of the energy performance

In section 4.2 it was shown that energy used for manufacture and storage contributes to shape the environmental profile of the mattress. Based on data provided by stakeholders on 7 mattresses, it was considered that energy consumption can range significantly (See Table 62).

Table 62: Estimation of energy consumption at the production and at the storage site

Energy for production (MJ/mattress)	**Latex**	**PUR**	**Spring**	**min**	**max**
Electricity	25.20	14.76	14.36	10%	200%
Heating, NG	40.00	21.60	11.64	10%	200%
Energy for storage (MJ/mattress)	**Latex**	**PUR**	**Spring**	**min**	**max**
Electricity	3.29	3.29	3.29	40%	260%
Heating, NG	3.97	3.97	3.97	40%	210%

Even if this sample of data cannot be considered statistically representative for the market, it however highlights the potential importance of this issue. Statistical information on energy consumption could be collected for the next revision to set thresholds on the energy performance of the manufacture stage.

Follow-up

Based on the information gathered along the project, statistical information on energy consumption could be collected for the next revision to set thresholds on the energy performance of the manufacture stage.

5.2.2 Promotion of best industrial practices

Introducing criteria for the promoting best practices for delivery and storage of mattresses would have the potential to produce direct benefits, as from the LCA information above.

The French Ecolabel for furniture “NF ENVIRONNEMENT – NF217: AMEUBLEMENT”[a] includes a criterion on "Requirement for the optimization of space during transport or storage" (Criterion #11) which could be used to inspire a similar prescription. A possible text could be the following:

The applicant must make available to the auditor the documents certifying that this factor has been taken into account (e.g. loading plans, the product design. the instructions for the delivery of packaging, etc.) The applicant may monitor his approach through a set of indicators (for example truck load rates, the ratio of number of orders / number of trucks ...).

[a] http://www.marque-nf.com/appli.asp?NumAppli=NF217

The applicant shall provide a report including the scores of the indicators chosen to monitor the improvement achieved by the company with its space optimization measures.

However, stakeholders generally doubt that it would be realistic and possible to introduce such a criterion. For instance, it was reported that:

- Such a prescription would impose additional burdens to manufacturers;
- Logistics practices are very complex and different;
- This issue was never introduced before and it would be difficult to be handled and verified;
- Ambitious levels should be defined quantitatively.

Follow-up

Based on the information and on feedback collected, this issue will not to be considered further within the current revision.

5.2.3 Requiring EMS and CSR for the production site

Demonstrating the responsibility of mattresses producers on environmental and social issues is considered an important topic. It could be thus proposed to add some prescriptions on the implementation of Environmental Management Systems (e.g. EMAS or ISO 14001) and/or Corporate Social Responsibility schemes (e.g. SO 26000) for the production facility. However, stakeholders overall agree that this is not the most relevant product group for focussing on these issues. This is apparently due to the large number of SMEs involved, which do not have time or resource to be certified.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, this action does not seem worthy of consideration for the current revision

5.3 Substances

5.3.1 Limitation in the use of hazardous materials and substances – Horizontal approach

Recent changes to the EU Ecolabel legislation (EC/66/2010) have placed further restrictions on the use of hazardous materials and substances. These changes are addressed in Article 6(6):

"The EU Ecolabel may not be awarded to goods containing substances or preparations/mixtures meeting the criteria for classification as toxic, hazardous to the environment, carcinogenic, mutagenic or toxic for reproduction (CMR), in accordance with 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 nor to goods containing substances referred to in Article 57 of Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency"

Hazardous materials and substances can be classified through hazard statements / risk phrases (provided in Appendix III). These substances, if present above a certain concentration threshold, must not be contained in the final product.

Derogations of specific substances are allowable in exceptional circumstances where inclusion would prevent take up of the EU Ecolabel or shift the environmental burden to other life cycle phases or impacts (Article 6(7) of the EU Ecolabel regulation).

The restrictions on hazardous substances and materials in the new EU Ecolabel regulation will require the addition of a new criterion to specifically handle these requirements. Restrictions are well defined and, for consistency, the technical wording used as base for discussion in other product groups[a] [b] were taken as reference and adapted here. This wording is shown in the technical report and could be modified when writing the draft criteria proposal to reflect any need of this product group.

The overall aim of the above-mentioned criteria is to install a horizontal ban of substances based on risk phrases/hazard statements, with derogations made under exception circumstances. The focus on hazardous substances (as required by article 6.6 of the regulation) raises some discussion points. Five main areas of discussion are presented below:

1. Appropriateness and robustness of an horizontal approach to limit the content of hazardous substances based on Hazard Statements/Risk Phrases.
2. Setting thresholds for substances.
3. How to identify substances which need to be derogated and what information is required.
4. Amalgamation of existing/other criteria with this new criterion.
5. Inclusion of schemes already implemented by industry to certify safety of materials.

Horizontal approach for the restriction on the use of hazardous substances

In general, stakeholders accepted that this general approach was required, most agreeing that a ban of specific properties was a sensible approach. However, not-homogeneous feedback was received over the way in which the existing criteria should be incorporated into this general ban.

[a] Commission Decision 2011/330/EU on establishing the ecological criteria for the award of the EU Ecolabel for notebook computers
[b] Commission Decision (Draft) on establishing the ecological criteria for the award of the EU Ecolabel for Industrial and Institutional Laundry Detergents, available at http://ec.europa.eu/environment/ecolabel/documents/Last-draft-Criteria-Laundry-detergents-PRO.pdf

Verification was even perceived as a key issue. For instance, ensuring all substances in a mattress do not carry any of the hazard statements associated with them could be difficult. This could be an arduous process, particularly as the list of phrases is long, and would either require large amounts of testing procedures or complete tracing of supply chains. In addition, there was uncertainty over the most appropriate way of verifying conformity with this criteria, as this could either be achieved through a third party verification and/or to a self declaration listing all substances and their hazard statements. With this respect, reference should be made to the list of registered substances under the REACH regulation scheme, available at: http://echa.europa.eu/information-on-chemicals/registered-substances

In addition, the inclusion of the risk phases R42 (May cause allergy or asthma symptoms or breathing difficulties if inhaled) and R43 (May cause allergic skin reaction), as already done for other product groups, was considered appropriate for this product group.

Follow-up

Based on articles 6.6 and 6.7 of the EU Ecolabel Regulation, a set of requirements dealing horizontally with chemical issues is needed.

Concentration threshold

The current EU Ecolabel approach to substances classified as hazardous according to the CLP regulation is to refer to the specific and generic concentrations reported in this piece of regulation. For Substances of Very High Concern as defined in the REACH regulation, the reference concentration is 0.1 % by weight.

It was noted that trace quantities of substances which meet the requirements for classification with the H statements / R phrases in Annex III are likely to be present in mattresses. For example, biocides used in cotton production may not be completely removed by processing, so may be present in very low concentrations.

The 0.1 % by weight of the final product could allow the presence of significant amounts of substances. For instance a midrange pocket sprung double mattress may weigh about 50kg.[a] Therefore, it may be appropriate to refer to homogeneous parts of the final product, where the particular hazardous substance is found. Industry reported that lower concentration limits would be impossible to be respected for bed mattresses because the 0.1 % concentration threshold of REACH is already a challenging burden. However, risk assessments are already provided in REACH Dossiers which ensure that the use of certain substances is safe.

Further points of discussion with stakeholders included:

- Concentration thresholds should be based on the evaluation of actual human health and environmental impacts for each substance.
- Impurities may be contained in the final materials used which may require separate specifications for some substances.
- Classification of hazardous substances depends on data available from manufacturers, which may not be complete. Reference to REACH Dossiers was suggested.

Follow-up

a http://www.johnlewis.com/231119190/Product.aspx, accessed 14/12/2011

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to refer to the limit concentrations reported in the CLP regulation. A 0.1% weight concentration threshold is suggested for Substances of Very High Concern.

Derogation of substances

Whilst substances are banned based on their hazard statements / risk phrases, derogations may be made for some substances (provided they are not listed as substances of very high concern, as shown above). Stakeholders were asked to provide an indication of substances and materials for which derogations may be taken into consideration within the bed mattress product group. A revised list of substances is provided in Table 63.

Table 63. Revised list of substances and materials which may be considered for derogation within the "bed mattresses" product group

Substance	Use	Relevant hazard statements/risk phrase(s)*	Comments
Antimony trioxide	Flame retardant (synergist)	H351 – Suspected of causing cancer	Use of ATO as catalyst in polyester or as flame retardant synergist in textiles should be allowed
Nickel	Springs can be made of stainless steel	H351 - Limited evidence of a carcinogenic effect H317 - May cause sensitization by skin contact H372 - Toxic: danger of serious damage to health by prolonged exposure through inhalation	Use of Nickel in stainless steel should be allowed
Other groups of substances	Textiles	Some of the Risk Phrases listed as "Category B" in Annex III	In order to align with the ongoing revision of the EU Ecolabel criteria for Textiles, some of the Risk Phrases listed as "Category B" in Annex III could be derogated for some groups of substances.
	Glues and adhesives	The substances must not be classified as H351, H350, H340, H350i, H360F, H360D, H361f, H361d H360FD, H361fd, H360Fd, H360Df, H331, H330, H311, H301, H310, H300, H370, H372	In order to align with the existing criterion on glues and adhesives.

** Taken from the European Inventory of Existing Commercial chemical Substances database References to SVHC candidate list*

A request for derogation could be examined properly only if supporting robust information is given to demonstrate that:
1. The use of the substance/material is significantly widespread within the product group
2. Inherently safer and more environmentally friendly options are not technically possible at the moment.

Antimony trioxide (ATO) can be used as catalyst for polyesters (the most used fibre in bed mattresses) or as flame retardant synergist with brominated flame retardants. The use of ATO for the latter application is justified by the fact that it enhances the effectiveness of flame retardants and decreases the amounts

of flame retardants necessary to obtain the required level of safety. According to the information gathered along the project, ATO is widely used in mattress covers but not in the core or in the padding.

The REACH dossier for ATO[a] classifies this substance as H351 - suspected of causing cancer. Hazards seems primarily associated to inhalation exposure during manufacture. Workplace safety is an element to be considered since Ecolabel focuses on the whole life cycle of products, as expressed in article 6(3) of the Ecolabel Regulation. Referencing to recently peer-reviewed scientific research[b] industry reported that the use of ATO in mattresses is safe for both the environment and human health. Moreover, workplace safety is guaranteed by complying with the Occupational Exposure Limits (currently 0.5 mg/m^3). There is a potential inhalation hazard linked to fine ATO dust particles, but it does not seem to cause any health damage to workers under the current, normal working conditions. This is confirmed by the results of lung capacity testing of workers in the biggest European ATO production facility, monitored from 2000-2011.

The replacement of a substance with a less hazardous material is recognized as one of the key principles of inherent safety which aims to reducing the possible sources of risks. Industry informed that at the moment there are no satisfactory alternatives to ATO.

For the use of ATO as catalyst, there are three main alternatives:
- Titanium (Ti): Ti performs well from a chemical point of view, but causes a yellow discoloration of the polyester (and might as well cause precipitation of TiO_2 and a thermal instability of the polyester). Additives are needed to compensate these negative properties (e.g. addition of Cobaltum to reach the neutral color). Ti has therefore a limited industrial use.
- Germanium (Ge): Ge performs well from a chemical point of view, but it is a very expensive metal with a limited global availability. It has mainly been used in Japan, but only accounted for a limited amount of worldwide PET production (<1% in 2005).
- Aluminium (Al): Al has been studied as an alternative, but with limited success.

Some alternatives have been explored for the use of ATO as brominated flame retardant synergist, for instance Bismuth (Bi), but they result to be less effective than ATO. Alternative flame retardants are, for instance, phosphorus or nitrogen based flame retardants[c].

The hazard statements associated with nickel are related to the pure metal rather than stainless steel. No hazard statement is associated with stainless steel, and its use in toys is allowed by EU[d] . A recommended derogation under similar circumstances is also under discussion in the development of EU Ecolabel criteria for imaging equipment.[e]

Based on these elements, it is suggested that the use of ATO (as catalyst in polyester or as flame retardant synergist in textiles) and Nickel (in stainless steel) is allowed.

During the project, the need for a derogation was even explored for acid boric and natural latex. However, a derogation does not seem necessary for acid boric because it is not used in mattresses in Europe. A derogation is not needed even for natural latex foams. Indeed, it was explained that natural latex can cause allergic skin reactions but that foams do not carry any risk phrases.

With respect to the substances which cannot be derogated, it was agreed that the SVHC list is the most appropriate reference, though a longer but less stable list of substances could be identified which comply

[a] http://apps.echa.europa.eu/registered/data/dossiers/DISS-9eb02d6b-39b7-666e-e044-00144f67d031/AGGR-79ef4347-6b30-427f-b8d6-e061caa8fad5_DISS-9eb02d6b-39b7-666e-e044-00144f67d031.html#L-a32752a0-6813-4bb3-9263-14d976a82166
[b] The European Union Risk Assessment Report for DIANTIMONY TRIOXIDE http://esis.jrc.ec.europa.eu/doc/risk_assessment/REPORT/datreport415.pdf
[c] http://www.cefic-efra.com/index.php?option=com_content&view=article&id=6&Itemid=217&lang=en)
d Directive 2009/48/EC Safety in toys
e http://susproc.jrc.ec.europa.eu/imaging-equipment/docs/Ecolabel%20Criterion%20Derogations%20Hazardous%20Substances.pdf

with article 57 of the REACH regulation. Moreover, it was indicated that introducing too strict criteria could have a detrimental impact on the number of applications for the EU Ecolabel.

Morever, in order to align with the ongoing revision of the EU Ecolabel criteria for Textiles, some of the Risk Phrases listed as "Category B" in Annex III could be derogated for some groups of functional substances. Other risk phrases should be derogated for glues and adhesives in order to align with the existing criterion number 7 of the EU Ecolabel for bed mattresses (Commission Decision 2009/598/EC).

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to derogate:
- ATO as catalyst in polyester or as flame retardant synergist in textiles; and
- Nickel in stainless steel.
- Some risk phrases for groups of chemicals contained in textiles.

Impact on existing criteria

This horizontal criterion could be used to replace some of the existing criteria on hazardous substances, bringing flame retardants, biocides, plasticizers and other substances under a single criterion. This would have the benefit of simplifying the criteria document, although it may make it more difficult to distinguish between different uses and properties of substances.

Stakeholders were asked to suggest which of the existing criteria could be absorbed within this horizontal criterion for hazardous substances and which specific uses/properties should be rather be handled separately.

Different views were provided with regard to the amalgamation of existing related criteria (such as that on flame retardants or biocides). The general position from industry is that the horizontal approach to restricting the use of substances is suitable to cover all substances, and therefore other criteria could be omitted once it was included. However, concerns were raised by some stakeholders that certain classes of substances which have specific applications/properties should continue to be handled separately as additional requirements are necessary. It was also indicated that the impact of intermediate materials could be missed by the horizontal approach as only the final product is covered.

Follow-up:

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to:
1. Keep specific prescriptions for components (i.e. latex foam, PUR foam, textiles)
2. Add a horizontal ban of hazardous substances plus some sub-criteria for specific groups of substances (e.g. flame retardants, biocides, plasticizers)
3. Add a list of derogated substances and a non-exhaustive list of prohibited substances to help manufacturers in choosing inherently safer materials.

Schemes available to certify safety of materials

Stakeholders outlined that schemes are available for some materials in order to certify the restricted use of certain substances. These are:
- CertiPUR[a] and Eurolatex[a] for PUR and latex foams, respectively

[a] http://www.europur.com/

- Oeko-tex for textiles [b] [c].

These schemes can be used to check if criteria of the Commission Decision 2009/598/EC related to materials are taking into account for the most recent information on hazardous substances.

The CertiPUR Label refers to a voluntary scheme highlighting the industry's commitment to the safety, health and environmental (SHE) performance of its products. Manufacturers who comply with the standards of the CertiPUR Label will be allowed to use the Label on their products. The CertiPUR Label commit on avoiding absolutely or limiting strictly the presence of any potentially harmful substance in flexible PU foams in accordance with the current EU legislation. Compliance is subject to audit by independent European laboratories. The scheme is primarily designed for European foam manufacturers, however, at present there are around 40 companies certified in Asian and Europe, with further implementation in the US.[d] The following groups of substances are currently included within this scheme:

1.1. Tinorganic substances;
1.2. Phthalate plasticizers (i);
1.3. TDA or MDA (resp. for TDI or MDI based foam);
1.4 Emission of volatile organic compounds;
2.1. Heavy metals;
2.2. Dyes;
2.3. Phthalate plasticizers (ii);
2.4. Substances with certain R-Phrases;
2.5. Blowing agents;
2.6 Total chlorine content of isocyanates (based on the input from the raw material supplier);
2.7. Other prohibited substances.

A series of possible modifications for the EU Ecolabel criteria on PUR foam have been identified on the basis of the observation of the CertiPUR scheme (see table 64)

Table 64. List of potential changes that could be applied to criteria on PUR foam

Proposed change	Comment
1. introduction of a reference to the criterion on biocides for the whole bed mattress	Inclusion based on the CentiPUR standard, alignment with the prescription for the whole mattress is needed.
2. Reducing the allowable concentrations of Arsenic and Lead from 0.5ppm to 0.2ppm, and the addition of selenium at a concentration of 0.5ppm.	Based on the CentiPUR standard
3. introduction of a limit of 0.7% by weight for the total chlorine content in the isocyanates used to produce the PUR	Based on the CentiPUR standard
4. Introducing prescriptions on phthalate plasticizers: • the intentional addition of phthalates is prohibited • residual content of DINP, DNOP, DEHP, DIDP, BBP, DIBP < 0.01 % w/w)	Based on the CentiPUR standard
5. Introduction of limits on the content of precursors for TDI and MDI:	Based on the CentiPUR standard

[a] http://www.eurolatex.com/home2.htm
[b] http://www.oeko-tex.com/OekoTex100_PUBLIC/index.asp?cls=02&group=all
[c] http://www.oeko-tex.com/oekotex100_public/content5.asp?area=hauptmenue&site=oekotexstandard1000&cls=02
[d] http://www.europur.com/uploads/DocumentsLibrary/documents/CertiPUR_Technical_Paper_11.05.2011.pdf

Proposed change	Comment
• 4,4'-diaminodiphenylmethane (101-77-9) < 5.0ppm 2,4-toluenediamine (95-80-7) < 5.0 ppm	
6. Addition of Tetra-organic tin compounds to banned tin organic compounds and further alignment with the verification requirement of the CertiPUR standard.	Based on the CentiPUR standard
7. Introduction of a list of banned substances: • Chlorinated or brominated dioxines or furans • Chlorinated hydrocarbons (1,1,2,2-Tetrachloroethane, Pentachloroethane, 1,1,2-Trichloroethane, 1,1-Dichloroethylene) • Chlorinated phenols (PCP, TeCP) – 87-86-5 • Hexachlorocyclohexane - 58-89-9 • Monomethyldibromo – Diphenylmethane - 99688-47-8 • Monomethyldichloro-Diphenylmethane -81161-70-8 • Nitrites • Polybrominated Biphenyls (PBB) - 59536-65-1 • Pentabromodiphenyl Ether (PeBDE)- 32534-81-9 • Octabromodiphenyl Ether (OBDE) - 32536-52-0 • Polychlorinated Biphenyls (PCB) - 1336-36-3 • Polychlorinated Terphenyls (PCT) - 61788-33-8 • Tri-(2,3-dibromo-propyl)-phosphate (TRIS) - 126-72-7 • Trimethylphosphate- 512-56-1 • Tris-(aziridinyl)-phosphinoxide (TEPA) - 5455-55-1 • Tris(2-chloroethyl)-phosphate (TCEP) -115-96-8 Dimethyl methylphosphonate (DMMP) - 756-79-6	Based on the CentiPUR standard
8. Introduction of limits on individual VOC emissions, specifically; • Toluene <0.1 mg/m^3 • Styrene < 0.005 mg/m^3 • Each CMR substance class 1a or 1b < 0.005 mg/m^3 • Sum of all CMR substances class 1a and 1b* < 0.04mg/m^3 • Aromatic hydrocarbons < 0.5 mg/m^3 • Total VOCs < 0.5 mg/m^3 Alignment of the verification procedure with the CertiPUR Standard	Based on the CentiPUR standard
9. Alignment of verification procedures to the CertiPUR Standard	-
10. Referring criteria on dyes to the updated ones for textiles	-

The euroLATEX ECO-Standard for latex foam cores has been developed by the European Latex Foam Manufacturers association in close co-operation with TFI (Deutsches Teppich-Forschungs Institut). The ECO-Standard defines the maximum acceptable limits of substances considered harmful to health that could occur in latex foam cores. This is based upon scientific data and stringent limits from other standards. Testing is performed on:

2.1 Contamination test. At the present time this extends to the following substances or classes of substances:

- pentachlorphenol, salts and esters
- pesticides (according the list of 3.1.2)
- butadiene

- vinyl chloride
- heavy metals

2.2 Emission test. At the present time this extends to the following substances or classes of substances:

- testing on the emission of volatile organic compounds
- testing on the emission of formaldehyde
- testing on the emission of volatile nitrosamines (list of substances according 2.3)

The Blue Angel for bed mattresses moreover includes a limit value for Carbon disulphide < 20 µg/m³ for latex foam.

A series of possible modifications for the EU Ecolabel criteria on latex foam have been identified on the basis of the observation of other schemes (see table 65)

Table 65. List of changes that could be applied to criteria on latex foam

Proposed change	Comment
1. Introduction of a list of banned pesticides, when the natural latex content is more than 20% by weight.	Based on the euroLATEX ECO-Standard
2.Addition of limits on VOC emissions, specifically; • Toluene <0.1 mg/m^3 • Vinyl cyclohexene <0.002 mg/m^3 • Styrene < 0.01 mg/m^3 • 4-Phenylcyclohexene <0.02 mg/m^3 • 1,1,1 – trichloroethane <0.2 mg/m^3 • Tetrachloroethylene < 0.15 mg/m^3 • Trichlorethylene <0.05 mg/m^3 • Vinyl chloride < 0.1µg/m^3 • total cumulative emissions of aromatic hydrocarbons <0.3 mg/m^3 total cumulative emissions of VOCs <0.5 mg/m^3	Based on the euroLATEX ECO-Standard
3. inclusion of formhaldeyde and nitrosamines in a single prescription on VOCs and SVOCs emissions	-
4. Emissions of carbon disulphide must be less than < 0.02 mg/m³ (verification through existing method DIN ISO-16000-6)	Based on the Blue Angel scheme for mattresses[a] Carbon disulphide is a gas and has the following hazard statements associated with it; • 48/23 – Harmful: danger of serious damage to health by prolonged exposure through inhalation • R62 - Possible risk of impaired fertility • R63 - Possible risk of harm to the unborn child
5. Alignment of verification procedures to the euroLATEX ECO-Standard	-
6. Referring criteria on dyes to the updated ones for textiles	-

Follow-up

[a] http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=140

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to apply some modifications to the prescriptions on specific materials (latex, PUR).

5.3.2 Use of flame retardants

The existing criterion on flame retardants foresee that only reactive flame retardants are allowed. All additive flame retardant containing mattresses are therefore non-permissible by default.

If any of the risk phrases specified below are associated with the flame retardant prior to application, these must not apply once it is in its applied, reacted form: **R40** (limited evidence of a carcinogenic effect), **R45** (may cause cancer), **R46** (may cause heritable genetic damage), **R49** (may cause cancer by inhalation), **R50** (very toxic to aquatic organisms), **R51** (toxic to aquatic organisms), **R52** (harmful to aquatic organisms), **R53** (may cause long-term adverse effects in the aquatic environment), **R60** (may impair fertility), **R61** (may cause harm to the unborn child), **R62** (possible risk of impaired fertility), **R63** (possible risk of harm to the unborn child), **R68** (possible risk of irreversible effects)

No testing is required, confirmed by a declaration that no additive flame retardants are present and a declaration of which reactive flame retardants are present.

Whilst the existing criterion refers to the whole mattress, the discussion below will be focused more on foam materials used as mattress fillings (i.e. latex, PUR) which fall under specific fire regulations. Different textile materials are used in ticking, wadding and other fillings, and have different properties to the foams (for example wool is known to be inherently flame retardant[a], though flame retardants may be added for some uses[b]). The textiles product group criteria are subject to an ongoing revision and the outputs of this process will be taken into consideration within this project. It may be thought of defining separate criteria for textiles and for fillings but no common agreement on this issue was found.

The term 'flame retardant' refers to a substance or substances which limit(s) or reduce(s) the spread of fire, and does not refer to a specific class of substances. Inclusion in products is generally a result of fire safety concerns; therefore flame retardants are present in products such as plastics in electronics, carpets and upholstered furniture including mattresses.

The use of flame retardants in mattresses and other products is fundamentally linked to the safety regulations across Europe. A good outline of current standards can be found[c], but in summary most European countries state that for domestic purposes the ignitability of mattresses by cigarette must meet EN standards such as EN 1021 and 597. The UK market has more stringent standards and must meet BS 7177: 2008, specifying resistance to other ignition sources such as matches. Mattresses used in non-domestic situations are often differentiated, and have higher standards to pass. Again within the EU Ecolabel market the UK's are the most stringent, specifying "resistance to higher sources of ignition". In addition to the performance of the mattress, the filling materials themselves may be subject to fire safety legislation; this is particularly applicable to foam fillings.[d] It is therefore important that the EU Ecolabel criteria ensure that these standards can be met, whilst ensuring high health and environmental standards are maintained, ensured that this will not exclude a significant portion of the market.

The use of flame retardants in products in general has been subject to a large amount of discussion, both within the context of the EU Ecolabel and more broadly. Halogenated flame retardants (brominated and

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aWool for interior textiles, IWTO

b PRIORITISATION OF FLAME RETARDANTS FOR ENVIRONMENTAL RISK ASSESSMENT, Environment Agency (UK), 2003

c REGULATORY ISSUES AND FLAME RETARDANT USAGE IN UPHOLSTERED FURNITURE IN EUROPE E. Guillaume, C. Chivas, A. Sainrat LNE – CEMATE – Fire Behaviour Division Research, Studies Fire Safety Engineering Activities, France, 2008

d Fire safety of furniture and furnishings in the contract and non-domestic sectors, FIRA, 2010

chlorinated) have perhaps being received the most attention, beginning with PCBs in the 1970s. This debate has been driven by two different aspects of the properties of these substances. On one hand they perform an important fire safety role by limiting the damage caused by fires. On the other, there are legitimate concerns over the health and environmental impacts of adding these substances to products. For example, they can be harmful or toxic, or may bio-accumulate: this is of particular concern in applications where leaching is a possibility. These concerns have led to restrictions on their use, for example in Europe a ban on penta- and octa-brominated di-phenyl ethers was introduced in 2003.[a]

The inclusion of fire safety issues in the LCA of products containing flame retardants was explored in literature. Although mattresses were not directly investigated, a study on upholstered sofas containing PUR foam may provide useful indications.[b] The aim of the study was to compare the environmental consequences of using or not using flame retardants, including taking into account the impact of having an accidental fire. The study shows that the impact of pollutants emissions from accidental fires may be very significant. Emission profiles with and without the use of flame retardants were weighted by the probability of having an accidental fire. It turned out that a sofa with no flame retardants emits higher quantities of poly-aromatic hydrocarbons when the occurrence of accidental fires is considered. Sofas with flame retardants instead emit larger amounts of halogenated species. The actual substances emitted are a result of the condition of the combustion process and of the chemicals which are burnt. However, other aspects of the problem are not covered by the study. For instance, higher blood concentrations of flame retardants are expected as a consequence of prolonged exposure, which is the typical case for bed mattresses.[c,d] Whilst the study does not provide firm conclusions for mattresses (or indeed sofas), it demonstrates that many factors need to be considered, and that further methodological development are necessary. Moreover, it also suggests that a broader view than simply banning flame retardants through substance risk phrases may be considered to take into account also for derivative substances produced on combustion.

The ongoing concerns mean it is important that flame retardants are considered within the present EU Ecolabel revision. In addition to this, feedback since the last revision of the mattress criteria indicated that the existing criteria on flame retardants had limited the number of applicants. Therefore, two main issues were identified within the existing criterion related to flame retardants:

1. The existing criterion on flame retardants may need some changes to reflect better EU Ecolabel regulation, legislative framework, technical feasibility and market acceptance.
2. The existing criterion for flame retardants appears to severely limit the prospect of awarding the EU Ecolabel within this product group.

It should be noted, however, that the Austrian and German environmental labelling schemes have an outright ban on all flame retardant substances.

Stakeholder feedback provided very useful information in this area. Overall, it is indicated that the criteria related to flame retardants was a major factor in contributing to the limited number of applications for this product group, and that a revision would be welcomed. More specific inputs are provided below:

- The distinction between additive and reactive flame retardants is not meaningful in this context, and is open to interpretation leading to uncertainty as to how these substances are classified. This uncertainty is one of the factor limiting manufacturers from applying for the EU Ecolabel. In

a Directive 2003/11/EC relating to restrictions on the marketing and use of certain dangerous substances and preparations
b Fire safety of upholstered furniture,A Life-Cycle Assessment, SP Swedish National Testing and Research Institute, 2003
c Polybrominated Diphenyl Ethers, Hydroxylated Polybrominated Diphenyl Ethers, and Measures of Thyroid Function in Second Trimester Pregnant Women in California Ami R. Zota, June-Soo Park, Yunzhu Wang, Myrto Petreas, R.Thomas Zoeller, and Tracey J. Woodruff, Environmental Science & Technology 2011 45 (18), 7896-7905
dEskenazi B, Fenster L, Castorina R, Marks AR, Sjödin A, et al. 2011 A Comparison of PBDE Serum Concentrations in Mexican and Mexican-American Children Living in California. Environ Health Perspect 119(10): doi:10.1289/ehp.1002874

addition to this, it was said that the environmental and health impacts are not necessarily linked to the additive or reactive nature of a substance.

- Furthermore it was claimed that, if the criterion is assumed to fully exclude any flame retardant substance which is not completely chemically bonded to the mattress materials, it could be impossible for most of the products to meet both fire regulations across the EU and the existing EU Ecolabel criteria. General product safety legislation which applies to all products is defined by Directive 2001/95/EE; this acts as a baseline for the safety of products to ensure high level safety and health of consumers. This is a broad-based legislative framework covering product safety in general terms across the EU. Product producers must ensure that their products entering the market are safe and only pose minimal risk to the users. Serious risks associated with the product must be identified. However, further specific legislation, either at an EU or territory based level may apply further conditions on certain product or product groups, for instance for fire safety regulations. This appears particularly critical into the UK (roughly accounting for 12-13% of the EU-27 mattresses market) due to the stricter national legislation. The variations in fire regulations across the EU also add to the difficulty of defining this criterion.
- Some materials meet the necessary standards themselves without the need for the addition of other substances; for example wool. However, these are generally present in high end mattresses, which have a mixture of materials present, some being intrinsically resistant to fire and others not. It is also very unlikely that these materials would completely replace PUR or latex in the wider market.
- No information on the specific flame retardants present was provided, and it was stated that manufacturers may not know as materials are bought to meet a specification. However it was clear that flame retardants are required in some mattress types and compositions to meet fire regulations in some Member States, for example in France, Ireland, Portugal, Spain and particularly the UK. This adds further to the uncertainty caused by the definitions of flame retardants as additive or reactive.

A recent study published by Defra examined the issue of flame retardants in mattresses in detail with respect to the EU Ecolabel.[a] The conclusions from this study agreed with the feedback above: that it was impossible to meet existing safety regulations if all additive type flame retardants were banned. The study indicates that at present flame retardant systems primarily use a chlorinated phosphorus system.[b] These satisfy the risk phrase based criteria, but use additive substances as part of the system. Therefore the current criteria are impossible to meet for standard types of mattress on the market. Although this could be mostly applicable to the UK, it appears generally true also for mattresses used in other countries.

The existing technologies for foams already avoid the use of brominated flame retardants, for which most concerns are raised. However the study concludes that a blanket ban on halogenated (bromine- and/or chlorine-containing) or specifically brominated flame retardants would not be appropriate, nor is excluding additive flame retardants. A risk phrase approach could be taken. This would potentially permit some existing chlorine phosphorus based systems, however information from industry is required to understand if specific derogations would be needed if this approach was taken.

It was also indicated that alternative flame retardant systems are becoming available which again meet the risk phrase criteria, for example tris(2-chloro-1-methylethyl)phosphate (TCPP) (further information indicates that this has the risk phrase R22 – harmful if swallowed) or melamine and its derivatives. These chemicals are expected to pose a lower overall hazard when compared to other flame retardants.[c,d] These are additive flame retardants and are excluded by the existing criterion. However, there are uncertainties about their performance, both as flame retardants and environmentally. Studies for

a Fire Retardant Technologies: safe products with optimised environmental hazard and risk performance, Defra, June 2010
b For examples see http://www.cefic-efra.com/Objects/2/Files/HalogenatedPhosphateEstersFactSheet.pdf
c European Union Risk Assessment Report TRIS(2-CHLORO-1-METHYLETHYL) PHOSPHATE (TCPP), European Chemicals Agency, 2008
d Melamine - www.inchem.org/documents/sids/sids/108781.pdf, UNEP Publications

phosphorus-based flame retardants were found; however, these were not applicable to mattresses or similar products.[a]

Moreover, overarching bans on substances or materials which have certain hazards will also be implemented (see issue above) as a result of the new EU Ecolabel legislation (Articles 6.6 and 6.7). The prohibited hazards cover and extend beyond those currently banned in the existing flame retardants criteria[b], though derogations may be required for some specific substances. On theory the criterion related to flame retardants could be thus removed (see Section 2b). This is the approach taken by the 2011 revisions of some EU Ecolabel criteria.[c] However, maintaining an explicit reference to flame retardants is considered extremely important by some stakeholders. In any case, the feeling is that the use of flame retardant systems should be allowed and the list of non-permissible risk phrases revised accordingly to the overarching ban above. Other points include:

- The use of a similar list to that used for Oeko-tex to forbid some specific flame retardant substances[d]
- The ban of brominated flame retardants as in Denmark. However, brominated flame retardants are largely banned by legislation and not used in all materials (e.g. not in PUR)
- The use of different criteria for fillings and coatings since these are made of different materials and since level of exposure is different. Technical differences should be taken on board if they exist.

Alternative options were also proposed (e.g. focus on mattress design, use of flame resistant barrier materials or flame retardant fibres, geographic exceptions based on national legislation, definition of minimum safety requirement, prescribing emission test on the products) but their implementation is not considered the most streamlined and feasible approach to the flame retardants issue.

Table 64. Preliminary list of flame retardants of potential concern for mattress systems

Name	CAS	Acronym	Reason for concern
Decabromodiphenlyether	1163-19-5	decaBDE	Candidate list Oekotex list H341, H373, H413
Hexabromocyclododecane	25637-99-4	HBCDD	Candidate list Oekotex list H361, H362, H400, H410
Octabromodiphenylether	32536-52-0	octaBDE	List of restricted substances Oekotex list H360Df
Pentabromodiphenylether	32534-81-9	pentaBDE	List of restricted substances Oekotex list H362, H373, H400, H410
Polybrominated biphenyls	59536-65-1	PBB	List of restricted substances Oekotex list
Short chain chlorinated paraffins (C10-C13)	85535-84-8	SCCP	List of restricted

a THE ECOLOGICAL FOOTPRINT OF FLAME RETARDANTS OVER THEIR LIFE CYCLE – A CASE STUDY ON THE ENVIRONMENTAL PROFILE OF NEW PHOSPHORUS BASED FLAME RETARDANTS, Marzi T., Beard A., Flame Retardants Conference, Feb. 2006, London

b Relevant phrases are listed in Appendix III, R46 does not appear, however this refers to mutagenic properties therefore is banned as it falls under CMR classification.

c 2011/330/EU (notebook computers) and 2011/337/EU (desktop computers)

d http://www.oeko-tex.com/xdesk/ximages/470/16459_100def.pdf

Name	CAS	Acronym	Reason for concern
			substances Oekotex list H351, H400, H411
Tri-(2,3-dibromopropyl)-phosphate	126-72-7	TRIS	List of restricted substances Oekotex list H350, H400, H410
Tris(2-chloroethyl)phosphate	115-96-8	TCEP	Candidate list Oekotex list H351, H360F, H411
Tris-(aziridinyl)-phosphinoxide	545-55-1	TEPA	List of restricted substances Oekotex list
Cresyldiphenyl phosphate	26444-49-5		H400, H410 (Filling materials) [a]
Tris(2-chloro-1-(chloromethyl)ethyl)phosphate	13674-87-8	TDCP	H351, H411 (Filling materials) [a]
Melamine cyanurate	37640-57-6		H373 (Cover) [a]
Phosphorous Red	7723-14-0	P red	H412 (Cover) [a]
Tetrakis (Hydroxymethyl) Phosphorum Chloride	124-64-1	THPC	H301, H360D, H400 (Cover) [a]

a. Keeping fire in check. An introduction to flame retardants used in upholstered furniture and textile applications. EFRA. Available at: http://www.albemarle.com/_filelib/FileCabinet/Literature_Library/Polymer_Solutions_Literature/Flame_Retardants/Advocacy/EFRAupholsteredfurnituremarch2012.pdf

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to keep a criterion restricting the use of specific flame retardants and to rely on the horizontal approach for hazardous substances. The distinction between reactive and additive flame retardants will be removed and a list of undesired flame retardants added in the appendix.

5.3.3 Use of biocides

Two of the existing criteria refer to biocides:

Textiles (6.1)
Chlorophenols (their salts and esters), PCB and organo-tin compounds shall not be used during transportation or storage of mattresses and semi-manufactured mattresses. Declaration of non-use: Verification by standard test may be required by extraction (as appropriate) and analysis by gas-liquid chromatography with an electron capture detector. The limit value is 0.05 ppm.

Biocides in the final product (10)
Only biocidal products containing biocidal active substances defined in relevant EU Directive 98/8/EC are allowed (specifically Annexes I, IA and IB), and only those specified for use in bed mattresses (Annex V of Directive 98/8/EC). This is confirmed by declaration of non-use, or providing a list of biocides used.

Research was unable to identify a significant market for domestic mattresses with biocides. Only one example was found which directly advertises the biocidal properties to help prevent infestations of bed bugs.[a] Therefore this appears to be a niche market at present, as also confirmed by stakeholders. However, two issues were raised:

- Some residual biocidal material may be present from processing, particularly in textiles.
- Healthcare mattresses may use biocides for hygienic purposes.

It should be also observed that the existing criteria refer to a piece of legislation which is going to be transferred to the REACH system.

The first of these issues is of relevance for the EU Ecolabel criteria for bed mattresses and also related to the revision of the EU Ecolabel criteria for textiles, as trace biocides are likely to arise from this source. The criterion on the final product could keep relying on a "white-list" approach. However this is going to expire and to be transferred to the REACH system. This could make preferable to remove the current criteria and to rule biocides through the introduction of a generic criterion on hazardous substances (see issue above). It should be noted that this criterion will be introduced anyway, influencing the use of biocides due to the restriction of substances which have certain hazards. Moreover, provisions may be made for substances appearing in trace quantities, such as remnant biocides from cotton production. An upper limit of 0.01% by weight was suggested by stakeholders. For the sake of comparison, biocidal products are generally banned within Blue Angel. However, this should not be necessary here because of the introduction of the horizontal criterion on hazardous substances.

The second of these issues can be confirmed through an analysis of the market, where various products containing biocides can be identified in the health sector.[b,c] It should be however noted that medical devices are excluded from the EU Ecolabel legislation.[d]

Two possible approaches for the current revision could be:

- Retain specific prescriptions on biocides.
- Absorb this prescription within the new horizontal criteria on hazardous substances.

As in the case of flame retardants, stakeholders were split on this issue. Competent bodies and consumer organisations were in favour of retaining the criteria, citing the Blue Angel criteria which has a separate criteria banning the use of biocides. This would present a clear signal to consumers. This is the route Oeko-tex has even taken, with a "black list" banning specific biologically active substances banned unless they are on a "white list".[e]

On the opposite side to this was industry which would prefer to handle this issue within the horizontal approach. However, as biocides seems used only rarely in mattresses (and typically for niche applications) the remaining inclusion is unlikely to influence the awarding of the EU Ecolabel.

The use of nanowires or nano materials such as nano-silver was also discussed. At present they are not used in mattresses, though there is some consideration of introduction, therefore some consideration of their use in the future may be necessary.

Overall it appears that there are very few products which specifically have biocidal substances added. Biocides seem present at very low concentrations as residuals from cotton or other textile production processes. Therefore, the current criteria could be left in the document without influencing the awarding of the EU Ecolabel.

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ahttp://www.sealy.co.uk/bugshield-collection-information.html, accessed 19/12/2011
b http://www.stm-healthcare.co.uk/index.php/products/mattresses-comprehensive-ranges.html accessed 19/12/2011
c http://www.parkhouse-hc.com/products/bariatric/permaflex-bariatric-mattress_92.html, accessed 19/12/2011
d Directive 93/42/EEC of 14 June 1993
e http://www.oeko-tex.com/OekoTex100_PUBLIC/content.asp?area=hauptmenue&site=chemischaktivesubstanzen&cls=02

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to have a criterion on biocides in addition to the horizontal approach for hazardous substances This could be formed by merging existing criteria 6.1 and 10, which is similar to the approach followed in the revision of the EU Ecolabel criteria for textiles. A list of undesired biocides could be even added in the appendix, in accordance with Oeko-tex.

5.3.4 Use of plasticizers

At present no EU Ecolabel mattress criteria directly limit the use of plasticizers. However, changes may be required to criteria so that they better reflect the legislative framework, EU Ecolabel regulation, technical feasibility and market acceptance.

Phthalates are a group of chemicals commonly used as a plasticiser to enhance the properties of plastics. Their use has been subject to significant health and environmental concerns. Within this product group the use of phthalates in mattresses appears to be limited to the use as a plasticiser in PVC outer coverings, which have been used for some baby and are used for medical mattresses.

Stakeholder feedback confirmed that the use of phthalates was limited to the uses described above. Some additional points raised include:

- Main use of phthalates is in PVC covers for mattresses.
- A full ban would present difficulties for mattresses used in hospitals and care homes, which are however out of the EU Ecolabel scope.

The European Council for Plasticisers and Intermediates[a] has indicated that phthalates can be divided into two main groups:

A. Low molecular weight phthalates (DEHP, BBP, DBP, DIBP), which are repro-toxic and classified ad hazardous
B. High molecular weight phthalates (DINP, DIDP, DPHP, DIUP, DTDP), which are apparently neither classified as CMR nor as hazardous.

Phthalates (as well as other materials) carrying specific risk phrases will be banned from bed mattresses according to the horizontal approach presented above. The phthalate of main concern appears to be DEHP which is listed as a substance of very high concern[b]. Substitution of DEHP is possible, typically with other phthalates such as DINP, which seem to pose less concerns for human health. Indeed, there is great variation of risks associated of different chemicals that fall within this group.

Currently the use of DEHP, DBP, BBP, DINP, DIDP and DNOP is restricted in toys, sex toys and childcare articles due to evidence they may be endocrine disruptors.[c,d] [e] A ban for this materials from baby mattresses may be thus necessary.

Phthalates have been rigorously treated in other product groups within the EU Ecolabel, the US Green Seal and Austrian Ecolabel. For example, the ban of phthalates within the EC Ecolabel footwear product group is based both on specific compounds and on risk-phrases associated with tem:

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[a] www.ecpi.org

b http://echa.europa.eu/web/guest/candidate-list-table, accessed 14/12/2011
c http://europa.eu/legislation_summaries/consumers/consumer_safety/l32033_en.htm, accessed 14/12/2011
d http://europa.eu/rapid/pressReleasesAction.do?reference=IP/99/829&format=HTML&aged=1&language=EN&guiLanguage=en, accessed 14/12/2011
[e] http://echa.europa.eu/documents/10162/13641/information_note_dinp_didp_en.pdf, accessed 13/12/2012

"Only phthalates that at the time of application have been risk assessed and have not been classified with the phrases (or combinations thereof): R60, R61, R62, R50, R51, R52, R53, R50/53, R51/53, R52/53, in accordance with Directive 67/548/EEC, may be used in the product (if applicable). Additionally DNOP (di-n-octyl phthalate), DINP (di-isononyl phthalate), DIDP (di-isodecyl phthalate) are not permitted in the product"

However, high molecular weight phthalates (HMW) such as DINP, DIDP and DPHP are registered under the REACH regulation, and are non-classified for any health and environmental hazard. The HMW phthalates are not on the Candidate List of substances of very high concern. Information about the risks posed by DNOP instead appear less clear and more uncertain. On the contrary, low molecular weight phthalates (LMW) such as DBP, BBP, DIBP and DEHP are recognised as substances of very high concern by the REACH regulation because of their effects on reproduction in animal studies.

Since the use of phthalates is required in order to enhance plastic flexibility, some actions could be followed:

1. Applying a ban on DNOP and on low molecular weight phthalates for all the types of mattresses,
2. Applying a ban on DINP and DIDP only for baby mattresses;
3. Relying on the horizontal approach to hazardous substances to prevent use of the relevant substances.

In the case of development of GPP criteria for healthcare or medical mattresses, the appropriateness of such a ban should be instead discussed.

Restrictions were found in other schemes, such as the Centi-PUR scheme which sets a threshold of 0.01% (to allow for minor impurities) and Oekotex, which includes 11 phthalates for testing, which in total must not exceed 0.1wgt% .[a]

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to introduce a criterion restricting the use of specific phthalates and to rely on the horizontal approach for hazardous substances. A list of undesired phthalates will be added in the appendix, in accordance with Oeko-tex.

[a] http://www.oeko-tex.com/OekoTex100_PUBLIC/content1.asp?area=hauptmenue&site=grenzwerte&cls=02#10

5.4 Fitness-for-use

Strengthening the requirements on the quality of bed mattresses is perceived as one of the most important factors to improve the environmental performance of a mattress and the attractiveness of the EU Ecolabel. A good quality product should indeed ensure that product is not replaced prematurely.
The current criteria document focuses on:

- Loss of height
- Loss of firmness

However, other technical standards could be referred to in order to promote an improvement in the quality of an EU Ecolabel mattress and to increase the appeal of the EU Ecolabel scheme within the bed mattresses market.
Ensuring an adequate durability of the mattress is another element which could be worthy of further consideration.

5.4.1 Ensuring an adequate durability of the mattress

The environmental profile of a mattress is determined by a delicate balance between the materials used to compose the product and its lifespan. Theoretically, an extension of the lifespan of a mattress would reduce the impacts of the product. Nevertheless, this would require increasing the amount and the quality of materials, which could offset the benefits due to an extended lifespan.

It would be interesting to determine which minimal requirements on materials could ensure an appropriate lifespan. However, this is not a task where a wide agreement can be found easily. The technical lifespan of a mattress is usually comprised between 7 and 10 years. However, the real life can range from less than 10 years, due to hygienic reasons, to 20-35 years. This indicates that the lifespan of a mattress is determined more by the consumer than by the design of the mattress.

A possible way to ensure consumers that the mattress can be correctly used for an adequate period of time could be to extend the legal warranty of the product and providing a series of recommendations to consumers. A study from Bain[a] suggests that 7 is a prudent number of years a mattress should be used without increasing significantly hygienic problems given by dust mites. However, based on stakeholders consultation, 10 years are proposed as recommended warranty period. Recommendations on how to use and maintain a mattress have been provided by IKEA and by the UK's National Bed Federation.

These are the "care and cleaning" instructions provided by IKEA in one of their mattresses:

- *Complement the mattress with a mattress protector or a mattress pad. It makes it more hygienic, as it is easy to remove and clean.*
- *Some mattresses and pads have a washable cover. Read the tag inside the cover for more information. Make sure that the zipper is closed when washing the mattress cover. Vacuuming the mattress helps to remove dust and mites. Use upholstery cleaner to remove stains.*
- *If your mattress is turnable you should turn it about every three months. Turning a mattress ensures more even wear and helps to prolong its comfort.*
- *Don't fold the mattress. It can damage the springs and materials inside.*
- *Even the best mattresses become less comfortable with age, and all mattresses accumulate dust and mites over the years. So even if the SULTAN mattresses have a 25-year guarantee, we still recommend that you change your mattress every 8–10 years.*

These are instead the guidelines provided by the UK's National Bed Federation:

[a] **Bain, D. (2006) A review of the bio-hazards presented by dust mites in older mattresses. Report from EBIA**

Proper care will keep your bed in good condition. Always read and retain manufacturers care instructions and ask your retailer for advice, too. Otherwise, the following tips will help you to get the best out of your bed during its natural life.

1. *Use a washable, protective cover to protect the mattress (and pillows) from stains. Barrier fabrics for allergy sufferers are also available.*
2. *In the mornings, throw back the bed clothes and leave the bed to air for 20 minutes to allow body moisture to evaporate.*
3. *Turning your mattress over from side and side and end to end every few months (every week for the first three months) helps upholstery fillings to settle down more evenly. Some more luxurious mattresses, with much thicker layers of fillings designed to mould themselves to the contours of your body, may retain signs of these impressions, despite turning. Even non-turn mattresses need to be rotated every few months.*
4. *Don't make a habit of sitting on the edge of the bed and don't let the kids bounce on it.*
5. *Don't roll up or squash a mattress to store or transport it - this can cause permanent damage.*
6. *Handles are designed to help you position a mattress on its base - do not use them to support the full weight of the mattress - they may pull out and damage the fabric.*
7. *Don't leave polythene wrappings on a new mattress - dampness, mildew and rotting could all result from a build-up of condensation.*
8. *Vacuum your mattress and base from time to time to remove fluff and dust. This should be carefully done so as not to dislodge fillings or damage tufts. Open windows while vacuuming -especially if there is an asthma sufferer in the house.*
9. *When tackling stains, use mild detergent and warm or cold water. Never over soak a mattress or base.*
10. *Putting a new mattress on a base for which it was not intended, a new mattress on an old base or a board between the mattress and base can impede comfort and reduce the useful life of the mattress - as well as affecting any guarantees or warranties.*

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, this action could be addressed in the present revision by requiring an extended warranty period and the education of consumers on the correct use and maintenance of the product. Aspects related to the eco-design of the products are recommended within the next revision.

5.4.2 Ensuring the quality of the product

The current criteria document focuses on the mattress durability, expressed in terms of:

- Loss of height
- Loss of firmness

Other technical aspects play a key role in defining the quality of a mattress, such as comfort thermo-hygrometric, ventilation and humidity control, ergonomic control.

A first requirement could be to ask applicant to produce a report in which it is demonstrated attention for quality issues. In particular, for what concern the comfort of the mattress in terms of temperature and humidity control, it could be required to carry-out to measure stationary and static thermal and vapour resistance; short-time water vapour absorbency with static load and measurement of the instationary buffering capacity of water vapour.

Moreover, product quality in terms of durability could be measured through the LGA-rating system developed by TUV. In this system, an overall score is given to the mattress base on four parameters:
a. change in height after test
b. change in hardness after 30 000 strokes
c. change in hardness after test
d. Resilience loss factor after test.

Minimum performance value is set to 50 points, a good quality mattress must score more than 70 points. It could be thus required to applicants that mattress performance is higher than a specific ambitious value, e.g. 80. However, the LGA test is apparently performed only by TUV in Germany and does not form part of any standards.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it could be proposed to ask applicants to show how quality aspects are considered in the design of the mattress. Parameters related to thermal and water control could be in particular measured.

5.5 Packaging

5.5.1 Appropriateness of a criteria on packaging

As apparent from Section 4.2, the contribution to the packaging to the environmental impacts of the product is marginal. Based on this outcome it is proposed to remove the prescription on the use of recycled plastics for primary and secondary packaging.

Follow-up

Based on the information gathered along the project, it is could be considered appropriate to remove the prescription on the use of recycled plastics for primary and secondary packaging.

5.6 End-of-life

The most common disposal route for end-of-life mattresses appears to be landfill. Mattresses account for a large proportion of the total waste sent to landfill (10% by volume according to one study for the South East of England), and this represents a large quantity of material which is not recovered. IOK Waste Management estimate that the 6 million people in the Flanders region of Belgium produce 5,220 tonnes of waste mattresses per annum.[a] It is clear this is an important factor to consider. For example, the EU Waste Framework Directive highlights the need to alter disposal routes, favouring prevention of waste, reuse, recycling and energy recovery over sending to landfill.[b] More specifically, the EU Landfill Directive targets the reduction volume of waste sent to landfill and increasing recycling rates.[c] A French based company, Recyc Matelas Europe, indicate that up to 95% of the materials in mattresses can be recycled.[d] Various recycling schemes have been identified, with several companies operating in this area recovering foam and metal from mattresses for recycling; however, this practice does not appear to be widespread.[e] The recycling process for mattresses is not generally sophisticated, relying on hand separation of materials and focussing on the most valuable materials. It is estimated that the yield per mattress was €1.6, based on a small scale of operation and recovery of metals; this would increase by increasing the number of materials recovered and scaling the operation up.[a] Processing end-of-life mattresses is also often complicated by the different compositions of mattresses, as they typically have a large number of different materials present in the wadding, in addition to the main support type. This provides uncertainty over the value of the recycled materials available in mattresses.

The stakeholder consultation raised various issues about the practicalities and potential of other disposal routes, particularly recycling. Several stakeholders responded to this proposal. Points mentioned include:

- There may be hygiene and health issues associated with the end of life processing of mattresses to separate materials out for recycling, as a result of several year of use.
- There were differing opinions over which materials could be recovered/recycled if separation was viable. Most responses indicated that recycling of metals and wood was relatively simple. It was indicated that it was technically possible to recover other materials, however this may be difficult in practice due to economics and contamination. Energy recovery might be more a reasonable option in this case.

a http://www.vvsg.be/Omgeving/Afval/Afval_inzamelen/Documents/CDdms35039_zachte%20landing%20voor%20matrassen%20Presentatie_06042011.pdf, accessed 09/02/2012
b Council Directive 2006/12/EC on waste
c Council Directive 1999/31/EC
d http://www.recyc-matelas.fr/index.html, accessed 09/02/2012
e Examples include ARES Recycling GmbH (Germany), JBS Fibre Recovery (UK),

- Logistics may be difficult on a large scale due to the bulky nature of these items. This is backed up by the market survey data which indicates that 68 million mattresses are sold *per annum*, indicating that a large number are also disposed of.

It is clear that mattress disposal is an issue of significant concern; however, this is generally an end-of-life issue and therefore outside the direct control of the mattress producers. This makes influencing these practices through the EU Ecolabel scheme difficult unless producers incorporate some form of extended producer responsibility.

Other ways of encouraging alternative disposal could be explored, such as:

- Providing information on best practices of final disposal to consumers,
- Listing the materials used in the mattresses for the benefit of recyclers,
- Implementing eco-design principles for more efficient use of resources and recycling after use,
- Limiting the quantity of materials used,
- Using recycled materials,
- Assigning a bonus if old mattresses are given back to the producer. This is the approach followed by the Austrian Ecolabel, that also requires a waste management system in place in the production site.
- Moreover, durability and quality of mattresses are other factors which have an indirect effect on the end of life impact of mattresses. Stricter requirements for these parameters could be another option to be explored.
- Stakeholders are kindly invited to provide their feedback on the actions they consider more feasible within this scheme.

Criterion 11, durability of mattresses, is indirectly linked to this topic and discussed in section 5.4. Two main issues have been identified as worthy of further discussion in this sub-section:

1. Implementation of a collection system to divert old mattresses from landfill
2. Design for disassembling and recovery of materials

5.6.1 Implementing a collection system to divert from landfill

In accordance with the Austrian Ecolabel for bed mattresses, a bonus could be assigned when old mattresses are given back to producers. This option was generally considered favourably amongst stakeholder, assuming that the manufacturers did not simply send the mattresses to landfill. However, some governments already have schemes in place which deal with this already, for example Germany (strict guidelines over landfill so mattresses typically are incinerated) and France (where mattresses are covered by an extended producer responsibility).

Within this scheme, it could be for instance proposed that producers promote the collection of used mattress. This could be for instance achieved giving an economic bonus for the purchase of a new mattress for every old mattress sent back to them. The producer should even declare that the material sent to landfill is minimised through incineration, recycling or other practices of waste valorisation. A survey on the most appropriate practises, based on industrial experiences, could be submitted by the applicant. The survey should present the practices already on place and those foreseen in the future but also an indication of the difficulties encountered and the probability of success.

However, stakeholders of this project seemed generally against to such a proposal because:

1. It would be too much prescriptive and difficult to be controlled;
2. Different disposal practices are implemented across the EU;
3. Mattress recovery/recycling practices have limited success;
4. The Ecolabel is not considered the right instrument to influence this aspect;
5. Commercial discounts should not be promoted with the Ecolabel.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, this is not considered an issue to be discussed further.

5.6.2 Design for disassembling and recovery of materials

Another action which could produce potential benefits for the environment could be focusing on the design of the mattress in order to improve:
- The possibility and ease of repair;
- The ease of disassembly to facilitate sorting and allow the best treatment of the material.

These factors are taken into account during the design of the product. It could be asked to applicants to provide a report in which they demonstrate that a preliminary design study was performed in order to improve the maintenance and disassembling of the mattress. The report should be even include a layout of the mattress, in the form of a exploding diagram clearly identifying the main component of the mattress and indicating the possible treatment routes for each component.

Guidelines on how to draft such a prescription can be found, for instance, on article 4 of the Commission Decision 2009/300/EC (EU Ecolabel criteria for televisions):

"4. Design for disassembly

The manufacturer shall demonstrate that the television can be easily dismantled by professionally trained recyclers using the tools usually available to them, for the purpose of:
— undertaking repairs and replacements of worn-out parts,
— upgrading older or obsolete parts, and
— separating parts and materials, ultimately for recycling.
To facilitate the dismantling:
— Fixtures within the television shall allow for its disassembly, e.g. screws, snap-fixes, especially for parts containing hazardous substances.
— Plastic parts shall be of one polymer or be of compatible polymers for recycling and have the relevant ISO11469 marking if greater than 25 g in mass.
— Metal inlays that cannot be separated shall not be used.
— Data on the nature and amount of hazardous substances in the television shall be gathered in accordance with Council Directive 2006/121/EC (1) and the Globally Harmonised System of Classification and Labelling of Chemicals (GHS).

Assessment and verification: A test report shall be submitted with the application detailing the dismantling of the television. It shall include an exploded diagram of the television labelling the main components as well as identifying any hazardous substances in components. It can be in written or audiovisual format. Information regarding hazardous substances shall be provided to the awarding competent body in the form of a list of materials identifying material type, quantity used and location."

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it could be proposed to provide evidence that the product was designed to improve the maintenance and disassembling of the mattress. A layout of the mattress and of its main components should be even made available. The prescription could take inspiration from the set of criteria of the Commission Decision 2009/300/EC (EU Ecolabel criteria for televisions).

5.7 Environmental performance

5.7.1 Improvement of the life cycle performance of the product

Setting energy requirements on the product is one of the recommendations passed from the last revision for this product group. However, stakeholders do not seem in favour of this option since:

- Including criteria specifically based on energy requirements or energy minimisation would present a significant barrier to applicants,
- Setting limits on energy could adversely affect the performance of mattresses as it would favour products with lower raw material consumption. Higher material consumption, and thus energy consumption, may lead to benefits elsewhere, such as improved performance.

Requiring a product declaration for the manufacture materials and selecting the more efficient one could be an alternative approach. Industry indeed appears experienced with carbon footprinting practices and standards already exist on how to report the GHGs emissions from products.[a] Environmental declarations do not mean ensuring that "sustainable" impacts are produced. However, this could be considered the first step of a process leading producers to increase their sensibility towards environmental issues and which should then be continuously improved in the future.

This approach would require applicants to carry out a LCA study for their product and to make public the environmental performance of the product. Moreover, it could be required to commit on the improvement of the environmental performance in order to obtain the renewal of the EU Ecolabel licence.

This approach would increase the responsibility of the producers and seems supported by stakeholders. However, two main aspects need to be addressed.

First of all, an appropriate set of indicators to measure the environmental performance of the product has to be established. Moreover, it is clear that any environmental product declaration should be based on specific product category rules, which would allow for a fair assessment of the environmental performance of the products.

For example, carbon footprint was proposed as one indicator, however other impacts such as acidification, eutrophication and consumption of resources may be even of importance for the product. These indicators were selected within the methodology provided by the French organisation AFNOR for the environmental communication on mass market products[b]. However ,a wider set of indicators could be chosen based on the guidelines provided within the Product Environmental Footprint methodology developed by the European Commission[c]. With respect to the definition of product category rules for this product group, a reference could be made to the methodology provided by the French organisation AFNOR.[d]

However, some points were raised against this approach, such as: scarce availability of data, uncertainty on the reliability of the results and on the environmental benefits which could be achieved, burdens for applicants. It was also pointed out that the International Standard on Carbon Footprinting (ISO 14067) is

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a These standards include ISO 14064 (Green house gas emissions inventory), Publically Available Specification 2050 (PAS 2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services), and PAS 2060 (Specification for the demonstration of carbon neutrality).

b General principles for an environmental communication on mass market products Part 10: Methodology for the environmental impacts assessment of bedding, AFNOR, 2011

c http://ec.europa.eu/environment/eussd/product_footprint.htm

d General principles for an environmental communication on mass market products Part 10: Methodology for the environmental impacts assessment of bedding, AFNOR, 2011

still under development, though is close to being finalised. Based on these observations it could be more appropriate to reconsider this criterion in the next revision.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is felt that the consideration of LCA-based criteria should be postponed to the next revisions. One possibility for the future is to require applicants to carry-out a LCA of the product. This should be carried-out in accordance with some reference methodologies, e.g. the PCRs provided by the AFNOR in France. The set of indicators should instead be compliant with the Product Environmental Footprint developed by the European Commission. Producers, in order to renew their licence should improve their environmental performance.

5.8 Other issues

5.8.1 Consistency of the criteria

In addition to the issues discussed above, another element which could prevent manufacturers from applying for the EU Ecolabel is the complexity of the existing criteria document, which is apparently coupled with presence of some inconsistencies. This could be improved by revising not only criteria content but also criteria formulation and structure. Some issues to be addressed further were found out through an insight of the existing criteria document. These are reported below. Some of the issues are directly related to the material presented before while others appear of marginal importance. However, brief discussion on these points is considered necessary in order to deliver a consistently revised criteria document.

1. Appropriateness of a 5% by weight cut-off threshold for the main components of a mattress

This requirement does not exist in the Blue Angel and it could be thus thought of remove it from the EU Ecolabel. In response to this industry stated that over 3000 raw materials are used in mattresses, many of which are below 5%.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to keep this 5% cut-off threshold.

2. Merging criteria for PUR and latex foams in a single group

Since many criteria for PUR and latex are repeated, it could be proposed to form a single group of requirements for foams. This proposal was supported by industry. However, technical complications related to this approach still needs to be evaluated.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, the possibility of merging criteria for foams will be explored.

3. Revision of wording and referencing

Wording and referencing need to be improved in some points:

- Criteria on wire and springs refer to PUR and the wording should be thus changed.
- Criterion on "Sustainable forest management" of wooden material include a sentence which apparently refer to wire and spring and needs to be deleted "If degreasing and/or cleaning of wire and/or springs is carried out with organic solvents, use shall be made of a closed cleaning/degreasing system".
- Reference on hazardous substances should be better made to Regulation (EC) No 1272/2008 all along the document. Other methods and standards need to be updated (for instance the ones related to VOCs).

Follow-up

Based on the information gathered along the project the actions presented above are proposed.

5.8.2 Information of consumers and box 2 of the label

Communication of producers to consumers could be improved through: the label itself, the packaging, written and audiovisual media (e.g. the web). Moreover, minor alterations to the wording of the Ecolabel box are moreover needed to reflect better the content of the criteria.

The current criterion related to the information appearing on the Box 2 of the EU Ecolabel states that the product:

- 'Minimises indoor air pollution'
- 'Hazardous substances restricted'
- 'Is durable and of high quality'

Few modifications could be proposed:

1. 'Durable and high quality' could be moved at the top of the list.
2. Air pollution and hazardous substances could be merged in one point.
3. A third point could state that environmental issues are taken into due account in the design of the product.

Follow-up

Based on the information gathered along the project and on the feedback received from stakeholders, it is proposed to modify the pieces of information reported in the EU Ecolabel.

5.8.3 VOC emissions from the entire mattress

A further point of discussion was raised by some industry stakeholders during the 2md AHWG meeting (Brussels, 25-26 September 2012). Industry stated that it is difficult to test VOCs in the entire mattress. This is especially true for SMEs because the test can cost roughly EUR 50 000 / mattress to setup. Other tests or verifications should be proposed.

The current criterion is based on an international standard, that should be checked to understand if modification of the testing procedure is possible or not. It was suggested to reduce the scale of test to a sample of the product. However, there is the risk that this would be not representative because of boundary effects. A manufacturer stated that they only perform test on a risk basis, e.g. where high content of recycled material is used. An alternative approach could be the measurement of VOC emission from each single parts of the mattress.

Apart from this, it was reported that testing procedures need to be updated:

- EN 13419-1 (test chambers) no longer exists. It is now available as ISO 16000-9.
- EN 13419-2 (test cells) no longer exists; it is now available as ISO 16000-10 but this is not a test chamber and therefore it is not applicable to mattresses.
- ISO 16000-6 refers to the measurement of VOCs. A new reference to ISO 16000-3 is necessary for the measurement of formaldehyde and other aldehydes.
- The latest version of AgBB now is of 2012, not 2005.
- Time reference must be always provided.

Follow-up

Based on the information gathered along the project, the criterion on VOC emissions from the entire mattress needs to be revised. Three options are proposed:

A. Test performed on the whole mattress (criterion as usual and reference)

B. Test performed on a sample of mattress and estimation of overall emissions (1st potential alternative)

C. Test performed on different materials and recombination of single results to estimate the overall emissions (2nd potential alternative)

Appendices

Appendix I: Summary of existing EU Ecolabel criteria

Appendix II: Comparison of environmental labelling schemes for Mattresses

Appendix III: Hazardous Substance, Risk Phrases and Hazard Statements

Appendix I: Summary of existing EU Ecolabel criteria

This summary is provided as a guide to the existing criteria, the full criteria document (2009/598/EC: Commission Decision of 9 July 2009) should be consulted for a complete outline

1. Latex Foam – Only applicable if latex is greater than 5% of mattress weight. Concentrations must be below values stated.

Criterion number	Applicable to	Criteria	Compliance
1.1	**Extractable heavy metals**	Limits on concentrations of: Copper <2 ppm Chromium, Nickel <1 ppm Arsenic, Lead, Antimony, Cobalt <0.5 ppm Cadmium <0.1 ppm Mercury <0.02 ppm	**Testing by atomic emission spectroscopy with inductively coupled plasma or with hydride or cold vapour technique**
1.2	**Formaldehyde**	Extractable formaldehyde <20 ppm or <0.005 mg/m^3 (dependent on testing method)	**EN ISO 14184-1 or chamber testing according to ENV 13419-1, with EN ISO 16000-3 or VDI 3484-1 for air sampling and analysis**
1.3	**VOCs**	VOCs <0.5 mg/m^3	**Chamber testing or DIN ISO 16000-6 for air sampling and analysis**
1.4	**Dyes, pigments, flame retardants and auxiliary chemicals**	As Commission Decision 2009/567/EC of 9 July 2009 for textile products. (a) Limits on metal ion impurities in dyes (colour matter with fibre affinity). Exclusion made for metals which are integral part of the dye molecule. (b) Limits on metal ion impurities in pigments(insoluble colour matter without fibre affinity) (c) Chrome mordant dyeing is not allowed (d) Azo-dyes which may cleave any one of a selection of aromatic amines are banned (e) A list of specific dyes which are classed as carcinogens, mutagenic or toxic to reproduction. Limits are also placed on dyes or dye preparations which contain greater than 0.1% by weight of substances which have specified risk phrases associated with them. (f) Potentially sensitizing dyes (listed) are not allowed.	**Declaration of non-use or compliance with relevant EU document**
1.5	**Metal complex dyes**	Metal complex dyes based on copper, lead, chromium or nickel shall not be used.	**Declaration of non-use**
1.6	**Chlorophenols**	Chlorophenols (salts and esters) <0.1 ppm mono, di-chlorinated phenols (salts and esters) <1 ppm	**Test through gas chromatography of an extracted sample**

1.7	**Butadiene**	Concentration of butadiene <1 ppm	**Tested through gas chromatography**
1.8	**Nitrosamines**	Nitrosamines <0.0005 mg/m^3	**Tested through chamber test**

2. Polyurethane Foam – Only applicable if PUR foam is greater than 5% of mattress weight.

Criterion number	Applicable to	Criteria	Compliance
2.1	**Extractable heavy metals**	As 1.1 – Latex	**As 1.1 – Latex**
2.2	**Formaldehyde**	As 1.2 – Latex	**As 1.2 – Latex**
2.3	**VOCs**	As 1.3 – Latex	**As 1.3 – Latex**
2.4	**Dyes, pigments, flame retardants and auxiliary chemicals**	As 1.4 – Latex	**As 1.4 – Latex**
2.5	**Metal complex dyes**	As 1.5 – Latex	**As 1.5 – Latex**
2.6	**Organic tin**	Mono and di-organic, tri-organic tin compounds shall not be used.	**Declaration of non-use**
2.7	**Blowing agents**	Halogenated organic compounds shall not be used as blowing agents, or auxiliary blowing agents.	**Declaration of non-use**

3. Wires and springs – Only applicable if PUR foam contributes to more than 5% of the total weight of the mattress.

Criterion number	Applicable to	Criteria	Compliance
3.1	**Degreasing**	A closed system is required when degreasing wire or springs.	**Self-declaration**
3.2	**Galvanisation**	Wire and springs must not be coated with a galvanic metallic layer	**Self-declaration**

4. Coconut Fibres – Only applicable if coconut fibres contributes to more than 5% of the total weight of the mattress

Criterion number	Applicable to	Criteria	Compliance
4	**Coconut fibres**	If rubberised, latex used must comply with criteria for latex foam	**As points 1(1) to 1(8)**

5. Wooden Material

Criterion number	Applicable to	Criteria	Compliance
5.1	**Sustainable forest management**	Sustainable forest management: a) All virgin solid wood shall originate from forests which are sustainably managed (Sustainable Forest Management and UNCED Forest Principles) b) 60% of virgin solid wood shall originate from forests with certified third party forest certification schemes c) Wood not certified must not originate from • disputed land rights or primary old growth forests • illegal harvesting • uncertified high conservation value forests.	**The applicant shall indicate types, quantities and origins of the wood used** **Certified sources – control chain of custody is required as proof of source** **Non-certified sources – species, quantity and origin of timber must be provided.**
5.2	**Formaldehyde emissions from untreated raw wood.**	Formaldehyde emissions from untreated raw wood-based materials. Particle board – emissions of formaldehyde shall not exceed 50% of the threshold value that would allow it to be classified as E1 according to EN 312-1. Fibreboard – emissions of formaldehyde shall not exceed 50% of the threshold value that would allow it to be classified as A1 according to EN 622-1. Class A will be accepted if fibreboards represent less than 50% of wood or wood material in product.	**Evidence that wood based materials comply with EN 312-1** **Evidence that wood based materials comply with EN 13986**

6. Textiles (fibres and fabric) – must meet following criteria for dyes and other chemical products, as well as fitness for use

Criterion number	Applicable to	Criteria	Compliance
6.1	**Biocides**	Chlorophenols (their salts and esters), PCB and organo-tin compounds shall not be used during transportation or storage of mattresses and semi-manufactured mattresses	**Declaration o f non-use. Verification by standard test may be required**
6.2	**Auxiliary chemicals**	Alkylphenolethoxylates (APEOs), linear alkylbenzene sulfonates (LAS), bis(hydrogenated tallow alkyl) dimethyl ammonium chloride (DTDMAC), distearyl dimethyl ammonium chloride (DSDMAC), di(hardened tallow) dimethyl ammonium chloride (DHTDMAC), ethylene diamine tetra acetate (EDTA), and diethylene triamine penta acetate (DTPA) shall not be used in any of the preparations or	**Declaration of non-use**

		formulations used	
6.3	**Detergents, fabric softeners and complexing agents**	95% by weight of detergents, fabric softeners and complexing agents used at each wet processing site shall be "sufficiently degradable" or eliminable in wastewater treatment plants (see criterion related to auxiliaries and finishing agents for fibres and yarns). This is with the exception of surfactants in detergents at each wet processing site, which shall be "ultimately aerobically biodegradable" (see Regulation (EC) No 648/2004)	**Appropriate documentation (safety data sheets, test reports and/or declarations, indicating the test methods and results)**
6.4	**Bleaching agents**	Only for natural fibres, chlorine agents are excluded for bleaching yarns, fabrics and end products.	**Declaration of non-use**
6.5	**Impurities in dyes**	As 1.4 Latex	**As 1.4 Latex**
6.6	**Impurities in pigments**	As 1.4 Latex	**As 1.4 Latex**
6.7	**Chrome mordant dyeing**	As 1.4 Latex	**As 1.4 Latex**
6.8	**Metal complex dyes**	If metal complex dyes based on copper, chromium or nickel are used: – In case of cellulose dyeing, where metal complex dyes are part of the dye recipe, less than 20 % of each of those metal complex dyes applied (input to the process) shall be discharged to waste water treatment (whether on-site or off-site). – In case of all other dyeing processes, where metal complex dyes are part of the dye recipe, less than 7 % of each of those metal complex dyes applied (input to the process) shall be discharged to waste water treatment (whether on-site or off-site). – The emissions to water after treatment shall not exceed: Cu 75 mg/kg (fibre, yarn or fabric); Cr 50 mg/kg; Ni 75 mg/kg.	**Declaration of non-use or documentation and test reports using the following test methods: ISO 8288 for Cu, Ni; EN 1233 for Cr.**
6.9	**Azo dyes**	As 1.4 Latex	**As 1.4 Latex**
6.10	**Dyes that are carcinogenic, mutagenic or toxic to reproduction**	As 1.4 Latex	**As 1.4 Latex**
6.11	**Potentially sensing dyes**	As 1.4 Latex	**As 1.4 Latex**
6.12	**Colour fastness to**	The colour fastness to perspiration (acid/alkaline) must meet level 3-4. A level	**Testing according to EN:ISO 105 E04**

	perspiration (acid/alkaline)	of 3 is allowable when they are dark (standard depth > 1/1), and are made of regenerated wool or more than 20% silk. This does not apply to white products, or products which are neither dyed nor printed.	
6.13	**Colour fastness to wet rubbing**	Colour fastness to wet rubbing shall be at least 2-3. A level of 2 is allowable for indigo dyed denim. This does not apply to white products, or products which are neither dyed nor printed.	**Testing according to EN:ISO 105 X12**
6.14	**Colour fastness to dry rubbing**	The colour fastness to dry rubbing must be at least level 4. Level 3-4 is allowable for indigo dyed denim. This does not apply to white products, or products which are neither dyed nor printed.	**Testing according to EN:ISO 105 X12**

7. Glues

Criterion number	Applicable to	Criteria	Compliance
7	**Glues**	Glues containing organic solvents are not permissible. Glues shall not be used which at time of application which are classified as carcinogenic (R45, R49, R40), harmful to the reproductive system (R46, R40), genetically harmful (R60-R63), toxic (R23-R28). The corresponding list of Hazard Statements is also provided.	**Declaration that the glues used comply with this criterion, together with supporting documentation**.

8. VOCs and SVOCs on the entire mattress

Criterion number	Applicable to	Criteria	Compliance
8	**VOCs and SVOCs**	VOC emissions from entire mattress shall not exceed specified limits (for formaldehyde, other aldehydes, total organic compounds). This is made in analogy with the 'health risk assessment process for emissions of volatile organic compounds (VOC) from building products' developed in 2005 by the AgBB.	**Chamber testing to be performed according to EN 13419-1, EN13419-2 and ISO 16000-6 (VOCs) standards**

9. Flame retardants used in the entire mattress

Criterion number	Applicable to	Criteria	Compliance
9	**Flame retardants**	Only reactive flame retardants are permissible (i.e. additive flame retardants are non-permissible). If a flame retardant has any of the R-phrases specified in directive 67/548/EEC (see below), these must not apply once the flame retardant is in its applied form. **R40** (limited evidence of a carcinogenic effect), **R45** (may cause cancer), **R46** (may	**Declaration that no additive flame retardants are present** **Declaration of which reactive flame retardants**

		cause heritable genetic damage), **R49** (may cause cancer by inhalation), **R50** (very toxic to aquatic organisms), **R51** (toxic to aquatic organisms), **R52** (harmful to aquatic organisms), **R53** (may cause long-term adverse effects in the aquatic environment), **R60** (may impair fertility), **R61** (may cause harm to the unborn child), **R62** (possible risk of impaired fertility), **R63** (possible risk of harm to the unborn child), **R68** (possible risk of irreversible effects) The corresponding list of Hazard Statements is also provided.	**have been used, and their conformity with the criterion**

10. Biocides in the final product

Criterion number	Applicable to	Criteria	Compliance
10	**Biocides in the final product**	Only biocidal products containing biocidal active substances defined in relevant EU Directives are allowed.	**Declaration of non-use**

11. Durability

Criterion number	Applicable to	Criteria	Compliance
11	**Durability of mattress**	The lifetime of a household mattress is expected to be 10 years; this will vary depending on application. Adult mattress – Loss of height <15%, loss of firmness <20% Baby mattress – Loss of height <15%, loss of firmness <20%	**Test report verifying these criteria are met using EN1957 (100 vs. 30 000 cycles)**

12. Packaging requirements

Criterion number	Applicable to	Criteria	Compliance
12	**Packaging**	Packaging shall be made from recyclable material, with plastic type marked according to ISO 11469. Specified text referring to the EU Ecolabel must appear	**Declaration of compliance, along with sample of product packaging and information supplied**

13. Information appearing on the Ecolabel

Criterion number	Applicable to	Criteria	Compliance
10	**Information appearing on the Ecolabel**	Box 2 of the Ecolabel shall contain specific text related: – 'Minimises indoor air pollution' – 'Hazardous substances restricted' – 'Durable and high quality'	**Declaration of compliance, along with sample of packaging with label**

Appendix II: Comparison of environmental labelling schemes for Mattresses

Issue	EU Ecolabel Jul 2009	Austrian Ecolabel UZ55 - Jan 2011	Blue Angel UZ 119 - Apr 2010
<u>Scope</u>	A surface to sleep or rest upon for indoor use. The products consist of : - a cloth cover filled with materials, - the material filling (e.g. latex foam, PUR foam and springs); - wooden bed bases that support the mattress. The product group includes spring mattresses (upholstered base of springs, topped with fillings, and mattresses fitted with removable and/or washable covers) Inflatable mattresses and water mattresses are excluded.	A surface to sleep or rest on consisting of a strong cloth cover filled with material that can be placed on a bed frame. The product group also Includes: - mattresses with built-in frame, i.e. padded mattress surrounded by filling material with a flexible core framework on which can be placed on a bed frame or free standing - mattresses with removable and / or washable covers - filler material for bed mattresses and latex foam, polyurethane foam and Springs Inflatable mattresses and water mattresses are excluded.	A surface to sleep or rest on consisting of a strong cloth cover filled with material that can be placed on a bed frame. The product group also Includes: - mattresses with an integrated frame, i.e. upholstered bed bases with a flexible core surrounded by filling material which may be put on a bed frame or designed for free standing - head rest pillows where they form part of the mattress and are made of the same materials. Inflatable mattresses and water mattresses are excluded.
<u>Materials</u>			
Hazardous Substances	-	A horizontal ban/limitation of substances based on CLP and REACH directives is prescribed.	The materials used for the manufacture of a mattress must not contain as integral elements any substances or preparations which are toxic (T), very toxic (T+), carcinogenic, mutagenic, toxic to reproduction, teratogenic
Latex/PUR Foam	Only if foam is more than 5% of mattress weight	As in the EU Ecolabel	No weight thresholds
	Limit on concentration of heavy metals: Antimony < 0.5 ppm Arsenic < 0.5 ppm Lead < 0.5 ppm Cadmium < 0.1 ppm	As in the EU Ecolabel	-

Issue	EU Ecolabel Jul 2009	Austrian Ecolabel UZ55 - Jan 2011	Blue Angel UZ 119 - Apr 2010
	Chromium < 1.0 ppm Cobalt < 0.5 ppm Copper < 2.0 ppm Nickel < 1.0 ppm Mercury < 0.02 ppm		
	Limit on Formaldehyde content:-20 ppm (EN ISO 14184-1) or 0.005 mg/m^3 (Chamber test)	As in the EU Ecolabel	-
	Limit on VOCs content: 0.5 mg/m^3	As in the EU Ecolabel	-
	Dyes and pigments: - limits in impurities in dyes - limits in impurities in pigments - ban on chrome mordant dyeing - ban on azo dyes which may release specific aromatic amines - ban on CMR dyes - ban on sensitizing dyes - ban on metal complex dyes based on copper, lead, chromium or nickel	As in the EU Ecolabel with respect to: - limits in impurities in dyes - limits in impurities in pigments - ban of chrome mordant dyeing - ban of CMR dyes - ban of sensitizing dyes - ban on metal complex dyes based on copper, lead, chromium or nickel Azo dyes banned also if they may release 4,4'-Methylen-bis-(2-chloranilin) (101-14-4),	-
Latex Foam	Only if foam is more than 5% of mattress weight	As in the EU Ecolabel	No weight thresholds
	Chlorophenols < 0,1 ppm, except mono- and di-chlorinated phenols (salts and esters) which shall not exceed 1 ppm	As in the EU Ecolabel	Chlorophenols (including salts and esters) < 1 ppm
	Butadiene < 1 ppm	As in the EU Ecolabel	As in the EU Ecolabel
	Nitrosamines < 0.0005 mg/m^3	As in the EU Ecolabel	Nitrosamines < 0.001 mg/m^3
	-	-	Carbon disulphide < 20 $\mu g/m^3$
PUR Foam	Only if foam is more than 5% of mattress weight	As in the EU Ecolabel	No weight thresholds

Issue	EU Ecolabel Jul 2009	Austrian Ecolabel UZ55 - Jan 2011	Blue Angel UZ 119 - Apr 2010
	No Mono and di-organic, tri-organic tin compounds	As in the EU Ecolabel	Tin in organic form (tin bonded to a carbon atom) shall not be used
	Halogenated organic compounds shall not be used as blowing agents or as auxiliary blowing agents.	Same as in the EU Ecolabel	Partially fluorinated hydrocarbons (HFCs), perfluorinated hydrocarbons (PFCs), partially halogenated chlorofluorocarbons (H-CFC), chlorofluorocarbons (CFCs) or methylene chloride shall not be used as physical blowing agent or auxiliary blowing agent
Wires & Springs	Only if foam is more than 5% of mattress weight	No weight thresholds	No weight thresholds
	Degreasing of wire & springs by organic solvents must use a closed loop system	In addition to EU Ecolabel criteria, it is prescribed that springs made of plastics must be free of halogenated organic compounds	Closed cleaning/degreasing system shall be used for cleaning and/or degreasing wires and/or elastic springs with organic solvents
	The surface of springs shall not be covered with a galvanic metallic layer		As in the EU Ecolabel
Coconut Fibres	Only if more than 5% of weight	As in the EU Ecolabel	No weight thresholds
	If rubberised, must comply with the criteria applicable to latex foam	As in the EU Ecolabel	Same criteria applying to latex foam must be observed
Wooden material	No weight thresholds	As in the EU Ecolabel	Same as in the EU Ecolabel
	100% of virgin wood from sustainable forestry management 60% certified If not certified from legal sources	100% of wood from legal sources 50% from sustainable forestry management	Wood not from primeval (boreal and tropical) forests

Issue	EU Ecolabel Jul 2009	Austrian Ecolabel UZ55 - Jan 2011	Blue Angel UZ 119 - Apr 2010
	Emissions of formaldehyde from particleboard < 50 % of the E1 threshold value (EN 312-1) Emissions of formaldehyde from fibreboard < 50 % of the class A quality value (EN 622-1). However fibreboards classified as Class A will be accepted if they do not represent more than 50 % of the total wood and wood-based materials used in the product.	As in the EU Ecolabel	Wood-based materials to be marked with the RAL-UZ 76 Environmental Label or they must not exceed in their raw state, i.e. prior to machining or coating, a formaldehyde steady state concentration of 0.1 ppm in the test chamber.
Textiles	No weight thresholds	As in the EU Ecolabel	Same as in the EU Ecolabel
	Biocides: Chlorophenols (their salts and esters), PCB and organo-tin compounds shall not be used during transportation or storage of mattresses and semi-manufactured mattresses	Biocides: Fabrics from natural plant fibers, wool and other animal fibers as Oeko-Tex Standard 100 – class II. Baby mattresses as Oeko-Tex - Class I	Biocides: The requirements for pesticides of „Öko-Tex Standard 100", product category II, must be observed for cover fabrics made of vegetable natural fibres, wool and other animal fibres. Compliance with EU Ecolabel is considered an alternative compliance verification.
	APEOs, LAS, DTDMA, DSDMAC, DHTDMAC, EDTA and DTPA shall not be used in any of the preparations or formulations used	-	-
	95% by weight of detergents, fabric softeners and complexing agents used at each wet processing site shall be "sufficiently degradable" or eliminable in wastewater treatment plants. This is with the exception of surfactants in detergents at each wet processing site, which shall be	-	-

Issue	EU Ecolabel Jul 2009	Austrian Ecolabel UZ55 - Jan 2011	Blue Angel UZ 119 - Apr 2010
	"ultimately aerobically biodegradable"		
	Only for natural fibres, chlorine agents are excluded for bleaching yarns, fabrics and end products.	-	-
	Prescriptions on dyes and pigments as for latex foam, with the exception of metal complex dyes, where limit emissions to water are assigned	As for latex/PUR foams	Dyes & pigments: a list of substances which canot be used is provided (azo dyes; dyes that are carcinogenic, teratogenic or toxic to reproduction; potentially sensitizing dyes, heavy metal-containing dyes) Compliance with EU Ecolabel is considered an alternative compliance verification.
	The colour fastness to perspiration (acid/alkaline) must meet level 3-4. A level of 3 is allowable when they are dark (standard depth > 1/1), and are made of regenerated wool or more than 20% silk. This does not apply to white products, or products which are neither dyed nor printed.	As in the EU Ecolabel	-
	Colour fastness to wet rubbing shall be at least 2-3. A level of 2 is allowable for indigo dyed denim. This does not apply to white products, or products which are neither dyed nor printed.	As in the EU Ecolabel	-
	The colour fastness to dry rubbing must be at least level 4. Level 3-4 is allowable for indigo dyed denim. This does not apply to white products, or products which are neither dyed nor printed.	As in the EU Ecolabel	-
	-	No mothproofing agents may be used for the	No mothproofing agents may be used for the protection of cover

Issue	EU Ecolabel Jul 2009	Austrian Ecolabel UZ55 - Jan 2011	Blue Angel UZ 119 - Apr 2010
		protection of cover fabrics and the underlying upholstery made of natural textiles (wool and other animal fibres).	fabrics and the underlying upholstery made of natural textiles (wool and other animal fibres).
Glues	No organic solvents which are: - Carcinogenic - Harmful to reproduction systems - Genetically harmful - Toxic	Adhesives containing organic solvents may not be used, depending on general criterion on hazardous substances	-
Packaging	Packaging must be made of recyclable materials & plastics marked	-	-
Flame Retardants	Only reactive FRs allowed. If a flame retardant has any of the R-phrases specified in directive 67/548/EEC, these must not apply once the flame retardant is in its applied form	Use of flame retardants is banned	Use of flame retardants is banned
Biocides	Authorized those in Annex I, IA and IB to Directive 98/8/EC and those where the active substance is authorised for use in bed mattresses according to Annex V to Directive 98/8/EC		No fungicides or insecticides are allowed, except for fungicides exclusively used for pot preservation of aqueous adhesives as well as adhesives based on aqueous dispersions.
Halogenated organic compounds	Halogenated organic compounds shall not be used as blowing agents, or auxiliary blowing agents.	Springs made of plastics must be free of halogenated organic compounds	No halogenated organic compounds (e.g. chloroorganic carriers in textiles) may be added to mattresses, including the materials used for the manufacture (textiles, foams, wood-based materials, adhesives etc)
<u>Manufacture</u>			
EMS	-	A waste management systems is required in the production facility	-

Issue	EU Ecolabel Jul 2009	Austrian Ecolabel UZ55 - Jan 2011	Blue Angel UZ 119 - Apr 2010
		EMAS registration or ISO 14001 certification are required in the production facility	
<u>Use</u>			
VOCs and SVOCs of whole product	Formaldehyde after 7 & 28 days < 60 µg/m^3 (< 0.05 ppm). Other aldehydes after 7 & 28 days < 60 µg/m 3 (< 0.05 ppm) Total Organic Compounds (retention range: C6-C16): < 500 µg/m 3 (after 7 days) < 200 µg/m 3 (after 28 days) Total Organic Compounds (retention range above C16) < 100 µg/m 3 (after 7 days) < 40 µg/m 3 (after 28 days)	As in the EU Ecolabel	As in the EU Ecolabel , plus: C-substances After 3 days < 10 µg/m³ (total value) After 7 days < 1 µg/m³ (per single value) After 28 days < 1 µg/m³ (per single value) Total VOC without LCI < 100 µg/m³ (after 7 days) < 40 µg/m³ (after 28 days) R-Value < 1 (after 7 days) < 1 (after 28 days)
Fitness for use	Durability 10 years. Max loss of height: 15% Max loss firmness: 20%	Strength and durability: a) Loss of height < 14 mm b) loss of strength < 20% Serviceability according to ÖNORM A 1610-6, ÖNORM A 1610-1, ÖNORM A 1605-6, ÖNORM EN 1334, ÖNORM EN 1725 and EN 1957	Strength and durability: a) Loss of Height < 15 mm. b) Loss of Firmness < 20%. Serviceability according to DIN EN 1334 (Methods of measurement and recommended tolerances), DIN EN 1725 (Safety requirements and test methods) as well as DIN EN 1957 (Test methods for the determination of functional characteristics) Quality and durability: the ash content of the base material is to be determined. For polyurethane foam the ash content must be < 1%. For latex foam it must be < 6%

Issue	EU Ecolabel Jul 2009	Austrian Ecolabel UZ55 - Jan 2011	Blue Angel UZ 119 - Apr 2010
End-of-life			
Disposal of bed mattresses	-	Mattresses can be disposed through the municipal solid waste collection system. Nevertheless, a bonus can be given if old mattresses are given back when a new one is purchased	-
Other			
Consumer Info	Box 2 of the Ecolabel shall contain specific text related: - 'Minimises indoor air pollution' - 'Hazardous substances restricted' - 'Durable and high quality'	-	Manufacturer Model name Product description, including information on material structure Hardness value Suitability for adjustable spring bases Information on the overall durability (loss of height and firmness) Information on the product's wearing resistance Cleaning and care instructions

Appendix III: Hazardous Substance, Risk Phrases and Hazard Statements

Hazard Statement	**Risk Phrase**
H300 Fatal if swallowed	R28
H301 Toxic if swallowed	R25
H304 May be fatal if swallowed and enters airways	R65
H310 Fatal in contact with skin	R27
H311 Toxic in contact with skin	R24
H330 Fatal if inhaled	R23/26
H331 Toxic if inhaled	R23
H340 May cause genetic defects	R46
H341 Suspected of causing genetic defects	R68
H350 May cause cancer	R45
H350i May cause cancer by inhalation	R49
H351 Suspected of causing cancer	R40
H360F May damage fertility	R60
H360D May damage the unborn child	R61
H360FD May damage fertility. May damage the unborn child	R60/61/60-61
H360Fd May damage fertility. Suspected of damaging the unborn child	R60/63
H360Df May damage the unborn child. Suspected of damaging fertility	R61/62
H361f Suspected of damaging fertility	R62
H361d Suspected of damaging the unborn child	R63
H361fd Suspected of damaging fertility. Suspected of damaging the unborn child.	R62-63
H362 May cause harm to breast fed children	R64
H370 Causes damage to organs	R39/23/24/25/26/27/28
H371 May cause damage to organs	R68/20/21/22
H372 Causes damage to organs	R48/25/24/23
H373 May cause damage to organs	R48/20/21/22
H400 Very toxic to aquatic life	R50
H410 Very toxic to aquatic life with long-lasting effects	R50-53
H411 Toxic to aquatic life with long-lasting effects	R51-53
H412 Harmful to aquatic life with long-lasting effects	R52-53
H413 May cause long-lasting effects to aquatic life	R53

EUH059 Hazardous to the ozone layer	R59
EUH029 Contact with water liberates toxic gas	R29
EUH031 Contact with acids liberates toxic gas	R31
EUH032 Contact with acids liberates very toxic gas	R32
EUH070 Toxic by eye contact	R39-41
H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled	R42
H317: May cause allergic skin reaction	R43

Notes

1. According to Regulation (EC) No 1272/2008 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

2. According to Directive 67/548/EEC and the REACH Directive 2006/121/EC and Directive 1999/45/EC as amended