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Revision of the EU Green Public Procurement (GPP) criteria for Furniture

Technical Report
Final version

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Abstract
This report presents criteria that can be applied to furniture products via procurement exercises that may directly or indirectly reduce their environmental impact. A broader approach to furniture procurement has been taken by not only considering the procurement of new furniture but also the procurement of furniture refurbishment services and End of Life collection services. Particular focus is placed on the presence/emission of hazardous substances that may be added to materials used in furniture products. A number of furniture criteria have been proposed that are of particular relevance to circularity, e.g. design for disassembly and repair, spare part availability and warranties.

Contents

0. Executive summary

Policy context

The environmental impacts of products throughout their lifecycle are highly variable from one product group to another and even within a particular product group itself. It is extremely challenging to address or influence all the life cycle stages of different product groups with a single policy tool. For this reason, the Commission has developed an Integrated Product Policy (IPP) which comprises a number of different policy instruments address the life cycle impacts of products from different angles.

As part of the Commission's IPP, Green Public Procurement (GPP, COM 2008/400) is a voluntary tool led by DG JRC on behalf of DG Environment of the European Commission. Other policy tools relevant to IPP include EU Ecolabel (Regulation (EC) No 66/2010), Energy Labelling (Directive 2010/30/EU), Ecodesign for energy-related products (Directive 2009/125/EC), End-of-Waste criteria (related to the Waste Framework Directive 2008/98/EC) and the Industrial Emissions Directive (Directive 2010/75/EU).

The revision of EU GPP Criteria for all product groups is carried out on a periodic basis, prioritising product groups where criteria may have become outdated, either due to innovation, market changes or new legal, technical or environmental requirements.

A close relationship between EU Ecolabel criteria and EU GPP criteria is desirable so that both policy tools can mutually support each other in order to increase awareness amongst procurers and market uptake.

Main findings

The objective of the research has been to identify the main environmental impacts of furniture products and consider ways in which these could be reduced by the application of technical criteria that respect relevant scientific, legal and political considerations. The project began with a broad stakeholder identification and consultation exercise. A Preliminary Report was published in 2014[1] to provide background to legal, technical and policy frameworks, market analysis, a review of relevant Life Cycle Assessment (LCA) literature relevant to furniture products prior to two ad-hoc working group meetings with stakeholders from a range of different backgrounds, including industry, Member State representatives, consumer organisations and NGOs. During the process a series of different draft Technical Reports were published to reflect the latest developments in the technical criteria for furniture and to provide supporting rationale for those criteria – culminating in this final Technical Report.

The previous EU GPP criteria for furniture where aimed predominantly at the procurement of new furniture. However, as organisations become increasingly aware of the potential cost and environmental savings that can be achieved by extending furniture life (e.g. through refurbishment or repair) it was deemed necessary to offer an approach towards the potential procurement of furniture repair/refurbishment services.

It was also observed that many furniture products become obsolete despite still being perfectly functional or in need of only minor repair (e.g. due to office relocations, changes in interior design of public buildings etc.). In these cases, there is a clear residual value for the obsolete furniture and procurers are encouraged to engage with organisations that are equipped to collect furniture, supply it to new users and take responsibility for the disassembly and recycling/ disposal of any unusable furniture.

At the end of the process, three different approaches are described in order to reflect the varying scenarios in which a Public Authority may find itself in:

- Approach A: The procurement of furniture refurbishment services.
- Approach B: The procurement of new furniture products.
- Approach C: The procurement of furniture End-of-Life services.

[1] Donatello et al., 2014. Revision of EU Ecolabel and EU Green Public Procurement criteria for furniture products. Preliminary Report. Available online in JRC publications repository.

Major environmental and economic benefits can be achieved by maximising the use of Approach A. Discussions revealed that it is mainly a lack of demand from Public Authorities restricting uptake and so awareness-raising is important.

The criteria for Approach B have a particular focus on the longevity of products via criteria for durable upholstery materials, ease of repair and disassembly, availability of spare parts and the encouragement of longer warranties.

The criteria for Approach C, in a similar manner to Approach A, are part of an awareness-raising exercise. Discussions revealed the relationship of this approach with the "social economy", where furniture is collected and directly reused/repaired/sold by not-for-profit enterprises – maximising the useful lifetime of furniture by cascading uses.

VOC emissions from furniture products are a particular concern for end users of indoor furniture. In order to avoid expensive mandatory tests, a flexible approach has been provided to ensure that emissions are minimised, either via the use of low VOC concentration coatings, the use of limited quantities of VOC-containing coatings or the testing of the final product / main sources of VOC emissions in the final product. Emissions of formaldehyde, a Category 1B carcinogenic VOC, from wood-based panels are addressed by a specific criterion which sets stringent limits which reflect current best practice and are much lower than the existing E1 technical standard that has been implemented across Europe.

The EU GPP criteria encourage the production of durable products that are fit for purpose and easy to repair in order to maximise their useful lifetime. At End-of-Life, the products will be easy to dismantle into separate material streams to maximise recycling potential. Design for repair and design for disassembly help ensure that EU Ecolabel furniture products embrace Circular Economy principles and respect the waste hierarchy.

Related and future JRC work

The EU GPP criteria set out in this Technical Report have been officially published in Staff Working Document: SWD(2017) 283. The criteria are closely related to the EU GPP criteria for textiles and also to several other EU Ecolabel product groups such as Textiles (see Commission Decision 2014/350/EU), Bed Mattresses (see Commission Decision 2014/391/EU) and Footwear (see Commission Decision (EU) 2016/1349).

1. Introduction

Europe's public authorities spend around 14% (excluding defence and utilities) of the European Union's (EU) Gross Domestic Product (GDP) on public procurement every year, which amounts to ~€2 trillion annually[2]. As major consumers, public authorities can use their purchasing power to contribute to sustainable consumption and production and stimulate eco-innovation and the development of 'greener' technologies[3]. This is referred to as Green Public Procurement or GPP. GPP is a voluntary instrument meaning that public authorities can determine the extent to which they implement it. It has an important role to play in the EU's efforts to become a more resource-efficient economy by stimulating demand for more sustainable goods and services. The development of clear and verifiable environmental criteria for GPP aims to help public authorities ensure that the goods, services and works they require are procured and executed in a way that reduces their associated environmental impacts. GPP criteria have been developed by the European Commission, as well as by individual European countries at the national level.

The European Commission's communication on Public procurement for a better environment (COM (2008) 400)[4] defines GPP as:

"a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured."

Since the 2008 Communication from the European Commission, EU GPP criteria covering more than 20 products and services have been developed, including furniture products, which are the focus of this technical report.

In order to make the criteria development process more participatory, and coherent with related environmental policy instruments, such as the EU Ecolabel and GPP, a new criteria development plan, led by the Joint Research Centre's Institute for Prospective Technological Studies (JRC-IPTS), was put forward in June 2010[5]. The new process involves adopting an annual GPP work-plan in consultation with the informal GPP Advisory Group (GPP AG), comprised of representatives from Member States as well as other stakeholders from industry, public procurement professionals, and local authorities[6]. The EU GPP work-plan is coordinated with the relevant EU Ecolabel work-plan to enhance the synergies between the two and streamline the process of developing and revising EU Ecolabel and GPP criteria for the same product groups, such as furniture[7].

The GPP work-plan also outlines the process for revising the criteria and the stakeholders involved in doing so, which at a high level includes:

- Drafting one preliminary report for the product group;
- Drafting one technical report with the criteria areas for discussion and revision;

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[2] European Commission (2016a) *Buying green: A handbook on green public procurement, 3rd Edition*, 2016, http://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf.

[3] European Commission (2015a) *Green Public Procurement (GPP)*, accessed 19 August 2015, http://ec.europa.eu/environment/gpp/index_en.htm.

[4] European Commission (2008a) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Public Procurement for a Better Environment (COM (2008) 400).

[5] European Commission (2015b) *Process for Setting Criteria*, accessed 19 August 2015, http://ec.europa.eu/environment/gpp/gpp_criteria_process.htm

[6] European Commission (2015c) *GPP Work Programme for 2015/2016*, accessed 19 August 2015, http://ec.europa.eu/environment/gpp/gpp_criteria_wp.htm

[7] European Commission (2014a) *EU Ecolabel Work Plan for 2011-2015*, July 2014, http://ec.europa.eu/environment/ecolabel/about_ecolabel/pdf/work_plan.pdf

- Holding two stakeholder consultation meetings (i.e. Ad Hoc Working Group meetings) and one written stakeholder consultation to inform the revision rounds;
- Holding a consultation with the GPP advisory group; and
- Adoption and publication of the EU GPP criteria.

Overall, the revision process can 2-3 years and the general sequence of steps is illustrated in Figure 1 below.

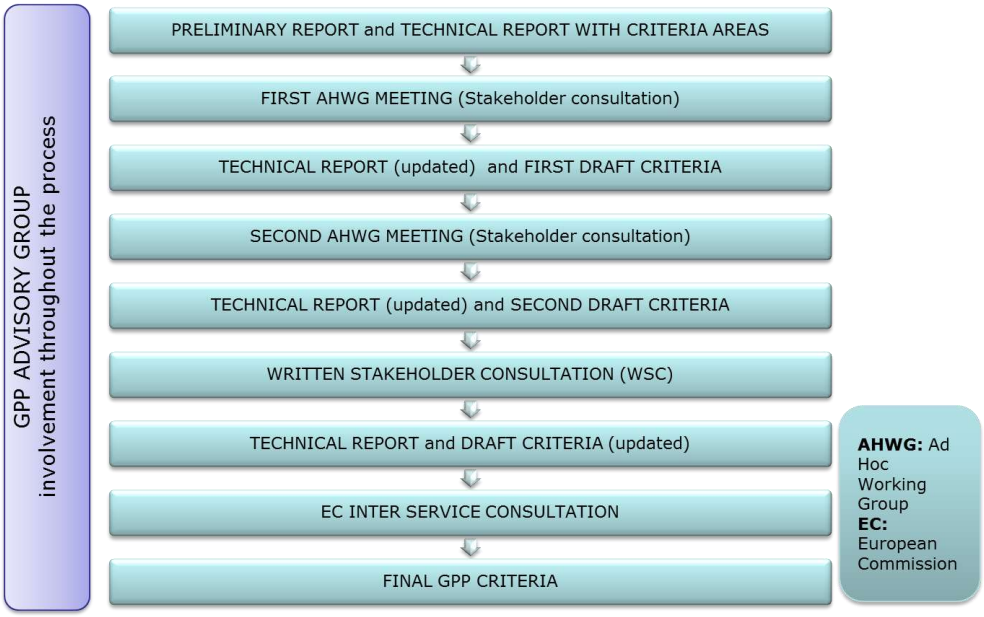

Figure 1. EU GPP criteria development/revision process

GPP criteria are revised periodically to reflect technical innovation such as evolution of materials or production processes, reductions in emissions and market advances. The Institute for Prospective Technological Studies (IPTS) based in Seville (Spain) of the Directorate General Joint Research Centre (DG JRC) is one of the European Commission's in-house science service hubs and has worked together with the Directorate General Environment (DG ENV) for the furniture GPP criteria revision.

Feedback from stakeholders representing manufacturers, intermediaries, consumer organizations, NGOs and Member States was gathered prior to the meeting via questionnaires, during the meeting via verbal dialogue and after the meeting via ongoing exchange of phone calls, emails and uploading of information onto the BATIS system[8], to which all registered stakeholders have access. Technical reports and other documents are also available online at the EC Joint Research Centre (JRC) website[9]. Specifically for the purposes of engaging more with procurement experts, a group was created in February 2014 on the European procurement forum website[10].

[8] http://eippcb.jrc.ec.europa.eu/batis/ - forum: furniture

[9] http://susproc.jrc.ec.europa.eu/furniture/documents.html

[10] www.procurement-forum.eu – group name "EU GPP criteria revision for furniture"

1.1. General background to GPP

The legal framework for public procurement is defined by the provisions of the Treaty on the Functioning of the European Union and by the two Directives on procurement; Directive 2014/24/EU on public procurement (repealing Directive 2004/18/EC) and Directive 2014/23/EU (repealing Directive 2004/17/EC) on the procurement procedures of entities operating in the water, energy, transport and postal services sectors. The 2014 Directives in contrast with earlier EU Directives governing procurement, contained for the first time specific reference to the possibility of including environmental considerations in the contract award process.

Furthermore in 2008 the European Commission adopted a Communication on GPP[11], which as part of the Sustainable Production and Consumption Action Plan[12,13] explained how environmental concerns should be taken into account at each separate stage of the contract award process. The objective of the Communication was to provide guidance on how to reduce the environmental impacts caused by the public sector consumption and how to use GPP to stimulate innovation in environmental technologies, products and services. At the EU level, the Commission set an indicative target that by 2010, 50% of all public tendering procedures should be green, where 'green' was defined as meaning compliant with endorsed common core EU GPP criteria. The Communication was accompanied by Staff working Documents which provided guidelines for public authorities on defining and verifying environmental criteria as well as legal and operational guidance.

In planning their procurement procedures, contracting authorities need to consider all stages of the process and examine where it is most appropriate to insert environmental considerations. Each of these procedures offers a number of stages where green considerations can be applied. For example this could be:

- **At the pre-procurement stage:** Prior to commencing the procurement, market dialogue may assist in identifying technologies or solutions with the potential to meet environmental objectives,
- **Via an open procedure:** All operators may submit tenders and all tenders meeting the pass/fail conditions specified by the public authority will be eligible to have their tender assessed. The public authority will therefore have access to the maximum choice of potential environmentally friendly solutions for which to select;
- **Via a restricted procedure:** The number of operators invited to tender can be limited and an assessment of environmental technical capacity could take place at an earlier stage. The staged procedure can help the public authority determine the appropriate level of environmental performance to aim for. However through restricted procedure it is possible that offers with high environmental performance will be missed out; and
- **Via a negotiated and competitive dialogue procedure:** These procedures allow in particular for the effect of environmental requirements on cost to be

[11] European Commission (2008a) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Public Procurement for a Better Environment (COM (2008) 400).

[12] European Commission (2008b) Communication from the Commission to the European Parliament, the European Economic and Social Committee and the Committee of the Region on the Sustainable Consumption and Production and Sustainable Industry Policy Action Plan (COM (2008) 397 final).

[13] European Commission (2008c) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan (SEC (2008) 2110).

better understood and controlled. However, both procedures require some level of skill and experience in engaging with suppliers if the best results are to be achieved.

As outlined in 'Buying Green' handbook, the basic steps for GPP are:

- Set priorities for the product and service groups you will address by consulting existing GPP criteria, ecolabels and other sources;
- Put in place information, training, networking and monitoring activities to ensure you reach your goals;
- Consider how green requirements will affect the procurement process for the goods and services you have chosen, and how you will implement them in line with legal obligations;
- Get an overview of the products and services available on the market by engaging suppliers and make a business case for GPP based on lifecycle costing;
- When tendering, define the subject matter and technical specifications for contracts in a way which takes into account environmental impacts throughout the life-cycle of the goods, services or works you are buying;
- Apply, where appropriate, selection criteria based on environmental technical capacity or environmental management measures and exclude tenderers who have committed serious breaches of environmental requirements;
- Set award criteria which encourage tenderers to deliver even higher levels of environmental performance than those you have specified, and apply these in a transparent way;
- Assess life-cycle costs when comparing tenders; and
- Set contract performance clauses which underline the environmental commitments made by suppliers or service providers, and provide appropriate remedies where they fall short. Ensure there is a system for monitoring these commitments.

GPP criteria are to be understood as being part of the procurement process and must conform to its standard format and rules as laid out by Public Procurement Directive 2014/24/EU (public works, supply and service contracts). Hence, EU GPP criteria must comply with the guiding principles of: Free movement of goods and services and freedom of establishment; Non-discrimination and equal treatment; Transparency; Proportionality and Mutual recognition. GPP criteria must be verifiable and it should be formulated either as Selection criteria, Technical specifications, Award criteria or Contract performance clauses, which can be understood as follows:

Selection Criteria (SC): Selection criteria refer to the tenderer, *i.e.*, the company tendering for the contract, and not to the product being procured. It may relate to suitability to pursue the professional activity, economic and financial standing and technical and professional ability and may- for services and works contracts - ask specifically about their ability to apply environmental management measures when carrying out the contract.

Technical Specifications (TS): Technical specifications constitute minimum compliance requirements that must be met by all tenders. It must be linked to the contract's subject matter (the 'subject matter' of a contract is about what good, service or work is intended to be procured. It can consist in a description of the product, but can also take the form of a functional or performance based definition, and must not concern

general corporate practices but only characteristics specific to the product being procured. Link to the subject matter can concern any stage of the product's life-cycle, including its supply-chain, even if not obvious in the final product, *i.e.*, not part of the material substance of the product. Offers not complying with the technical specifications must be rejected. Technical specifications are not scored for award purposes; they are strictly pass/fail requirements.

Award Criteria (AC): At the award stage, the contracting authority evaluates the quality of the tenders and compares costs. Contracts are awarded on the basis of most economically advantageous tender (MEAT). MEAT includes a cost element and a wide range of other factors that may influence the value of a tender from the point of view of the contracting authority including environmental aspects (refer to the Buying Green guide for further details), (European Commission (2016a)). Everything that is evaluated and scored for award purposes is an award criterion. These may refer to characteristics of goods or to the way in which services or works will be performed (in this case they cannot be verified at the award stage since they refer to future events. Therefore, in this case, the criteria are to be understood as commitments to carry out services or works in a specific way and should be monitored/verified during the execution of the contract via a contract performance clause). As technical specifications, also award criteria must be linked to the contract's subject matter and must not concern general corporate practices but only characteristics specific to the product being procured. Link to the subject matter can concern any stage of the product's life-cycle, including its supply-chain, even if not obvious in the final product, *i.e.*, not part of the material substance of the product. Award criteria can be used to stimulate additional environmental performance without being mandatory and, therefore, without foreclosing the market for products not reaching the proposed level of performance.

Contract Performance Clauses (CPC): Contract performance clauses are used to specify how a contract must be carried out. As technical specifications and award criteria, also contract performance clauses must be linked to the contract's subject matter and must not concern general corporate practices but only those specific to the product being procured. Link to the subject matter can concern any stage of the product's life-cycle, including its supply-chain, even if not obvious in the final product, *i.e.*, not part of the material substance of the product. The economic operator may not be requested to prove compliance with the contract performance clauses during the procurement procedure. Contract performance clauses are not scored for award purposes. Compliance with contract performance clauses should be monitored during the execution of the contract, therefore after it has been awarded. It may be linked to penalties or bonuses under the contract in order to ensure compliance.

For each criterion there is a choice between two levels of environmental ambition, which the contracting authority can choose from according to its particular goals and/or constraints:

The **Core criteria** are designed to allow easy application of GPP, focussing on the key areas of environmental performance of a product and aimed at keeping administrative costs for companies to a minimum.

The **Comprehensive criteria** take into account more aspects or higher levels of environmental performance, for use by authorities that want to go further in supporting environmental and innovation goals.

1.1 Status of EU GPP criteria for furniture in different countries

The Communication on Integrated Product Policy (IPP)[14] encouraged Member States to draw up publically available National Action Plans (NAPs) for greening their public procurement. By October 2015, 23 Member States had done so (excluding Estonia, Greece, Hungary, Luxembourg and Romania). The NAPs include an assessment of the existing situation related to GPP implementation and set targets for the next three years, outlining measures to achieve them. They are the means by which Member States address the environmental and social impacts of public procurement. Identification and prioritisation of product groups is usually performed by considering the level of government spend on a particular product group, along with the level of environmental impact it has.

Table 1. Situations of GPP criteria for furniture products in the EU-28+Norway

Direct recommendation of EU GPP criteria	Development of specific national GPP criteria	No recommendation of any GPP criteria
Belgium	Austria	Bulgaria
Cyprus	Czech Republic	Croatia
Denmark	Finland*	Estonia
Latvia	France	Greece
Poland	Germany	Ireland
Slovakia	Italy	Hungary
Slovenia	Lithuania	Luxembourg
	Malta	Portugal
	Netherlands	Romania
	Norway	
	Spain	
	Sweden	
	UK	

*under development

The data in Table 1 implies that the bulk of the EU-28 population is covered by specific national GPP of EU GPP criteria for furniture but that there are a number of countries which are yet to embrace GPP criteria, either for furniture products in particular or for all product groups in general.

[14] European Commission (2003) Communication from the Commission to the Council and the European Parliament: Integrated Product Policy - Building on Environmental Life-Cycle Thinking (COM (2003) 302 final).

1.2 Structure of the report

A brief summary of the Preliminary Report that was produced as a joint exercise for the simultaneous revision of EU Ecolabel and EU GPP criteria for furniture is provided in this Technical Report. This will provide the reader with some appreciation of the main legal and technical aspects, market analysis, hot-spots identified in LCA of furniture products and the certain other issues.

The scope and definition of the product group is provided. Then an overview of the different approaches (A, B and C) and associated criteria that are proposed for furniture procurement is provided, with reasoning to justify why each approach should be considered in this report.

For each approach, the criteria are split criterion by criterion and presented in the following general format:

Approach A: Procurement of furniture refurbishment services

- Background technical discussion and supporting rationale.
  - why relevant to GPP?
  - stakeholder discussion
  - what relevant ecolabel and other green initiatives say
  - ambition level
- Criterion text (core and comprehensive levels) as well as assessment and verification text is published in a standard table.
- A summary of the supporting rationale is summarised in a few bullet points.

Approach B: Procurement of new furniture products

- Background technical discussion and supporting rationale.
  - why relevant to GPP?
  - stakeholder discussion
  - what relevant ecolabel and other green initiatives say
  - ambition level
- Criterion text (core and comprehensive levels) as well as assessment and verification text is published in a standard table.
- A summary of the supporting rationale is summarised in a few bullet points.

Approach C: Procurement of furniture End-of-Life services

- Background technical discussion and supporting rationale.
  - why relevant to GPP?
  - stakeholder discussion
  - what relevant ecolabel and other green initiatives say
  - ambition level
- Criterion text (core and comprehensive levels) as well as assessment and verification text is published in a standard table.
- A summary of the supporting rationale is summarised in a few bullet points.

Finally any large Tables that would not have easily fitted directly into the Criteria text are included as Appendices.

2. Summary of Preliminary Report

2.1 Legal aspects and standards relevant to furniture

Numerous pieces of legislation are relevant to one degree or another for specific furniture products.

Regarding the definition and use of hazardous substances, the importance of the REACH Regulation (1907/2006) and the CLP Regulation (1272/2008) must be highlighted. Other more specific legal instruments include the VOC Directive (1999/13/EC) for installations where significant quantities of VOC containing compounds (e.g. formaldehyde resins for wood-based panels or surface coating chemicals for furniture) are handled and the Biocides Regulation (528/2012) which lists authorised active ingredients in biocidal products as a function of the application (for example Product Type 8 biocides apply to wood and Product Type 9 can apply to leather and textiles used in furniture[15]).

For wood and wood based materials, Regulation 995/2010 (the EU Timber Regulation) outlines the requirements for any timber to be legally sold on the EU market and links with existing processes for FLEGT licenses and CITES permits. Going beyond legal requirements, the most relevant programmes for demonstrating that wood and wood based materials are from sustainably managed forests are the FSC and PEFC certification schemes. Across the EU, wooden particleboards, fibreboards and panels, are classified as E1 (0.1ppm) or E2 (0.1-0.3ppm) based on their release rates of formaldehyde as assessed by relevant EN standards such as EN 622 and EN 717.

A large number of EN standards exist that are specifically designed for individual product types such as EN 527 for work tables and desks in offices, EN 581 for outdoor tables and sets, EN 747 for bunk beds and EN 1335 for office chairs. These standards are important from an environmental point of view when they refer to durability or performance-based aspects of the furniture. In terms of national fire regulations, another important standard that applies to upholstered furniture is EN 1021.

[15] http://ec.europa.eu/environment/chemicals/biocides/biocidal-products/product-types_en.htm

2.2 Market analysis

According to the World Furniture Outlook by CSIL[16], the global furniture market was worth around **US$420 billion** in 2010 alone. The global market is dominated by China (37%) but the 3rd and 4th main producers were Germany and Italy (each with a 6% market share). In total, EU-27 countries account for around 20% of global furniture production.

The EU furniture industry faces strong competition from cheaper overseas competitors, in particular China. In response, it is developing more innovative and sophisticated furniture products and giving increased attention to the environmental impact of its products.

It is difficult to quantify any direct environmental impact of assumed scenarios of the uptake of the GPP criteria listed here because most market data is expressed in number of units of furniture or production value whereas environmental impacts related to materials are directly expressed as unit mass or volume of that material.

Nonetheless, some of the more likely impacts of the application of GPP criteria in furniture procurement activities would be as follows:

- Increasing awareness of procurers of the potential for furniture refurbishment services.
- Incentivise the use of recycled wood fibres by including an award criterion.
- Sending a market signal to producers to increase the use of recycled plastic.
- Encouraging innovation in furniture companies in terms of design for disassembly, and partial replacement of components.
- Fostering skills development in furniture repair, renovation and responsible End-of-Life (EoL) disposal (either of the tendering companies or 3rd parties).
- Reduction of the quantities of furniture waste sent to landfill as products become easier to separate.

[16] *CSIL Furniture Outlook. Global trends and forecasts for the furniture sector.* CSIL Alessandra Tracogna. Feb. 2012. (available online at: http://www.slideshare.net/ClarionGermany/03-csil-alessandratracogna)

2.3 Life cycle assessment of furniture

The life cycle of furniture products has been considered in the following phases; Materials, Manufacturing, Packaging, Distribution, Use and End-of-Life (EoL). An original total of 109 reports related to the LCA of furniture were assessed. After analysis of 13 screened Life Cycle Assessment (LCA) studies and 35 verified Environmental Product Declarations (EPDs) the following conclusions were drawn:

- The dominant fraction (80-90%) of environmental impacts is linked to furniture **materials/ components**. While embodied energy in metals and plastics are higher than wood, durability and recyclability are also important considerations. Specifying recycled materials can help reduce material impact.
- **Manufacturing**, the assembly and/or treatment of components, is the next most significant source of environmental impacts due to the use of chemicals in surface coatings and elevated temperature curing processes.
- Impacts due to **packaging** could vary depending on the individual product but two LCA studies quoted in the preliminary report estimate total impacts due to packaging at 6%.
- **Distribution** was difficult to investigate since this can vary widely due to the global nature of the furniture market. In most LCA studies, average transportation scenarios were used, which masks the varying importance of this part of the furniture life cycle.
- The **use** phase was not important in terms of environmental impact. However, durability and reparability of products are important considerations to extend the use phase.
- The **EoL** impacts vary considerably depending on what materials are used in the furniture. Recycling of furniture components or recovering energy from furniture waste is often complicated due to difficulties in separating components.

2.4 Uptake of furniture GPP in the EU

In 2008, the European Commission set up a target that by 2010, 50% of all public tendering procedures should be compliant with core EU GPP criteria for 10 priority product groups, including furniture. The existing EU GPP criteria for furniture at the time of the survey contained 7 core criteria[17]. According to a CEPS study[18] in 2011-12, involving a survey of 850 public authorities from 26 EU countries, information on 151 furniture contracts was obtained, predominantly (91%) regarding the purchase of indoor furniture. Around 50% of the contracts (41% monetary value) presented contained at least one core GPP criterion but only 14% (25% monetary value) complied with all core criteria. The performance of different countries (who each supplied at least 5 contract examples) is shown below.

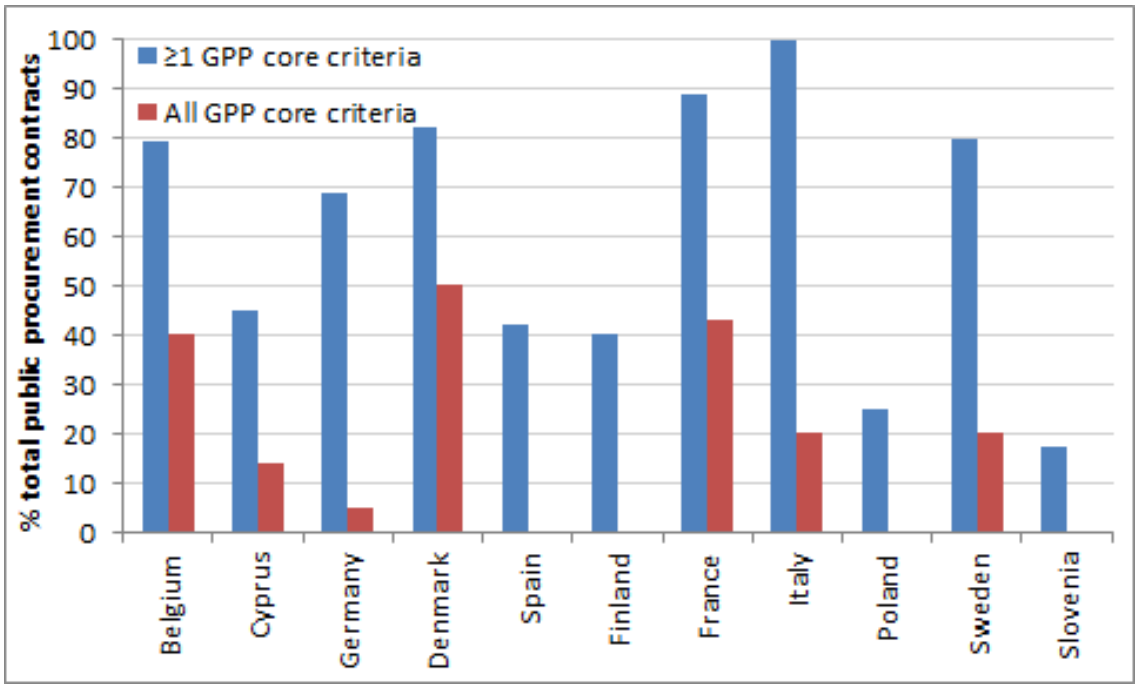

Figure 2. Fraction of furniture public procurement contracts including GPP core criteria.

From the contract details which were supplied, the uptake of core GPP criteria was less that hoped for but still encouraging. However, it should be noted that those authorities who were proactive enough to respond to the survey are also the same authorities more likely to incorporate GPP criteria into their procurement procedures.

[17] (i) legally sourced wood; (ii) marking of plastic parts >50g; (iii) restricted substances in surface coatings; (iv)VOC in glues <10%; (v) recyclable and (vi) separable packaging materials; (vii) Durability, reparability, fitness for use and ergonomic requirements.

[18] The uptake of Green Public Procurement in the EU-27. Centre for European Policy Studies in collaboration with College of Europe. February 2012. (available online at: http://ec.europa.eu/environment/gpp/pdf/CEPS-CoE-GPP%20MAIN%20REPORT.pdf)

2.5 Consumer interests for furniture products

GPP criteria should reflect issues that are important to consumers. This will help ensure the uptake of such criteria by procurers in calls for tenders and send signals to the market. In this regard, it is worth referring to the results of a survey conducted by FederlegnoArredo shown in Figure 3 below.

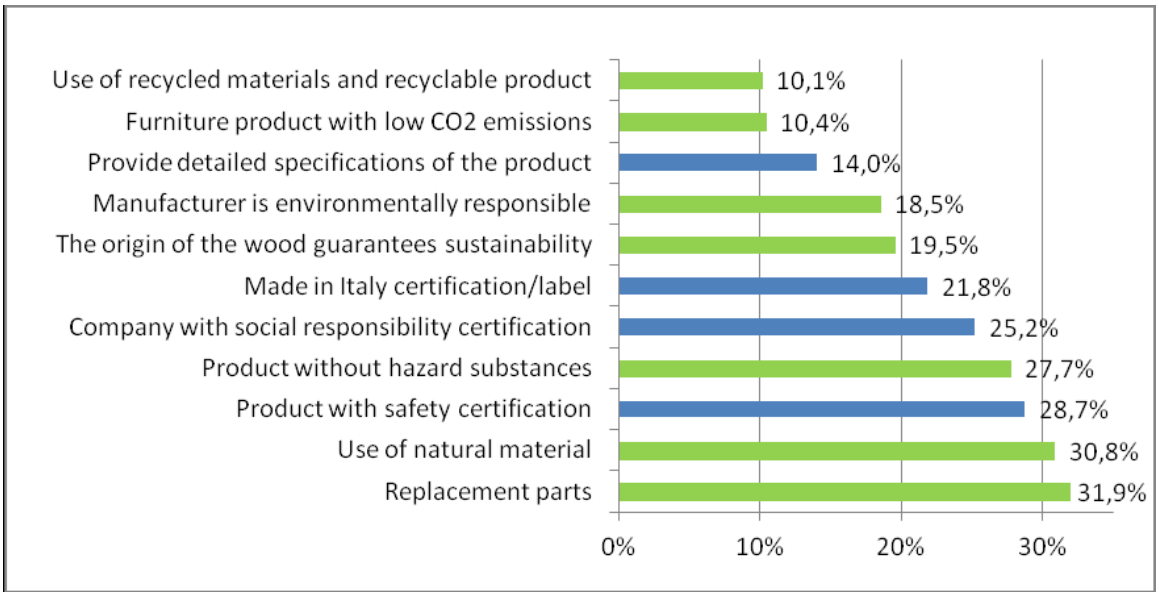

Figure 3. Furniture characteristics that consumers are willing to pay an extra 10% for[19] (note that green bars relate to environmental concerns and blue bars to social/information concerns).

The results clearly indicate the importance of spare part availability and by extension, the reparability of the product in order to extend its useful life. Regarding the use of natural materials, it was not clear whether this implies a preference for wood versus metals and plastics or for timber wood against resin bound fibreboard panels or for plant-based fibres versus synthetic fibres in textile fabrics or for real leather versus faux leather (coated fabrics based on PVC and/or polyurethane). Nonetheless, it is an important issue, as was the origin of the wood material. Concern was also shown about hazardous substances and so should be addressed to some extent in GPP criteria.

[19] Adapted from the report "Voglio di Piu. Ambiente, Tecnologia e Web 2.0", 2011. An abstract to the report can be found here:

3. Scope and definition

The product group "furniture" shall comprise free-standing or built-in units, whose primary function is to be used for the storage, placement or hanging of items and/or to provide surfaces where users can rest, sit, eat, study or work, whether for indoor or outdoor use. Bed mattresses are included within the scope.

The product group does not include the following products:

(a) Products whose primary function is not to be used as furniture. Examples include but are not limited to: streetlights, railings and fences, ladders, clocks, playground equipment, stand-alone or wall-hung mirrors, electrical conduits, road bollards and building products such as steps, doors, windows, floor coverings and cladding.

(b) Furniture fitted into vehicles used for public or private transit.

(c) Furniture products which consist of more than 5% (weight by weight) of materials other than: solid wood, wood-based panels, cork, bamboo, rattan, plastics, metals, leather, coated fabrics, textiles, glass or padding materials.

4. Criteria structure and overview

A breakdown of the criteria presented in the remainder of this Technical Report is provided below.

Table 2. Overview of GPP criteria structure

Criterion	Minimum technical specifications	Award criteria
Approach A – refurbishment of existing furniture stock		
TS-1: Refurbishment requirements	X	
TS-2: Durable upholstery coverings	X	
TS-3: Blowing agents	X	
TS-4: Refurbished furniture product warranty	X	
AC-1: Low chemical residue upholstery coverings		X
AC-2: Low chemical residue padding materials		X
AC-3:Low emission padding materials		X
AC-4: Extended warranty periods		X
Approach B – procurement of new furniture		
TS-1: Sourcing of legal timber for furniture production	X	
TS-2: Formaldehyde emissions from wood-based panels	X	
TS-3: Coating formulation restrictions	X	
TS-4: Restrictions for metals	X	
TS-5: REACH Candidate List substances	X	
TS-6: Durable upholstery coverings	X	
TS-7: Blowing agents	X	
TS-8: Fitness for use	X	
TS-9: Design for disassembly and repair	X	
TS-10: Product warranty and spare parts	X	
AC-1: Formaldehyde emissions from wood-based panels		X
AC-2: Plastic marking		X
AC-3: Low chemical residue upholstery coverings		X
AC-4: Low VOC emission furniture		X
AC-5 Extended warranty periods		X
AC-6: Low chemical residue padding materials		X
AC-7: Low emission padding materials		X
Approach C – procurement of furniture End-of-Life services		
TS-1: Collection and reuse of existing furniture stock	X	
AC-1: Improvement in the reuse targets		X

The significant number of award criteria is to encourage furniture manufacturers to innovate and become more competitive in invitations to tender in a number of areas that are strongly related to the environmental impact of furniture and which, in many cases, are already specified in ISO 14024 Type I Ecolabels, reinforcing the impact of these voluntary initiatives on the furniture industry.

The remainder of the document presents a brief background to each criteria area and rationale for why it has been chosen as a minimum technical specification or as an award criterion.

5. Approach A. Procurement of furniture refurbishment services

5.1 Technical Specification 1: Refurbishment requirements

5.1.1 Why relevant to GPP?

The Life Cycle Assessment (LCA) screening of furniture products carried out in the Preliminary Report[20] revealed that environmental impacts are dominated by (i) the impacts of material production (i.e. wood, metal, plastic) and (ii) further processing of those materials into furniture components (i.e. cutting, drying, moulding, welding and chemical treatment).

Due to the fact that the environmental impacts of furniture during the use phase are virtually zero, any extension of the useful lifetime of the furniture has direct environmental benefits. According to Bartlett[21], the typical lifetime of office furniture in the UK is 9-12 years, despite the fact that furniture is often designed with much longer function lifetimes. The premature End-of-Life (EoL) of office furniture is often determined by corporate decisions to redecorate or relocate offices and results in perfectly functional furniture being disposed of for aesthetic reasons. In general, the need for new furniture stock in a public organisation may be due to:

- New premises/staff or expansion of existing premises,
- Old furniture not being adequate after renovation of existing public buildings (for example the wrong colour, shape or size),
- Old furniture falling into disrepair (damaged furniture that is no longer safe and/or fully functional).

With the latter two situations, it may be possible to actually refurbish existing furniture instead of buying brand-new products. Recently (June 2014), the UK government published the latest version of its guidance document for furniture procurement. The document proposes taking the following hierarchical approach to address furniture needs:

The disposal of desks simply because they are not the same height as new desks or that the finish is a slightly different colour and the disposal of office chairs simply because the upholstery appears worn or the covering is the wrong colour is completely avoidable if refurbishment is considered.

Refurbishment operations avoid the need to produce new products (and their associated environmental impacts), generally result in cost savings to the procurer and encourage local skilled labour and businesses due to the importance of low transport costs on the overall cost of refurbishment.

One of the key barriers to the furniture refurbishment industry is the lack of demand from public authorities in Europe and a lack of experience with such contracts. In contrast, anecdotal evidence from one US furniture manufacturer showed that 9% of their commercial sales were due to remanufactured furniture.

Procurement guidance and best practice has focussed on new furniture, but a more holistic approach is needed which aims higher up on the waste hierarchy and helps contribute to the circular economy[22] within the EU. For this reason, particular emphasis

[20] Preliminary Report: Revision of EU Ecolabel and Green Public Procurement criteria for the product group "Wooden furniture", JRC-IPTS, 2013, click here to access online version.

[21] Bartlett, 2009. "Reuse of office furniture – incorporation into the 'Quick Wins' criteria: A study of the market potential for reused and remanufactured office furniture in the UK.

[22] http://ec.europa.eu/environment/circular-economy/

is given to furniture refurbishment in the EU GPP criteria. To emphasise the potential economic benefits with this approach, some cost estimates from a UK study that furniture reuse or refurbishment could achieve are reproduced in the table below.

Table 3. Estimated average unit prices for furniture items as new, reused or refurbished[23]

	Desks (£)	Chairs (£)	Shelving (£)	Pedestal (£)
New RRP	209	122	100	107
Reused RRP* proxy	105	86	50	53
Refurbished RRP* proxy	84	49	40	43

*RRP – Recommended Retail Price

As shown in Table 3, the potential cost savings with reused or refurbished furniture are substantial. Other figures quoted are more conservative but still mention cost savings of 25-50%[24]. Due to the fact that the major environmental impact of furniture products is associated with the materials used in production – refurbished furniture can greatly reduce these impacts too.

One study considered that the carbon footprint of a typical office chair (82kg CO_2e) and a typical office desk (146kg CO_2e) can be reduced by 45% and 35% respectively if minimal refurbishment results in the lifetime being doubled. Even complete replacement of the work surface of a desk can result in carbon emissions being reduced by 20%.

5.1.2 Stakeholder discussion

During the stakeholder meetings, the potential to include criteria that would facilitate the procurement of refurbished furniture was discussed. There was support to include such criteria since it is obvious how such products have much lower environmental impacts than new items. However, concerns were also expressed that such products cannot be properly tested for certain technical and safety requirements according to EN standards.

5.1.3 Ambition level and best practice

There are a number of different approaches which procurers can take to refurbished furniture:

- Procure refurbished furniture products directly from third parties.
- Procure a refurbishment service for their existing furniture stock in order to reduce or completely avoid the need to procure new furniture.
- Procure new furniture with clauses that permit 3rd parties, mainly not-for-profit organisations, to accept the furniture at EoL with the condition that it will be reused or refurbished prior to reuse.

The first point may not be appropriate for GPP at this moment due to the low quantity of suitable refurbished furniture available on the market and because of doubts over the history of the furniture products how to prove that the furniture was really refurbished in the first place.

The third point is interesting but does not actually reduce the demand for new furniture by public organisations.

[23] UK Government Buying Standards Impact Assessment: click here.

[24] Walsh, 2011. "Public procurement of remanufactured products. An examination of the potential for increasing the use of remanufactured products by local authorities in the North East of England". Click here.

The second point is considered as the optimum ambition level because the need to procure new furniture is reduced and the procurer will be assured that the refurbished furniture items originated from themselves due to the fact that it is a closed-loop service where the contracting authority actually provides the old furniture to be refurbished to the service provider and receives back the refurbished furniture product(s) as illustrated in Figure 4 below.

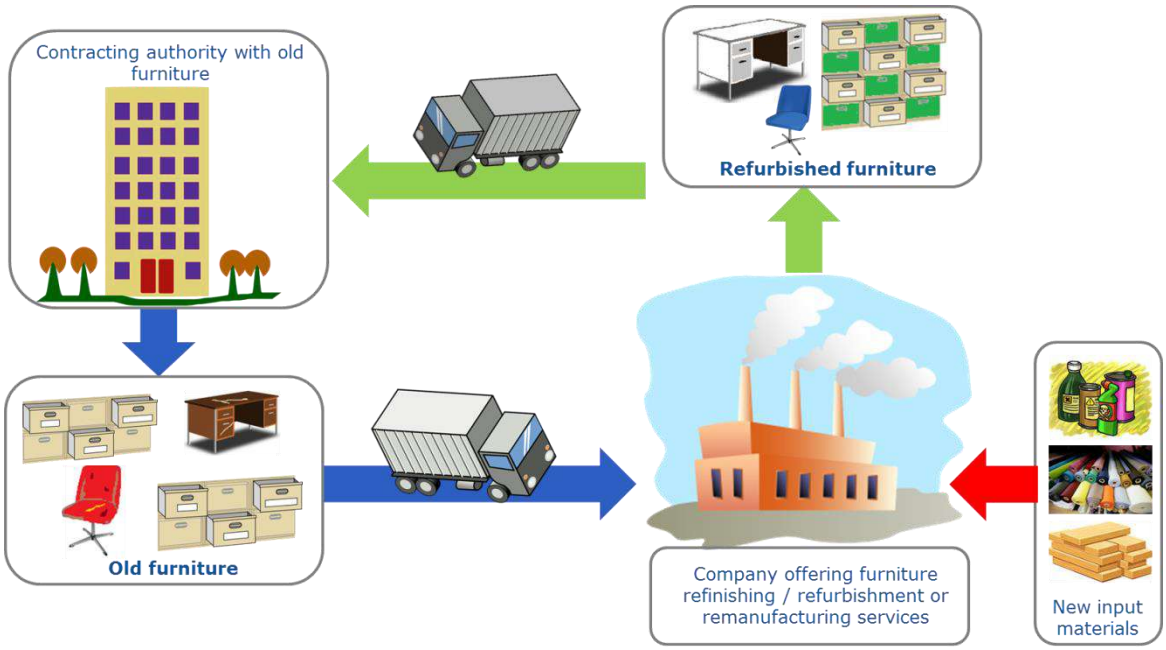

Figure 4. Flow diagram of a "closed loop" refurbishment/manufacturing/refinishing operation.

(i) Best practice with the closed loop approach – tenderer side

Discussions with a leading company in Belgium led to an understanding of what could be considered to be best practice in this area. The company was ISO 14001 and EMAS certified and with each project, discusses with the client what standard options, materials and services the company can offer although any custom requests are also welcomed. Due to the nature of most refurbishment operations, the furniture must be transported to the service providers' site, although some minor operations can be carried out at the client's site. The company keeps an inventory of any new materials and chemicals used during the refurbishment operation and use an LCA tool to calculate the CO2 equivalent savings due to the refurbishment operation compared to a typical scenario if new furniture was instead purchased. A certificate of the CO2 savings is presented to the client. It was emphasised that in addition to CO2 savings, there were considerable economic savings too. However, the potential for companies offering refurbishment services to enter into invitations for tender was completely blocked if requirements for compliance with EN testing standards or proof of origin of wood were included.

The use of existing furniture in a "closed loop" from the client greatly simplifies the calculation of the LCA savings and can allay any concerns from clients about the quality of the product provided. Some type of furniture products lend themselves better to refurbishment than others. For example, more complex refurbishment operations that require cutting and reshaping of wooden materials cannot always be carried out with lower quality wooden panels.

(ii) Best practice with the closed loop approach – procurer side

The UK can be considered as one of the leading authorities. In response to a perceived lack of demand, the UK Government has outlined plans to increase the amount of refurbished or refinished furniture, as reflected in the wording of their recently revised (June 2014) furniture buying standards[25].

Figure 5. Hierarchical approach promoted by the UK government for furniture procurement.

Unfortunately, as of November 2014, no furniture refurbishment framework contract had yet been signed by the centralised UK procurement organisation (the Crown Commercial Service) although it will be very helpful in the future to understand the issues that may arise for procurers with such contracts.

(iii) Degrees of refurbishment

The term "refurbishment" is considered as a catch-all term to include the various degrees of repair, refurbishment and refinishing that may be applied to a furniture product that contribute towards the product looking and/or functioning "as new" but also for other operations (i.e. remanufacturing, reupholstering and remodelling) that may transform the product it something unrecognisable from the original product. As a guide to procurers, the following terms and definitions will be considered to fall within the scope of furniture refurbishment:

- ***Surface refinishing*** (of coated wooden surfaces): complete removal of the original finish, sanding of the freshly exposed wood, followed by staining and sanding again prior to the application of a new finish. The finish will likely include more than one coating and the type of coating(s) used in the finish will depend on the requirements of the customer. This operation will completely change the appearance of the product which will appear "as new".
- ***Surface refurbishing*** (of coated wooden surfaces): Colouring or filling of scratches and chips as well as blending of any worn areas by the application of new stain. May include a complete new top coating on top of the existing surface finish. Not as extensive a job as refinishing and cheaper. This operation may also completely change the appearance of the product depending on the nature of the top layer, if one is applied. Product will have an "as new" appearance. In certain cases, due to silicone and other contaminants, an unsatisfactory uneven surface may occur, in which case surface refinishing would be necessary.
- ***Touch up / spot repair*** (of coated wooden surfaces): Repairs made by colouring or filling of isolated scratches or other visible damage and blending into

[25] http://sd.defra.gov.uk/advice/public/buying/products/furniture/standards/

the surrounding area. Much simpler task than refinishing or surface refurbishment and may be carried out at the customers site.

- ***Mechanical refurbishment***: Tasks will vary depending on the nature of the furniture product but may include tasks such as checking, lubrication, adjustment, tightening, repair and/or replacement of: drawer runners, table slides, joints, protective floor glides, gas-lifts, doors and drawers.
- ***Reupholstering***: May include the basic repair of torn upholstery fabric covering material, the complete replacement of the upholstery fabric covering material, the replacement of the underlying padding material or the replacement of both the padding material and covering fabric.
- ***Remodelling***: Involves the conversion of an existing furniture product (or products) into a new furniture product (or products) with different dimensions and/or functionality. For example the conversion of a large L-shaped desk into two smaller rectangular desks or the conversion of a TV cabinet with open shelves into a set of drawers.

In order to estimate the cost of any refurbishment operation, it is necessary to understand clearly the initial condition of the furniture and the desired end product. Based on the difference between the starting furniture and the desired output, the refurbishment operations that are needed can be identified. This information should be provided in the Invitation to Tender (ITT) as far as possible.

The tenderer should be afforded the freedom to decide precisely how much of the original material can be used in the refurbished product(s) in order to produce good quality furniture that meets any other relevant technical specifications. However, the contracting authority may wish to fix certain requirements such as the colour and material for any upholstery or dimensional requirements.

5.1.4 TS1: Criteria proposal for refurbishment requirements

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS1: Refurbishment requirements *(same for core and comprehensive)* The tenderer shall refurbish the furniture items provided by the contracting authority according to the specified requirements. Depending on the kind of furniture to be refurbished and the condition of the existing furniture, the public authority shall detail as much as possible the operations to be carried out (e.g. re-spraying of metalwork, repair and/or re-finishing of wood surfaces, re-upholstery, desk conversions etc.). (The public authority might first tender a separate study to receive an evaluation of the existing furniture stock (type, number, state etc.) and provide this description with the call for tender.) **Verification:** The tenderer shall provide details of all the refurbishing operation(s) to be carried out.	

Summary of rationale:

- Clear potential for environmental benefits and economic savings with refurbishment.
- Necessary to clarify what scale or type of refurbishment is expected from tenderers.
- Does not necessarily limit the tenderers to specific refurbishment operations if they believe a slightly different approach can be taken to achieve the same result at a lower cost.

5.2 Technical Specification 2: Durable upholstery coverings

5.2.1 Why relevant to GPP?

The physical requirements for upholstery covering materials are of paramount importance to upholstered furniture products. Poor quality covering materials are more likely to suffer from wear and tear and even minor damage will grow into more serious damage with continued normal use if the covering material is not repaired. Damage to upholstery covering materials is highly visual and may lead to consumer association with low quality products and perhaps result in premature end-of-life of the entire product.

This is an especially important consideration with GPP since the price is the determinant factor in the award of the tender and that lower quality and less durable upholstery materials are frequently cheaper than good quality and more durable materials. Consequently, the use of higher quality upholstery materials, due to their impact on improved durability of the entire furniture product, should be either specified as minimum requirements as a safeguard against cheaper and less durable alternative materials being used or at least as an award criterion to encourage tenderers to source more durable materials even if these are slightly more expensive.

Furniture upholstery materials (ignoring padding) generally fall into three main categories:

- Textile fabrics (such as cotton, wool, polyester);
- Coated fabrics (i.e. continuous layers of typically PVC or polyurethane that may have a textile backing – often regarding as artificial leather); or
- Genuine leather.

5.2.2 Stakeholder discussion

Representatives from the leather industry highlighted that there has been a long history of dialogue between furniture manufacturers and leather producers regarding what is good quality leather that is fit for use in furniture and what is not. This has resulted in the publication of *EN 13336: "Leather – Upholstery leather characteristics – Guide for selection of leather for furniture*". In Table 7 of Appendix I, the EN 13336 requirements for the physical quality of leather can be found.

For textile fabrics and coated fabrics, the physical quality requirements set out in Table 8 and Table 9 of Appendix I have been developed in collaboration with industry representatives. The values stated in Appendix I are considered to represent high quality coated fabrics that would effectively prevent the use of much cheaper and lower quality coated fabrics being used.

5.2.3 What relevant ecolabel criteria and other green initiatives say

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) simply requires that any textile coverings used must meet the requirements of the EU Ecolabel for textiles or any other regionally recognised ISO Type I Ecolabel or the OEKO-TEX 100 standards.

The Blue Angel RAL UZ 148 (Jan. 2010) criteria for low emission upholstery leathers simply requires that any leather should comply with requirements for safety, abrasion resistance, tensile strength, light-fastness, rub-fastness and deformation to compression as per existing ISO, EN or DIN standards.

The Nordic Ecolabel for textiles, hides/skins and leather (version 4.0, Dec. 2012) has a series of physical requirements for textile fabrics. Dimensional changes during washing of furniture fabrics should be less than or equal to 2.0% after washing according to EN 6330 and ISO 5077 tests at the temperature stated on the fabric. Colour fastness to washing for removable and washable furniture fabrics that are non-white and have been dyed or printed, should be at least level 3-4 according to ISO 105 C06. Resistance to wet rubbing and dry rubbing should be at least level 2-3 and level 3-4 respectively according to ISO 105 X12 for any non-white furniture fabrics that have been dyed or printed. Colour fastness to light must be level 5 for furniture fabrics according to EN ISO 105 B02 although a level of 4 is permitted for light coloured fabrics of certain fibre blends. The resistance to pilling of furniture fabrics needs to be at least level 4 according to EN ISO 12945-2.

The EU Ecolabel for textiles addresses the same physical requirements for textiles as mentioned for the Nordic Ecolabel and is virtually identical in the ambition level and applicable conditions.

This EU GPP award criterion follows the same criteria addressed by the Nordic and EU Ecolabel for textiles. Each of the requirements can be verified by well-established international standards. Consequently, any suppliers who make the effort to produce compliant coated fabric, leather or textile fabric upholstery covers can appeal not only to textile companies and furniture companies that are interested in applying for an EU Ecolabel license but also to those companies that want to be more competitive in relevant EU GPP ITTs.

5.2.4 Ambition level

The ambition level for coated fabrics and leathers has been decided in collaboration with industry standards. It should be emphasised that these standards are not legally enforced but are voluntary industry guidelines which, in the case of leather, has been published as an official EN standard.

With textiles, the ambition level broadly aligns with the physical durability criteria set out for EU Ecolabel textiles in Decision 2014/350/EU[26] as far as these criteria are relevant to furniture upholstery.

For textile fabrics, coated fabrics and leather, the ambition level is aligned with the criteria set out in the EU Ecolabel for furniture (Commission Decision (EU) 2016/1332).

[26] Commission Decision of 5 June 2014 establishing the ecological criteria for the award of the EU Ecolabel for textile products. OJ L 174, 13.6.2014, p. 45-83.

5.2.5 TS2: Criteria proposal for durable upholstery coverings

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS2: Durable upholstery coverings *(only applicable to upholstered furniture)* *(same for core and comprehensive)* (*This criterion shall only apply when the refurbishment operations involve the introduction or replacement of upholstery covers*). The tenderer shall use upholstery covering materials, which may be based on either leather, textile fabrics or coated fabrics that comply with all of the physical quality requirements set out in Table 7, Table 8 or Table 9 of Appendix I, as appropriate. **Verification:** The tenderer shall provide a declaration from the leather supplier, textile fabric supplier or coated fabric supplier as appropriate, supported by relevant test reports, that the upholstery covering material meets the physical requirements for leather, textile fabrics or coated fabrics as specified in Table 7, Table 8 and Table 9 of Appendix I respectively. Upholstery materials which have been awarded the EU Ecolabel for textiles, as established in Commission Decision 2014/350/EU or other relevant ISO Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.	

Summary of rationale:

- Low quality (and cheaper) upholstery coverings can lead to premature end of life of the entire furniture product. It is necessary to incentivise the use of more durable and higher quality upholstery coverings, so that they can be competitive in invitations to tender.
- Physical requirements follow industry guidance for leather and for coated fabrics.
- Minimum requirements for textile fabrics are covered by Nordic Ecolabel and EU Ecolabel criteria.

5.3 Technical Specification 3: Blowing agents

5.3.1 Why relevant to GPP?

Blowing agents are of high relevance to the physical properties of padding materials used in furniture upholstery. The most common padding materials used are polyurethane foam (PUR, representing around 80% of the market) and latex foam.

The aim of any blowing agent is to create bubbles in a liquid matrix which, when set, will result in a low density, low thermal conductivity matrix with adequate strength, elasticity and other product specific properties.

Blowing agents may act by a predominantly *physical mechanism* (where liquid agents are volatilised into gases during the high processing temperatures and later cool back down to liquids) or by a predominantly *chemical mechanism* (where gaseous reaction products created bubbles within the liquid matrix prior to it setting).

Some of the best "*physical action*" blowing agents, in terms of product properties, include several chlorofluorocarbons (CFCs) which have been recognised for a number of years to have a strong and adverse effect on both ozone layer depletion and global warming potential. Considering that most physical action blowing agents remain in the foamed product in liquid forma and can be released to the atmosphere at the End-of-Life (EoL) of the product, their use is a major environmental concern.

Following the implementation of the Montreal Protocol over 20 years ago, CFCs have been gradually substituted by hydrochlorofluorocarbons (HCFCs) and almost completely phased out by 2010.

However, while much better than CFCs, many HCFCs also exhibit a significant ozone depletion potential and global warming potential. The Montreal Protocol began phasing out of HCFCs in 1996 – a process that is not expected to be completed until around 2030. A major alternative for HCFCs are hydrofluorocarbons (HFCs) which, due to the absence of chlorine, pose no significant threat to the ozone layer.

Despite the low ozone depletion potential of HFCs, they are known to exhibit a high global warming potential and so there is continued pressure to find lower environmental impact alternatives to HFCs as well. A working group is currently considering possible amendments to the Montreal Protocol that would lead to a framework for the future phasing out of HFCs.

In the context of furniture upholstery padding materials, current industry practice has shown that it is possible to produce latex foams by mechanically beating liquid latex to entrain air bubbles and to produce polyurethane foams by using hydrocarbons, liquid CO_2, water with isocyanates or combinations thereof.

5.3.2 Stakeholder discussion

Only limited stakeholder discussion took place regarding the potential criteria applying to blowing agents since it was widely accepted that there were clear environmental concerns with the use of halogenated blowing agents. Industry representatives confirmed that PUR foams produced according to best practice in the industry used non-halogenated blowing agents.

In terms of assessment and verification, industry experts confirmed that in the absence of a satisfactory declaration, it would be possible to test a foam sample relatively routine laboratory processes for gas extraction and analysis by gas chromatography to determine if halogenated blowing agents had been used.

5.3.3 What relevant ecolabel criteria and other green initiatives say

The FEMB sustainability basic level requirements for office and non-domestic furniture for indoor use (Draft 2, July 2012) state that as a prerequisite that no halogenated organic compounds, CFCs or HCFCs shall be used as blowing agents or auxiliary blowing agents.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires no CFC, HCFC or HFC to be used in any padding materials as expansion agents and that any isocyanates used are named.

The Blue Angel RAL UZ 117 (Sept. 2009) criteria for low emission upholstered furniture require that:

"partially fluorinated hydrocarbons (HFCs), perfluorinated hydrocarbons (PFCs), partially halogenated chlorofluorocarbons (H-CFC), chlorofluorocarbons (CFCs) or methylene chloride shall not be used as physical blowing agents or auxiliary blowing agents".

The Nordic Ecolabel for furniture and fitments (version 4.9, Mar. 2011) states in criterion R38 that:

"*CFC, HCFC, HFC, methylene chloride and halogenated organic compounds must not be used as blowing agents*".

In addition to this, the Nordic ecolabel requires that the use of isocyanates for blowing processes is only permitted where adequate protective equipment is used and the process carried out according to regulatory requirements.

Both the EU Ecolabel criteria for bed mattresses (Commission Decision 2014/391/EU) and the EU Ecolabel criteria for furniture (Commission Decision (EU) 2016/1332) state that:

"Halogenated organic compounds shall not be used as blowing agents or as auxiliary blowing agents."

The industry-led voluntary CertPUR initiative, which is promoted in the EU by EuroPUR, states in part 2.5 of the 2016 version of its technical requirements for certification that no CFC, HCFC or halons may be used as blowing agents.

No requirements regarding blowing agents appear in the EuroLATEX ECO standard (version 2002) because it is believed that instead a mechanical process is used to entrain air bubbles within liquid latex mixtures prior to the setting process.

Overall, it is clear that the Blue Angel, Nordic Ecolabel and EU Ecolabel ban both chlorinated and fluorinated blowing agents. A different wording is used in the CertiPUR standard which quite clearly bans all of the main chlorinated blowing agents of concern as well as many fluorinated compounds of concern by the exclusion of HCFCs and halons.

5.3.4 Ambition level

Due to the seriousness of the potential environmental impacts, the well-established alternative and less harmful blowing agents available and the potential to verify declarations with testing if deemed necessary, it is considered to be of particular value to fully align with the relevant EU Ecolabel requirements and encourage upholstery producers to use non-halogenated blowing agents. Even though HFCs are not currently being phased out as blowing agents, it is likely that this will eventually happen, as was the case with their CFC and HCFC predecessors.

5.3.5 TS3: Criteria proposal for blowing agents

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS3: Blowing agents *(only applicable to upholstered furniture)* *(same for core and comprehensive)* Where foam padding materials are used in furniture upholstery, halogenated organic compounds shall not be used as blowing agents or as auxiliary blowing agents in the manufacture of such padding materials. **Verification:** The tenderer shall provide a declaration of non-use from the manufacturer of the foam.	

Summary of rationale:

- CFCs and HCFCs have a considerable potential to both deplete the ozone layer and contribute to global warming. The use of HCFCs will not be phased out until 2030, so they should be specifically excluded now under GPP criteria.
- HFCs are better alternatives (negligible ozone depletion potential) but have a large global warming potential and so should be avoided too. There are currently no international and binding agreements about phasing out their use.
- Industry has shown that alternatives to halogenated blowing agents (e.g. CFCs, HCFCs and HFCs) can be used and so they should be actively encouraged via GPP criteria.

5.4 Technical Specification 4: Refurbished furniture product warranty

5.4.1 Why relevant to GPP?

The lifetime of a furniture product has a strong influence on its environmental impact. However, many of the EN standards relating to the durability of furniture entail destructive testing, which would not be practical when applying to relatively small groups of refurbished furniture products, many of which may be slightly different or have different histories of use.

Instead of requiring compliance with technical standards, it is considered more appropriate to promote the refurbished product's durability, longevity and reparability and to use warranty and spare part availability criteria as useful proxy for durable and long lasting products.

The legal guarantee of consumer goods set out in Directive 1999/44/EC only applies to consumers that are physical persons. Legal entities (companies with limited liability, public limited companies, non-profit organisations, public authorities etc.) are not consumers according to the law and thus the EU directive is not applicable.

To avoid possible confusion between legal guarantees and commercial guarantees, the term "warranty" is used instead of "commercial guarantee". It is therefore advisable (unless there are different national rules covering this issue) that the warranty period is set out in the technical specifications.

5.4.2 Stakeholder discussion

Unlike for new furniture, only limited discussion has taken place regarding warranties for refurbished furniture. However, it was generally agreed that such warranties would represent a practical and common sense alternative to requirements for complying with any relevant EN technical standards relating to the product type.

For new furniture in particular, stakeholders were largely against the idea of extended warranties on furniture products. They pointed out that many promises can be made to win points in an ITT but what really matters is who the terms and conditions of any extended warranty, which are often far from clear, may be applied in cases where a lack of conformity of the furniture arises. So unless the terms and conditions required in an extended warranty are made clear in an ITT and required to be essentially identical for all tenderers, then such a criterion could potentially become problematic.

5.4.3 What other relevant ecolabel criteria and green initiatives say

It should be noted that the authors are unaware of any specific requirements that relate to warranties for refurbished furniture. It should be noted that the following references will generally refer to new furniture products.

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) a 5 year commercial warranty be applied to furniture products at the prerequisite level or a 10 year commercial warranty at the advanced level.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2104) does not make any clear provision about final product guarantees or warranties, but simply a 5 year commitment to provide spare parts.

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) does not make a specific commitment to a certain minimum warranty period but only to compliance with relevant EN or ISO fitness for use standards.

The Blue Angel criteria for low emission upholstered furniture (RAL UZ 117, Sept. 2009 version) and for low emission furniture and slatted frames made of wood and wood-based materials (RAL UZ 38, Jan. 2013 version) specify a minimum 5 year guarantee of furniture parts that are subject to wear, such as hinges, locks and table leaves, but not lights or light fittings.

5.4.4 Ambition level

It is difficult to set a universal minimum warranty period for all furniture products because there is such a huge range of products within the scope, each with different types or use and subject to different types of wear and tear, so contracting authorities are strongly encouraged to investigate what is a reasonable warranty period to expect for the specific furniture types they are seeking to procure. This becomes even more challenging when considering refurbished products.

There are several examples of companies based in North America that provide warranties ranging from 0 to 5 years for refurbished office furniture products. In the EU, there is much less information available regarding warranties with refurbished furniture. The provision of product warranties with refurbished furniture is likely to result in a cost increase to the procurer.

It would be reasonable to ask as a core level requirement that the refurbished furniture meets the same minimum legal requirements that are set out for new furniture products sold to end consumers (i.e. 2 years). At the comprehensive level, it appears that 5 years would reflect the best practice currently available in North America.

The comprehensive level of GPP criteria is set to 3 years and if procurers which to incentivise longer warranties, the approach proposed here is to use extended warranties as part of award criteria.

During the warranty period, if the furniture product is found to be out of conformity with the contract specifications, spare parts or any relevant repair and replacement service needed should be provided at no additional cost to the contracting authority so long as the lack of conformity can be presumed to have arisen either before use or only after normal use.

5.4.5 TS4: Criteria proposal for refurbished furniture product warranty

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS4: Refurbished furniture product warranty The tenderer shall provide a minimum two year *(longer for more valuable items)* warranty effective from the date of delivery of the product. This warranty shall cover repair or replacement and include a service agreement with options for pick-up and return or on-site repairs. The warranty shall guarantee that the goods are in conformity with the contract specifications at no additional cost. **Verification:** The tenderer shall provide a written declaration covering the above-mentioned guarantee. A copy of the warranty shall be provided by the tenderer. They shall provide a declaration that they cover the conformity of the goods within the contract specifications.	**TS4: Refurbished furniture product warranty** The tenderer shall provide a minimum three year *(longer for more valuable items)* warranty effective from the date of delivery of the product. This warranty shall cover repair or replacement and include a service agreement with options for pick-up and return or on-site repairs. The warranty shall guarantee that the goods are in conformity with the contract specifications at no additional cost. **Verification:** The tenderer shall provide a written declaration covering the above-mentioned guarantee. A copy of the warranty shall be provided by the tenderer. They shall provide a declaration that they cover the conformity of the goods within the contract specifications.

Summary of rationale:

- Warranties are of particular importance in refurbished products since compliance with technical standards applicable to new items cannot reasonably be expected.
- The level of ambition at the core level reflects the length of warranty that would apply to new products in the EU while the comprehensive level reflects best-practice amongst suppliers of refurbished office furniture and also aligns with the EU Ecolabel ambition level.
- The useful lifetime of refurbished furniture is an important aspect of furniture LCA.

5.5 Award criterion 1: Low chemical residue upholstery coverings

5.5.1 Why relevant to GPP?

Upholstery covering materials may come into direct skin contact with users and the potential presence of hazardous substances that can generate adverse health effects via dermal contact is an obvious concern. Where dermal contact is possible, assessment of the extractability of substances from materials in contact with artificial sweat solutions, for example as defined in EN ISO 105 E04, is especially relevant. Of particular concern are heavy metals that may be used in dyes, residual formaldehyde and arylamines. Test protocols for the analysis of extractable heavy metals in leather (e.g. EN ISO 17072-1 and EN ISO 17075) and in textiles (e.g. OEKOTEX 100 an independent testing and certification system) are well established and can be verified by testing of the final material if necessary.

Due to uncertainty over the market availability of upholstery fabrics and leather that meet this criterion, it was considered that this would not be suitable as a minimum technical specification but only as an award criterion. Nonetheless, furniture refurbishment is an ideal opportunity to introduce upholstery covers of good environmental performance.

5.5.2 Stakeholder discussion

The substances to test for and applicable limits are the same as those applied in other "green" schemes and so no detailed discussion took place amongst stakeholders. The standards apply to either leather of textile fabrics, although a representative of the coated fabric industry confirmed that the tests and limits for textiles fabrics could also be applied to coated fabrics.

5.5.3 What relevant ecolabel criteria and other green initiatives say

The FEMB sustainability basic level requirements for office and non-domestic furniture for indoor use (Draft 2, July 2012) list 29 azo dyes that are classified as either carcinogenic or that may cleave to form carcinogenic by-products and states that these should not be present (i.e. not exceed 20mg/kg per substance) in any textile or leather used in the furniture product if that leather or textile is used in proportions that exceed 1% of the furniture product weight. The same basic level requirements set a limit of 300 mg/kg for free formaldehyde. The advanced level requirements simply state that the textile or leather should meet the requirements of any regionally recognised ISO Type I ecolabel (including the EU Ecolabel, OEKO-TEX 100, Blue Angel RAL UZ 154 for textiles or RAL UZ 148 for leather).

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) simply requires that any textile coverings used must meet the requirements of the EU Ecolabel for textiles or any other regionally recognised ISO Type I ecolabel or the OEKO-TEX 100 standards.

The Blue Angel RAL UZ 148 (Jan. 2010) criteria for low emission upholstery leathers set the same limit of 3 mg/kg for chromium VI in leather as stated here. A list of 9 carcinogenic, mutagenic or toxic to reproduction (CMR) azo dyes, 22 azo dyes that may cleave to form CMR by-products and 20 potentially sensitising dyes are specifically banned. Furthermore, no dyes or pigments based on cadmium, mercury, lead or nickel are permitted. These same conditions apply in RAL UZ 117 for low-emission upholstered furniture (Sept. 2009).

The Nordic Ecolabel for textiles, hides/skins and leather (version 4.0, Dec. 2012) has the same limit of 3 mg/kg for chromium VI in leather but also introduces further requirements of no lead or cadmium being detectable (with 10 mg/kg considered as the limit of detection). A list of 23 azo dyes that are not permitted to be used is also provided. The limits for free or partly hydrolysable formaldehyde in textiles are set to 20 mg/kg and for leather, 75 mg/kg.

The OEKO-TEX standard defines limits for four categories of textiles (I – baby, II – direct skin contact; III- no direct skin contact and IV – decoration material). The criteria set out limits different chemical residues in the final textile product. For formaldehyde, the EU GPP limits correspond to OEKO-TEX Category III and IV textiles and for extractable heavy metals, the limits correspond to OEKO-TEX limits for Category II, III and IV textiles.

The EU Ecolabel for textiles (Commission Decision 2014/350/EU) sets a stricter limit of 75 mg/kg for free formaldehyde in textiles and the limits for extractable heavy metals are the identical to those proposed with this EU GPP award criterion. Furthermore a list of 24 carcinogenic arylamines that should be tested for in textiles is provided as well as an indicative list of 142 dyes which may cleave to form carcinogenic arylamines and whose use is not recommended and a list of 30 dyes which are CMR and/or potentially sensitising and whose use is banned.

5.5.4 Ambition level

As a general note, the levels of residues in textiles have stricter limits for those products intended for use with babies or children less than 3 years old and in particular with clothing. Such products are not considered as a predominant factor in GPP for furniture and so the ambition level has been aligned with the requirements for typical furniture products used in offices and commercial environments.

The restricted arylamine compounds may be present not only due to the direct use of restricted dyes but also as by-products of a side-reaction from non-restricted dyes. A list of restricted arylamine compounds provided in entry 43 (Appendix 8) of Annex XVII to REACH is reproduced in Appendix II of this report (Table 10).

For reference, Appendix II also includes a list of dyes that are not recommended to be used (Table 11) because they may cleave to form some of the restricted arylamines listed in Table 10 of Appendix II.

Formaldehyde is a chemical residue that is often left after finishing treatments. The most serious hazard classification it has is H351 (suspected of causing cancer) and it is also classified as H317 (skin sensitiser), which is of concern in furniture upholstery that come into direct and prolonged skin contact with users. The free formaldehyde limit of 300 mg/kg aligns with the requirements set out in the OEKO-TEX 100 standards for Category II, III and IV textile products.

For artificial sweat extractable heavy metals, the limits are aligned with the OEKO-TEX limits for Category II (direct skin contact). The OEKO-TEX limits are identical for Category III (no direct skin contact) and Category IV (decoration materials) textiles. Chromium VI is a concern that is unique to leather due to the potential use of large quantities of chromium-based tanning agents.

5.5.5 AC1: Criteria proposal for low chemical residue upholstery coverings

Core criteria	Comprehensive criteria
AWARD CRITERION	
	AC1: Low chemical residue upholstery coverings *(only applicable to upholstered furniture)* Points shall be awarded where the upholstery covering material is shown to comply, as appropriate, with the limits for restricted arylamine dyes, extractable heavy metals and free formaldehyde set out below. For textile fabrics and coated fabrics: • No restricted arylamines (see Table 10 in Appendix II) present above 30 mg/kg (limit applies to each individual amine) according to EN ISO 14362-1 and 14362-3. • Free and partly hydrolysable formaldehyde ≤ 75 mg/kg according to EN ISO 14184-1. • Extractable heavy metals determined according to EN ISO 105-E04 being less than the following limits (in mg/kg): antimony ≤ 30.0; arsenic ≤ 1.0; cadmium ≤ 0.1; chromium ≤ 2.0; cobalt ≤ 4.0; copper ≤ 50.0; lead ≤ 1.0; mercury ≤ 0.02 and nickel ≤ 1.0. For leather: • No restricted arylamines (see Table 10 in Appendix II) present above 30 mg/kg (limit applies to each individual amine) according to EN ISO 17234-1. • Chromium VI should not exceed 3 mg/kg according to EN ISO 17075 (detection limit). • Free and partly hydrolysable formaldehyde ≤ 300 mg/kg according to EN ISO 17226-1. • Extractable heavy metals determined according to EN ISO 17072-1 being less than the following limits (in mg/kg):

	antimony ≤ 30.0; arsenic ≤ 1.0; cadmium ≤ 0.1; chromium ≤ 200.0; cobalt ≤ 4.0; copper ≤ 50.0; lead ≤ 1.0; mercury ≤ 0.02 and nickel ≤ 1.0. **Verification:** Points shall be awarded to tenderers that provide a declaration that the leather, textile fabric or coated fabric upholstery covering material, as appropriate, complies with the above limits, supported by results from relevant test methods either commissioned by the tenderer themselves or the material supplier. Upholstery materials which have been awarded the EU Ecolabel for textiles, as established in Commission Decision 2014/350/EU or other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.

Summary of rationale:

- Chemical residues are inevitable in textile, coated fabric and leather upholstery, but these should be minimised as far as is practical in materials that can be expected to come into direct skin contact, such as furniture upholstery.
- The arylamine dyes, extractable heavy metals and free formaldehyde are common chemical residues of concern in these types of materials.
- The requirements stated in this award criterion align with the relevant requirements of OEKO-TEX 100, EU Ecolabel textiles and so should help reinforce these schemes, by incentivising furniture refurbishers to try to source them in order to make their bids more competitive.

5.6 Award criterion 2: Low chemical residue padding materials

5.6.1 Why relevant to GPP?

The production of polyurethane or latex foams are specifically targeted with this criterion due to the fact that together they account for over 90% of the market for padding materials used in upholstered furniture. A number of hazardous chemicals may be used in the production process or either type of foam and may remain in the final product, where there is a limited risk for exposure to users and a more significant risk for release to the environmental at the End-of-Life. The aim of this criterion is to promote those foams that are produced according to industry best practice and which limit the quantities of hazardous substances that remain as residues in the foam product.

5.6.2 Stakeholder discussion

The substances, test methods and limits are the same as those applied in voluntary industry-led initiatives. No detailed discussion took place amongst stakeholders although a representative from the polyurethane industry confirmed that the requirements were in line with industry best practice for PUR producers.

5.6.3 What relevant ecolabel criteria and other green initiatives say

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) that flexible PUR foam must comply with the CertiPUR standard and that for latex foams, the butadiene content must be less than 1 mg/kg latex.

The Blue Angel RAL UZ 117 (Sept. 2009) criteria for low emission upholstered furniture require that no "organotin" compounds are to be used in polyurethane manufacture. An organotin compound is defined as a compound with a Tin-Carbon bond. For latex foams, the Blue Angel requirements are as follows:

- Chlorophenols (including salts and esters) < 1 mg/kg
- Butadienes < 1 mg/kg

The Nordic Ecolabel for furniture and fitments (version 4.9, Mar. 2011) requires that padding materials comply with the horizontal chemical requirements, which include the non-presence / non-addition of halogenated organic compounds, PFOA, PFOS, BPA, chlorophenols, dimethylfumarate, alkylphenols and alkylphenolethoxylates, phthalates, aziridine, polyaziridines, any CMR compounds, pigments or additives based on lead, tin, cadmium, chromium VI or mercury, dyes that are classified as CMR, toxic, highly toxic or toxic to the environment, chemicals with aromatic solvents in concentrations exceeding 1% by weight and glues with VOC contents exceeding 3% by weight. In addition to this, the following specific requirements for latex and PUR foams apply:

- (Latex) Butadiene < 1 mg/kg latex
- (PUR and Latex) Formaldehyde < 20 ppm (as per EN ISO 14184-1)
- (PUR and Latex) Formaldehyde ≤ 0.005 mg/m3 (as per ENV 13419-1)

The EuroLATEX ECO standard (version 14.02.02 from 2002) sets a number of requirements for chemical residues in latex foams, including pentachlorophenol, a list of 22 pesticides plus related compounds, butadiene, vinyl chloride monomer, extractable heavy metals (arsenic, lead, cadmium, total chromium, cobalt, copper, nickel and mercury) as well as various limits for VOCs that will be detailed in the next award criterion.

The CertiPUR standard (version 2016) that is promoted in Europe requires testing for the following residual chemicals: 8 tinorganic substances (i.e. TBT, DBT, MBT, TeBT, MOT, DOT, TcyT and TPhT), 6 phthalate plasticisers, TDA and MDA, heavy metals (antimony, arsenic, cadmium, total chromium, chromium VI, cobalt, copper, lead, nickel, mercury and selenium), the non-use of allergenic dyes, CMR dyes or dyes that may cleave to CMR arylamines as well as the non-use of a list of specific individual hazardous substances.

The EU Ecolabel for bed mattresses (Commission Decision 2014/391/EU) and for EU Ecolabel for furniture (Commission Decision (EU) 2016/1332) have the same criteria for latex foams and PUR foams. For the former, the non-use of chlorophenols is required, limits are set for 9 different heavy metals and 25 specific pesticides and butadiene content must be below 1 ppm. For PUR foams, the non-use of biocidal products must be declared. Limits are set for 11 heavy metals, 6 different phthalate plasticisers and 8 tinorganic substances as well as for TDA and MDA. A further 17 substances or substance groups must be declared as not intentionally added during the production process.

5.6.4 Ambition level

The ambition level generally follows the EU Ecolabel for furniture, which in turn is aligned with the EU Ecolabel for bed mattresses. In turn, the criteria for EU Ecolabel bed mattresses were largely inspired by the existing voluntary and industry-led EuroLATEX ECO standard and CertiPUR standard.

However, after some consideration and cross-checking, some modifications have been made to the EU GPP criteria that distinguish it from the EU Ecolabel criteria for furniture and for bed mattresses.

The testing requirement for antimony in latex foam has been removed from EU GPP criteria for furniture because this requirement does not appear in the EuroLATEX ECO Standard but was simply kept in the current EU Ecolabel criteria for bed mattresses due to the fact that it was present in the previous EU Ecolabel criteria version.

The distinction between cumulative limits for phthalates in PUR foams that appears in the EU Ecolabel for furniture where both DIDP and DINP are restricted for furniture designed for children less than 3 years old but not restricted for other furniture has not been considered simply to avoid any potential confusion amongst procurers.

Overall, the proposed requirements for this EU GPP award criterion are equal to or slightly lower than the accepted industry standards (EuroLATEX and CertiPUR) and relevant EU Ecolabel criteria for bed mattresses and furniture.

5.6.5 AC2: Criteria proposal for low chemical residue padding materials

Core criteria	Comprehensive criteria
AWARD CRITERION	
	AC2: Low chemical residue padding materials[27] ***(only applicable to upholstered furniture)*** Where latex foam is used as a padding material in furniture upholstery, points shall be awarded if the foam complies with the requirements for chlorophenols, heavy metals, pesticides and butadiene listed in Table 12 of Appendix III, in accordance with the corresponding test method (A-D) listed in the same table. Where polyurethane foam is used as a padding material in furniture upholstery, points shall be awarded if the foam complies with the requirements for heavy metals, plasticisers, TDA, MDA, tinorganic substances and other specific substances listed in Table 13 of Appendix III in accordance with the corresponding test method (A-E) listed in the same table. Where other padding materials are used, points shall be awarded if compliance with the chemical residue limits set out in either Table 12 or Table 13 of Appendix III can be demonstrated. **Verification:** **For latex foams:** The tenderer shall provide a declaration of compliance with this criterion, supported by test reports according to the following methods: A. For chlorophenols the tenderer shall provide a report presenting the results of the following test procedure. 5 g of sample shall be milled and chlorophenols shall be extracted in the form of phenol (PCP), sodium salt (SPP) or esters. The extracts shall be analysed by means of gas chromatography (GC). Detection shall be made with mass spectrometer or electron capture detector (ECD). B. For heavy metals the tenderer shall provide a report presenting the results of the following test procedure. Milled sample material is eluted in accordance with DIN 38414-S4 or equivalent in a ratio of 1:10. The resultant filtrate shall be passed

[27] Note that chemical residue testing requirements for latex foam and polyurethane foams have been established by industry-led voluntary schemes such as the EuroLatex ECO Standard and the CertiPUR standard. At the time of writing, these schemes were considered to provide a sufficient level of assurance.

	through a 0.45 µm membrane filter (if necessary by pressure filtration). The solution obtained shall be examined for the content of heavy metals by inductively coupled plasma optical emission spectrometry (ICP-OES), also known as inductively coupled plasma atomic emission spectrometry (ICP-AES), or by atomic absorption spectrometry using a hydride or cold vapour process. C. For pesticides the tenderer shall provide a report presenting the results of the following test procedure. 2 g of sample is extracted in an ultrasonic bath with a hexane/dichloromethane mixture (85/15). The extract is cleaned up by acetonitrile agitation or by adsorption chromatography over florisil. Measurement and quantification are determined by gas chromatography with detection on an electron capture detector or by coupled gas chromatography/mass spectrometry. The testing on pesticides is requested for latex foams with a content of at least 20 % natural latex. D. For butadiene the tenderer shall provide a report presenting the results of the following test procedure. Following milling and weighing of the latex foam, headspace sampling shall be performed. Butadiene content shall be determined by gas chromatography with detection by flame ionisation. **For polyurethane foams:** The tenderer shall provide a declaration of compliance with this criterion, supported by test reports that demonstrate compliance with the limits in Table 13 of Appendix III. For methods B, C, D and E, 6 composite samples shall be taken from a maximum depth of up to 2 cm from the surface faces of the material sent to the relevant laboratory. A. For phthalates and other specific substances listed in Table 13 of Appendix III, the tenderer shall provide a declaration supported by declarations from suppliers of the foam confirming that they have not been added intentionally to the foam formulation. B. For heavy metals the tenderer shall provide a report presenting the results of the following test procedure. Milled sample material is eluted in accordance with DIN 38414-S4 or equivalent in a ratio of 1:10. The resultant filtrate shall be passed through a 0.45 µm membrane filter (if necessary by pressure filtration). The solution obtained shall be examined for the content of heavy metals by atomic emission spectrometry with inductively coupled plasma (ICP-AES or ICP-OES) or by

	atomic absorption spectrometry using a hydride or cold vapour process. C. For the total amount of plasticizers the tenderer shall provide a report presenting the results of the following test procedure. Extraction shall be performed using a validated method such as the subsonic extraction of 0.3 g of sample in a vial with 9 ml of t-Butylmethylether during 1 hour followed by the determination of phthalates by GC using a single ion monitoring mass selective detector (SIM Modus). D. For TDA and MDA the tenderer shall provide a report presenting the results of the following test procedure. Extraction of a 0.5 g composite sample in a 5 ml syringe shall be performed with 2.5 ml of 1 % aqueous acetic acid solution. The syringe is squeezed and the liquid returned to the syringe. After repeating this operation 20 times, the final extract is kept for analysis. A new 2.5 ml of 1% aqueous acetic acid is then added to the syringe and another 20 cycles repeated. After this, the extract is combined with the first extract and diluted to 10 ml in a volumetric flask with acetic acid. The extracts shall be analysed by high-performance liquid chromatography (HPLC-UV) or HPLC-MS. If HPLC-UV is performed and interference is suspected, reanalysis with high performance liquid chromatography–mass spectrometry (HPLC-MS) shall be performed. E. For tinorganic substances the tenderer shall provide a report presenting the results of the following test procedure. A composite sample of 1-2 g weight shall be mixed with at least 30ml of extracting agent during 1 hour in an ultrasonic bath at room temperature. The extracting agent shall be a mixture composed as follows: 1750 ml methanol + 300 ml acetic acid + 250 ml buffer (pH 4.5). The buffer shall be a solution of 164 g of sodium acetate in 1200 ml of water and 165 ml acetic acid, to be diluted with water to a volume of 2000 ml. After extraction the alkyl tin species shall be derivatised by adding 100 µl of sodium tetraethylborate in tetrahydrofuran (THF) (200 mg/ml THF). The derivative shall be extracted with n-hexane and the sample shall be submitted to a second extraction procedure. Both hexane extracts shall be combined and further used to determine the organotin compounds by gas chromatography with mass selective detection in SIM modus.

Summary of rationale:

- Latex and PUR foams are the dominant padding materials used in furniture (more than 90% of the market) and their production involves the use of a number of hazardous substances.
- Chemical residues are inevitable in padding materials and by limiting their content, risks or harmful effects of exposure both during use and after End-of-Life are minimised.
- The ambition level here reflects current best practice by industry and aligns closely with relevant EU Ecolabel criteria for bed mattresses and for furniture – offering several simplified routes to demonstrating compliance.

5.7 Award criterion 3: Low emission padding materials

5.7.1 Why relevant to GPP?

The production of polyurethane or latex foams are specifically targeted with this criterion due to the fact that together they account for over 90% of the market for padding materials used in upholstered furniture. The emission of VOCs from these materials, especially in mattresses, where user contact is greatly prolonged, can be a concern and lead to adverse health effects. The degree of VOC emissions from any particular foam will depend greatly upon its composition and the production method used.

The requirement for low VOC emission foams via EU GPP award criteria can help promote industry best practice and increase procurer awareness of the better options that are available on the market.

5.7.2 Stakeholder discussion

The VOC emissions are very material specific and discussion was largely limited to specialised stakeholders representing the PUR foam industry. No objections were raised by other stakeholders to the proposal of such award criteria.

5.7.3 What relevant ecolabel criteria and other green initiatives say

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires that any flexible PUR foam should comply with the CertiPUR standard and that emissions of nitrosamines from latex foams should not exceed $5x10^{-4}$ mg/m^3.

The Blue Angel RAL UZ 117 (Sept. 2009) criteria for low emission upholstered furniture set the following emission limits for latex foams, the Blue Angel requirements are as follows:

- N-nitrosamines (test chamber method) < 1 µg/m^3
- Carbon disulphide (test chamber method) < 20 µg/m^3

Specific VOC emissions for padding materials are not specified in the Blue Angel criteria but overall VOC emission limits are set for leather and for textile covered armchairs.

The Nordic Ecolabel for furniture and fitments (version 4.9, Mar. 2011) only require for formaldehyde emission testing according to ENV 13419, setting a limit of 0.005 mg/m^3 in the test chamber. However, this is an optional test method, the other being to do a water-based extraction according to EN ISO 14184-1.

The EuroLATEX ECO standard (version 14.02.02 from 2002) sets limits for emissions of individual VOCs (e.g. vinyl chloride monomer, toluene, vinylcyclohexane, styrene, 4-phenylcyclohexene, 1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene and formaldehyde) and cumulative limits for groups of VOCs (nitrosamines, aromatic hydrocarbons and total VOCs).

The CertiPUR standard (version 2016) that is promoted in Europe requires testing for the following VOCs: formaldehyde, toluene, styrene, CMR 1A or 1B compounds, aromatic hydrocarbons and Total VOCs (TVOCs).

The EU Ecolabel for bed mattresses (Commission Decision 2014/391/EU) and for EU Ecolabel for furniture (Commission Decision (EU) 2016/1332) essentially have the same criteria for latex foams and PUR foams although they are slightly stricter than the EuroLATEX ECO standard in the sense that they require testing for carbon disulphide and that the acceptable limits for formaldehyde and nitrosamine emissions are half of the

values accepted by EuroLATEX. The stricter requirements originated from a combination of already being present in the last version of EU Ecolabel criteria (for formaldehyde and nitrosamine emission limits) and alignment with the Blue Angel (for carbon disulphide).

5.7.4 Ambition level

The ambition level generally follows the EU Ecolabel for furniture, which in turn is aligned with the EU Ecolabel for bed mattresses. In turn, the criteria for EU Ecolabel bed mattresses were largely inspired by the existing voluntary and industry-led EuroLATEX ECO standard and CertiPUR standard.

However, after some consideration and cross-checking, some modifications have been made to the EU GPP criteria that distinguish it from the EU Ecolabel criteria for furniture and for bed mattresses.

The testing requirement for carbon disulphide in latex foam has been removed from EU GPP criteria for furniture because this requirement does not appear in the EuroLATEX ECO Standard but was inserted in the current EU Ecolabel criteria for bed mattresses due to the fact that it was agreed during that revision process to align with the Blue Angel requirements.

The acceptable emission limits in EU GPP criteria for furniture for formaldehyde and nitrosamines have been increased by a factor of two to reflect the same ambition as the current EuroLATEX ECO standard.

Overall, the proposed requirements for this EU GPP award criterion are equal to or slightly lower than the accepted industry standards (EuroLATEX and CertiPUR) and relevant EU Ecolabel criteria for bed mattresses and furniture.

5.7.5 AC3: Criteria proposal for low emission padding materials

<table>
<tr><th>Core criteria</th><th>Comprehensive criteria</th></tr>
<tr><td colspan="2">AWARD CRITERION</td></tr>
<tr><td></td><td>
AC3: Low emission padding materials[28]
(only applicable to upholstered furniture)
AC3.1: Low emission latex foam padding materials
Where latex foam is used as a padding material in furniture upholstery, points shall be awarded if the latex foam complies with the requirements for VOC emissions as listed below.
Where other padding materials are used, points can also be awarded if compliance with the VOC emission limits set out below can be demonstrated.
<table>
<tr><th>Substance</th><th>Limit value (mg/m³)</th></tr>
<tr><td>1,1,1 – trichloroethane</td><td>0.2</td></tr>
<tr><td>4-Phenylcyclohexene</td><td>0.02</td></tr>
<tr><td>Formaldehyde</td><td>0.01</td></tr>
<tr><td>Nitrosamines*</td><td>0.001</td></tr>
<tr><td>Styrene</td><td>0.01</td></tr>
<tr><td>Tetrachloroethylene</td><td>0.15</td></tr>
<tr><td>Toluene</td><td>0.1</td></tr>
<tr><td>Trichloroethylene</td><td>0.05</td></tr>
<tr><td>Vinyl chloride</td><td>0.0001</td></tr>
<tr><td>Vinyl cyclohexene</td><td>0.002</td></tr>
<tr><td>Aromatic hydrocarbons (total)</td><td>0.3</td></tr>
<tr><td>VOCs (total)</td><td>0.5</td></tr>
<tr><td colspan="2">* N-nitrosodimethylamine (NDMA), N-nitrosodiethylamine (NDEA), N-nitrosomethylethylamine (NMEA), N-nitrosodi-i-propylamine (NDIPA), N-nitrosodi-n- propylamine (NDPA), N-nitrosodi-n-butylamine (NDBA), N-nitrosopyrrolidinone (NPYR), N-nitrosopiperidine (NPIP), N-nitrosomorpholine (NMOR).</td></tr>
</table>
Verification:
The tenderer shall provide a declaration of compliance with this criterion, supported by a test report presenting the results of chamber test analysis in accordance with ISO 16000-9 or an equivalent test.
The wrapped sample shall be stored at room temperature at least for 24 hours. After this period the sample shall be unwrapped and immediately transferred into the test chamber. The sample shall be placed on a sample holder, which allows air access from all sides. The climatic factors shall be adjusted according to ISO 16000-9. For comparison of test
</td></tr>
</table>

[28] Note that VOC emission testing requirements for latex foam and polyurethane foams have been established by industry-led voluntary schemes such as the EuroLatex ECO Standard and the CertiPUR standard. At the time of writing, these schemes were considered to provide a sufficient level of assurance.

	results, the area specific ventilation rate (q=n/l) shall be 1. The ventilation rate shall be between 0.5 and 1. The air sampling shall be done 24±1 h after loading of the chamber during 1 hour on DNPH cartridges for the analysis of formaldehyde and other aldehydes and on Tenax TA for the analysis of other volatile organic compounds. Sampling duration for other compounds may be longer but shall be completed before 30 hours. The analysis of formaldehyde and other aldehydes shall comply with the standard ISO 16000-3 or equivalent tests. Unless specified differently, the analysis of other volatile organic compounds shall comply with the standard ISO 16000-6. The analysis of nitrosamines shall be done by means of gas chromatography in combination with a thermal energy analysis detector (GC-TEA), in accordance with the BGI 505-23 method (formerly: ZH 1/120.23) or equivalent.
	AC3.2: Low emission polyurethane foam padding materials *(only applicable to upholstered furniture)* Where polyurethane foam is used as a padding material in furniture upholstery, points shall be awarded if the foam complies with the requirements for VOC emissions listed below. Where other padding materials are used, points can also be awarded if compliance with the VOC emission limits set out below can be demonstrated. **Substance (CAS number) / Limit value (mg/m³)** Formaldehyde (50-00-0) / 0.01 Toluene (108-88-3) / 0.1 Styrene (100-42-5) / 0.005 Each detectable compound classified as categories C1A or C1B according to the Regulation (EC) No 1272/2008 of the European Parliament and of the Council / 0.005 Sum of all detectable compound classified as categories C1A or C1B according to Regulation (EC) No 1272/2008 / 0.04 Aromatic hydrocarbons / 0.5 VOCs (total) / 0.5 **Verification:** The tenderer shall provide a declaration of compliance with this criterion, supported by test results that show compliance with the limits stated above. The test sample/chamber combination shall be either: 1 sample of 25x20x15 cm dimensions is placed in a 0.5 m^3 test chamber or 2 samples of 25x20x15 cm dimensions are placed in a

	1.0 m^3 test chamber. The foam sample shall be placed on the bottom of an emission test chamber and conditioned for 3 days at 23 °C and 50 % relative humidity, applying an air exchange rate n of 0.5 per hour and a chamber loading L of 0.4 m^2/m^3 (= total exposed surface of sample in relation to chamber dimensions without sealing edges and back) in accordance with ISO 16000-9 and ISO 16000-11 or equivalent tests. Sampling shall be done 72 ± 2 h after loading of the chamber during 1 hour via Tenax TA and DNPH cartridges for VOC and formaldehyde analysis respectively. The emissions of VOC are being trapped on Tenax TA sorbent tubes and subsequently analysed by means of thermo-desorption-GC-MS in accordance to ISO 16000-6 or equivalent tests. Results are semi-quantitatively expressed as toluene equivalents. All specified individual analytes are reported from a concentration limit ≥ 1 $\mu g/m^3$. Total VOC value is the sum of all analytes with a concentration ≥ 1 $\mu g/m^3$ and eluting within the retention time window from n-hexane (C6) to n-hexadecane (C16), both included. The sum of all detectable compounds classified as categories C1A or C1B according to Regulation (EC) No 1272/2008 is the sum of all these substances with a concentration ≥ 1 $\mu g/m^3$. In case the test results exceed the standard limits, substance specific quantification needs to be performed. Formaldehyde can be determined by collection of the sampled air onto DNPH cartridge and subsequent analysis by HPLC/UV in accordance with ISO 16000-3 or equivalent tests.

Summary of rationale:

- Latex and PUR foams are the dominant padding materials used in furniture (more than 90% of the market) and their production involves the use of a number of chemicals that will result in VOC emissions from the foam product.
- The potential adverse health effects caused by prolonged exposure to many VOCs are becoming a larger concern and measures are best taken to minimise emissions in the first place rather than looking to improve the ventilation of rooms.
- The ambition level here reflects current best practice by industry and aligns closely with relevant EU Ecolabel criteria for bed mattresses and for furniture – offering several simplified routes to demonstrating compliance.

5.8 Award criterion 4: Extended product warranty

5.8.1 Why relevant to GPP?

Extended warranty periods, although not a concrete guarantee that the product is more durable, nonetheless represents a commitment from the producer that the furniture product has been designed and built in a robust and durable fashion to the extent that they are confident it can maintain its fitness for use during a longer period.

The warranty indirectly encourages that the furniture product should be straightforward to repair or to change replaceable parts for damage that has the highest probability of occurring.

As mentioned with earlier criteria, any improvement in the durability or useable lifetime of the furniture product has clear and direct benefits on the life cycle impact of the product due to the fact that most impacts are associated with the raw materials used in furniture and their processing into useable component parts or materials in the final product.

5.8.2 Stakeholder discussion

Unlike for new furniture, only limited discussion has taken place regarding warranties for refurbished furniture. However, it was generally agreed that such warranties would represent a practical and common sense alternative to requirements for complying with any relevant EN technical standards relating to the product type.

For new furniture in particular, stakeholders were largely against the idea of extended warranties as award criteria for furniture products. They pointed out that many promises can be made to win points in an ITT but what really matters is who the terms and conditions of any extended warranty, which are often far from clear, may be applied in cases where a lack of conformity of the furniture arises. So unless the terms and conditions required in an extended warranty are made clear in an ITT and required to be essentially identical for all tenderers, then such a criterion could potentially become problematic.

5.8.3 What relevant ecolabel criteria and other green initiatives say

To avoid repeating the same text twice, the reader is referred to this same sub-section for TS4 for the procurement of furniture refurbishment services in section 5.4.

5.8.4 Ambition level

Due to the fact that this is an award criterion, the ambition level is quite open-ended in order to encourage longer warranties although maximum points shall be awarded for any length of warranty that is 4 or more years longer than that specified for the minimum technical specification to prevent unrealistic warranties being offered simply to make bids more competitive.

5.8.5 AC4: Criteria proposal for extended warranty periods

Core criteria	Comprehensive criteria
AWARD CRITERION	
AC4: Extended warranty periods ***(same for core and comprehensive)*** A maximum of X additional points shall be awarded for each additional year of warranty and service agreement offered that is more than the minimum technical specification (see TS above) as follows: - 4 or more years extra warranty: x points - 3 years extra warranty: 0.75x points - 2 years extra warranty: 0.5x points - 1 year extra warranty: 0.25x points **Verification:** The tenderer shall provide a written declaration detailing the offered period and stating that it covers the conformity of the goods with the contract specifications, including all indicated usage.	

Summary of rationale:

- Extended product warranties are a very relevant proxy measure for durable and robust products with a longer expected lifetime than other products with shorter warranties.
- The increased risk to tenderers of future repair and replacement costs caused by an extended warranty is likely to result in an increased cost of the furniture product. For this reason, if the contracting authority wishes to encourage products with longer warranties to be more competitive with other equivalent products with shorter warranties, then an award criterion should be used.

6. Approach B. Procurement of new furniture

As stated earlier, the procurement of new furniture should only be considered by following the hierarchical approach illustrated in Figure 5. Only if the procurement of refurbished furniture cannot meet the requirements of the contracting authority, then the procurement of new furniture should be considered.

More extensive criteria can be set for new furniture products since far more information about the materials can be known and verified. Some of the criteria are common to both refurbished furniture and new furniture, for example the award criterion for take-back schemes, but may be worded in a slightly different manner due to the nature of these schemes.

As with the criteria for refurbished furniture, a significant number of award criteria are included in order to encourage innovation amongst manufacturers and to reinforce criteria that already exist in relevant ISO 14024 Type I ecolabels.

6.1 Technical Specification 1: Sourcing of legal timber for furniture production

6.1.1 Why relevant to GPP?

According to research undertaken by the Chatham House in 2015 (Alison Hoare, 2015), more than 80 million m^3 of timber was harvested illegally in 2014 by nine producing countries[29] (measured as roundwood equivalent (RWE) volume). This is equivalent to one-third of their total production of timber, releasing 190 million tonnes of carbon dioxide into the atmosphere. The reasons provided by the report is that new markets for timber have diluted the impact of policies introduced by some developed countries. Half of all the trade in illegal wood-based products is now destined for China, the largest consumer as well as a major processing hub. At the same time, domestic demand for timber has been rising in producer countries, providing a market for both legal and illegal timber. Furthermore, more forest is being cleared for agriculture and other land uses. As much as half of all tropical timber traded internationally now comes from forest conversion, of which nearly two-thirds is thought to be illegal. Finally, logging by small-scale producers has soared in many countries. Such activity is often illegal and remains beyond the scope of many policy and regulatory efforts.

Impacts of illegal logging include the loss and degradation of forests; loss of habitat and biodiversity; implications for climate change adaptation and mitigation; loss of government revenue leading to loss of employment and of exports; distorted global prices as illegal timber is often cheaper; lack of recognition of land and resource use rights of forest communities with knock-on effects on their livelihood; and even the funding of national and regional conflicts (Illegal Logging Portal, 2016).

6.1.2 Stakeholder discussion

The various principles, established criteria and definitions relating to the concept of sustainable forestry were discussed in detail as well as considerations across the supply chain of how to ensure traceability of legal and/or sustainable certified wood and the impact of the relatively recent implementation of the EU Timber Regulation (2010).

[29] These are Brazil, Cameroon, the Democratic Republic of the Congo [DRC], Ghana, Indonesia, Laos, Malaysia, Papua New Guinea [PNG] and the Republic of the Congo.

Specific aspects related to (i) legally sourced wood and (ii) sustainable wood are provided below:

(i) Legally sourced timber

The Timber Regulation (EC) 995/2010 introduced new requirements for the sourcing of timber products from 2013. It prohibits illegally harvested timber from being placed on the EU market and introduces requirements for 'due diligence', which it defines as comprising:

> (a) measures and procedures providing access to the [origin of] the operator's supply of timber or timber products placed on the market;
>
> (b) risk assessment procedures enabling the operator to analyse and evaluate the risk of illegally harvested timber or timber products derived from such timber being placed on the market.
>
> (c) except where the risk identified in course of the risk assessment procedures referred to in point (b) is negligible, risk mitigation procedures which consist of a set of measures and procedures that are adequate and proportionate to minimise effectively that risk and which may include requiring additional information or documents and/or requiring third party verification.

The Regulation defines legally harvested as wood and wood-based materials (excluding packaging and recycled wood) that have been 'harvested in accordance with the applicable legislation in the country of harvest'. "Applicable legislation" means the legislation in force in the country of harvest covering the following matters:

- Rights to harvest timber within legally gazetted boundaries;
- Payments for harvest rights and timber including duties related to timber harvesting;
- Timber harvesting, including environmental and forest legislation, forest management and biodiversity conservation, where directly related to timber harvesting;
- Third parties' legal rights concerning use and tenure that are affected by timber harvesting; and
- Trade and customs, in so far as the forest sector is concerned.

Valid EU FLEGT and UN CITES licenses are deemed to provide assurance of legality. Europe is in the process of introducing the FLEGT (Forest Law Enforcement Governance and Trade) licensing scheme. FLEGT is based on bilateral agreements between the EU and timber producing countries. Third party forest and forest products certification systems that meet the due diligence criteria set out in Article 6 of the Regulation can be used as a valuable tool in the due diligence system.

(ii) Sustainably Sourced timber

Further investigation of the basis for both European sustainable forestry policy[30] and certification schemes for sustainable forestry[31] confirms their basis in the UNEP and FAO principles of Sustainable Forestry Management (SFM) established at the Rio Earth Summit in 1992[32]. These principles, although not defined in specific detail in UNEP or FAO literature, provide an internationally agreed reference point which is used by certification schemes. The conformance of schemes with ISO/IEC 17065 is also a

[30] European Commission, *EU forests and forest related products*, http://ec.europa.eu/environment/forests/home_en.htm

[31] Rametsteiner, E and M, Simula, *Forest certification—an instrument to promote sustainable forest management?* Journal of Environmental Management 67 (2003) 87–98

[32] Castaneda, F. *Criteria and indicators for sustainable forestry management.* UN FAO, http://www.fao.org/docrep/x8080e/x8080e06.htm#TopOfPage

consideration in relation to the quality and assurance provided by the verification systems used[33].

In terms of market share the two most significant certification schemes are those operated by the Forestry Stewardship Council (FSC)[34] and the Programme for the Endorsement of Forestry Certification (PEFC)[35]. FSC is an NGO-initiated scheme which was formally established following the Rio Earth Summit 1992. The PEFC scheme was founded by national organisations from 11 countries in 1999 and now incorporates the Sustainable Forestry Initiative (SFI), the Malaysian Timber Certification Council (MTCC) and American Tree Farm System (ATFS).

In 2009 these schemes accounted for 9% of global forestry and 26% of industrial timber supplies[36]. PEFC is the most significant scheme, accounting for over two thirds of certified timber on the world market. The majority (over 90%) of certified timber originates from Europe and North America.

Belgium[37], Denmark, Germany[38], the UK[39] and the Netherlands[40] are notable for their detailed monitoring and evaluation of forestry certification schemes in support of Green Public Procurement (GPP)[41]. These Member States use their own adapted criteria and processes to determine whether certification schemes provide sufficient assurance. The current consensus of these Member States is that, in general, FSC and PEFC provide sufficient levels of assurance based on their national criteria. Denmark, Germany, the Netherlands and the UK are currently working together to identify the common ground of their respective timber procurement policies.

6.1.3 What relevant ecolabel criteria and other green initiatives say

The FEMB sustainability basic level requirements for office and non-domestic furniture for indoor use (Draft 2, July 2012) describes a basic pre-requisite that all wood specified in the product, with the exception of recovered or reused wood, is CITES compliant and/or compliant with the EU Timber Regulation. Advanced level requirements are split into two different ambition levels. The lower level requires that at least 70% (volume or mass) of solid wood or 50% of wood chips/fibres used in wood-based panels is certified as coming from sustainably managed forests according to FSC, PEFC or equivalent schemes. The more ambitious requirement sets a minimum of 95% /volume or mass) of sustainable certified wood or wood-based products.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires that at least 70% (volume or weight) of all solid wood or 50% of all wood-based materials are certified as coming from sustainably managed forests according to FSC, PEFC or equivalent schemes. Furthermore, the standard specifically states that the percentage can be calculated using a sliding average of supplies over a maximum period pf 12 months.

[33] ISO/IEC 17065: 2012, Conformity assessment – requirements for bodies certifying products, processes or services.

[34] Forestry Stewardship Council, http://www.fsc.org/

[35] Programme for the Endorsement of Forestry Certification, http://www.pefc.org/

[36] UNECE and FAO (2010) *Forest products annual market review 2009-2010*

[37] UK Central Point of Expertise on Timber, *Government procurement of timber in Belgium*, http://www.cpet.org.uk/uk-government-timber-procurementpolicy/international-context/international-policies-1/belgium

[38] Germany Government Procurement Policy, *Wood and paper based products*, http://www.sustainableforestprods.org/tools/german_government_procurement_policy

[39] UK Central Point of Expertise on Timber (2008) *Review of forestry certification schemes results*

[40] Timber Procurement Assessment Committee, Netherlands, http://www.tpac.smk.nl/

[41] UK Central Point of Expertise on Timber (2008)*A comparative study of the national criteria for 'legal and 'sustainable' timber and assessment of certification schemes in Denmark, UK, Netherlands and Belgium* http://www.cpet.org.uk/uk-government-timber-procurement-policy/international-context/international-policies-1/comparativestudy-of-danish-uk-dutch-and-belgium-national-criteria

The Blue Angel RAL UZ 38 for low emission furniture and slatted frames made of wood and wood-based materials (Jan. 2013) states that at least 50% of the solid wood or primary raw materials used in wood-based materials shall be sourced from sustainably managed forests. A hierarchical approach to verification is used where the simplest option is for the furniture manufacturer to be CoC certified by FSC or PEFC.

The Nordic Ecolabel for furniture and fitments (version 4.9, Mar. 2011) states that at least 70% by weight of any wood from pine, spruce, birch and tropical timber or 50% by weight of any other type of wood must be derived from sustainable certified forests if the total amount of solid wood in the furniture product exceeds 10% by weight. For wood-based panels, the minimum quantity of sustainable certified wood is 50% by weight and again only applies if wood-based panels account for at least 10% by weight of the furniture product.

The revision of the EU Ecolabel for furniture proposes that at all wood or wood based materials should be legally sourced and that at least 70% by weight of wood or wood-based materials shall be sourced from sustainably managed forests or pre-consumer or post-consumer recycled material.

6.1.4 Ambition level

A basic requirement for all wood to be legally sourced may not seem very ambitious when considering the obligations of the EU Timber Regulation. However, there is still a risk that wood or wood-based materials in furniture provided under a public contract may come from non-legal sources. A number of exemptions apply to the application of the EU Timber Regulation, which include products that fall under the following custom codes:

- 9401: Seats (excluding those of heading 9402), whether or not convertible into beds, and parts thereof.
- 9402: Medical, surgical, dental or veterinary furniture; barbers' chairs & similar chairs, having rotating parts of the foregoing articles
- 9403 80 00: Furniture of other materials, including cane, osier, bamboo or similar materials
- 9403 90: Furniture parts

Even if it does not contravene the EU Timber Regulation, the discovery that procured furniture contains wood sourced from illegally harvested wood poses a reputational risk for the contracting authority. Public authorities, which wish to have a higher degree of reassurance that the timber is actually legally sourced, can include a selection criterion regarding the technical ability of the tenderer to ensure compliance with the obligations from the EU Timber Regulation (but not excluding the furniture items listed above) combined with a contract performance clause requiring that the timber supplied under the contract has been legally placed on the market.

Although certified sustainable wood is available, supply chain development may be required to build relationships with alternative suppliers in some countries. The most ambitious requirement would be to request 100% certified sustainable wood. However, this could be difficult to achieve due to possible fluctuations in market supply, particularly for SMEs that are accustomed to working with a limited number of suppliers.

6.1.5 TS1: Criteria proposal for sourcing of legal timber for furniture production

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS1: Sourcing of legal timber for furniture production ***(same for core and comprehensive)*** All timber used in furniture[42] to be supplied under the contract must be legally harvested in accordance with Regulation (EU) 995/2010 (the 'EU Timber Regulation')[43]. Any timber or timber products not covered by the Regulation (EU) 995/2010 should be either covered by FLEGT licences, covered by CITES licences or subject to a due diligence system implemented by the tenderer which provides information on the country of harvest, species, quantities, supplier details and information on compliance with relevant national legislation. Where a risk of illegal timber in the supply chain is identified, the due diligence system should define procedures for mitigating this risk. **Verification:** A declaration that only timber from legal sources will be used in the furniture product (see CPC1 below).	
CPC1. Sourcing of legal timber *(Same requirements for Core and Comprehensive criteria. When possible it is recommended that spot checks be carried out in cooperation with the competent authority responsible for implementation of Regulation (EU) 995/2010)* The contracting authority is entitled to carry out spot checks regarding compliance with Technical Specification TS1 for all or a specified sub-set of the wood-containing furniture products used under the contract. Upon request, the contractor should provide evidence to demonstrate compliance with the EU Timber Regulation: In most cases – where the contractor is not the company first placing timber or timber products on the EU market but obtains such products from others (defined as a 'trader' [44] in Regulation 995/2010), the contractor should provide the following information in respect of timber or timber products to be verified during the spot check: - The operators or the traders who have supplied the timber and timber products used in the piece of furniture; - Documents or other information indicating compliance of those timber products with the applicable legislation[45]; - Evidence of the risk assessment and mitigation procedures put in place in accordance with Article 6(1) (b) and (c) of Regulation (EU) 995 of 2010. In cases where the contractor places timber or wood-containing furniture products for the first time on the EU market (defined as an 'operator' [46] in Regulation 995/2010), the	

[42] for timber and timber products within the remit of EU Timber Regulation

[43] *Note to contracting authorities on the sourcing of legal timber:* Suitable remedies should be provided under the contract for cases of non-compliance with the above clause. Advice on the application of these requirements, and the monitoring organisations able to verify compliance, may be obtained from the competent national authorities listed at:

http://ec.europa.eu/environment/forests/pdf/list_competent_authorities_eutr.pdf

[44] 'trader' means any natural or legal person who, in the course of a commercial activity, sells or buys on the internal market timber or timber products already placed on the internal market

[45] see Regulation (EU) 995/2010 article 2 (h)

contractor should provide the following information in respect of timber or timber products covered by the spot check:

- A description of each type of timber used, including the trade name, type of product, the common name of tree species and, where applicable, its full scientific name;
- Name and address of the supplier of the timber and timber products;
- The country of harvest, and where applicable[47]:

  (i) Sub-national region where the timber was harvested;

  (ii) Concession of harvest;

  (iii) Quantity (expressed in volume, weight or number of units);
- Documents or other information indicating compliance of those timber products with the applicable legislation;
- Evidence of the risk assessment and mitigation procedures put in place in accordance with Article 6(1) (b) and (c) of Regulation (EU) 995 of 2010. This may include certification or other third party verified schemes.

Timber covered by valid EU FLEGT licences or CITES permits shall be considered to have been legally harvested according to Regulation (EU) No 995/2010.

Note: These GPP criteria do not include a proposal on the sourcing of wood from sustainable forestry, for the following reasons:

The EU Forest Strategy provides a definition of sustainable forest management (SFM). Nonetheless, for public procurement, precise requirements, detailing the different elements of the SFM definition would be needed. For the time being, however, such detailed elements are not available on the EU level.

Accordingly, several Member States are using their own sets of national criteria, to identify wood-based products stemming from sustainably managed sources, in their respective tendering processes for green or sustainable public procurement. They also have different procedures in place to determine whether certification or other third-party-verified schemes provide sufficient assurance of SFM. In this situation, it has not yet been possible to propose a set of procurement requirements which include harmonised criteria for sustainable forest management.

The current consensus of the Member States with an active sustainable timber procurement policy is that, in general, proprietary certification schemes, such as those of the FSC and PEFC, provide sufficient levels of assurance for compliance with their national criteria. Although wood certified as 100% sustainable wood is desirable, it could be difficult or impossible to achieve due to: a) a relatively limited supply of certified wood available on the market, despite widespread forest certification in the EU and other major global supply regions; b) possible fluctuations in specific market supplies, particularly for SMEs that are accustomed to working with a limited number of suppliers. Instead, a minimum of 70% sustainable wood should be achievable. This level also fits well with the current requirements of the FSC and PEFC labelling schemes. Nonetheless, public authorities are recommended to seek feed-back from the market prior to publishing the Invitation To Tender (ITT) and are reminded that, in any case and under all circumstances, alternative means of proof must be allowed.

Summary of rationale:

- In order to ensure compliance with the EUTR, it is required that for all furniture, even including those items that may be exempted from the requirements of the EUTR such as seating and bamboo furniture, tenderers shall provide documentary

[46] 'operator' means any natural or legal person that places timber or timber products on the market;

[47] for more information, see: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012R0607&from=

evidence of due diligence to verify legal sourcing or traceability along the supply chain. The information requested shall depend on whether the tenderers are 'operators' or 'traders' as defined by the EUTR. Moreover, in GPP, the requirement for due diligence shall be extended to the 'specifier' of wood in the comprehensive criteria in order to promote a higher level of supply chain assurance in furniture contracts.

- For the moment, in view of the differences in national approaches to sustainable timber procurement and the on-going work aiming at identifying the communalities between different schemes, no definitions or proposed criterion addressing the sustainability of timber is proposed within this criteria set.

6.2 Technical Specification 2: Formaldehyde emissions from wood-based panels

6.2.1 Why relevant to GPP?

The development of wood-based panels has revolutionised the furniture industry and provides very economical alternatives to solid wood in many products that can also incorporate significant quantities of recycled wood chips and fibres. The most negative aspect of wood-based panels is the use of formaldehyde emitting resins to bind together the wood chips or fibres. Formaldehyde has been previously classified as a Category 2 carcinogen (H351-suspected of causing cancer) but, following a decision by the ECHA Risk Assessment Committee in 2012 based largely on animal evidence, is now classified as a Category 1B carcinogen (H350-may cause cancer) in the EU after the 6th Adaptation to Technical Progress of the CLP Regulation[48]. The most commonly used resin formulation in wood-based panels has been urea-formaldehyde (UF). Early formulations used in the 1970's resulted in significant formaldehyde emissions to indoor environments.

With wood-based panel manufacture, most emissions occur during the initial reaction of the formaldehyde resin, which takes place under controlled conditions. As the resin cures, emissions rapidly decrease towards zero. However, unlike VOC emissions from paints, which are also high at the beginning and continually decrease towards zero, panels that use UF resins never reach zero formaldehyde emissions but instead, under constant environmental conditions, reach a steady state equilibrium concentration. This is because the thermoset UF resin can be attacked by atmospheric humidity which leads to the release of small but detectable quantities of formaldehyde that was previously bound in the resin. Ever since the term "sick-building syndrome" was coined for modern buildings, concerns about indoor air quality have increased, as is reflected in the work being carried out by the JRC[49] and the ongoing efforts by different Member States such as Belgium, France and Germany with regards to VOC emissions from products. Formaldehyde is arguably the VOC of greatest concern due to its widespread use in wood-based panels, which can appear in furniture, cladding or floor coverings.

In 1985, the E1 standard was introduced in Europe and linked to the EN 717-1 standard method. This method required that after 28 days, the air in a ventilated chamber containing a specific quantity of wood-based panels should reach a steady state concentration of less than 0.1ppm (0.124mg/m^3). Currently the E1 standard is defined by the table given in Annex B of EN 13986 which describes relevant limits considered equivalent to E1 for formaldehyde emissions from wood-based panels according to EN 120, EN 717-1 and EN 717-2.

6.2.2 Stakeholder discussion

Stakeholder opinions can be split into two broad groups: those who consider that the existing E1 standard introduced in 1985 is still appropriate and those who think a more ambitious approach, reducing the limit to 50% of the E1 emission limit, has to be taken to reflect advances made since 1985.

[48] See the following link for specific changes to formaldehyde classification (entry 605-001-00-5): http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOL_2014_167_R_0004&from=EN To be included in part 3 of Annex VI of 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.

[49] Kephalopoulos and Geiss, 2013. Environment and Quality of Life Report No 29. "Harmonisation framework for health based evaluation of indoor emissions from construction products in the European Union using the EU-LCI concept.

Opinions in favour of the E1 standard argued that toxicological studies show that no conclusive toxic effects are demonstrated when the formaldehyde concentration of the air is below 0.1ppm, that there is limited market availability of panels that meet the 50% of the E1 emission limit and that these panels may have inferior technical properties and durability. However, no clear examples, reports or studies to back up these latter two points were cited. These stakeholders also mentioned that the production processes for wood-based panels are highly optimised and are generally tailored according to the properties of the resin used. Consequently it is not so simple for a manufacturer to simply change from one type of resin to another.

Stakeholders in favour of the lower, 50% of E1 emission limit stated that significant advances have been made in resin formulations that can reduce or even completely eliminate formaldehyde emissions, going well beyond the E1 requirement. The UF resin is the most susceptible to be attacked by atmospheric humidity but resistance can be improved by substituting part of the urea component for melamine (i.e. MUF). Pure melamine (MF) resins have greater still resistance to formaldehyde emission. This was clearly shown in a study by Kim and Kim[50]. Phenol formaldehyde resins (PF) are so resistant to formaldehyde release that they are considered as near-zero emission resins. With polymeric diphenyl methane diisocyanate (pMDI), the resin itself does not contain any formaldehyde that could be released.

The relevance of any GPP criteria that simply referred to compliance with E1 emissions was questioned due to the fact that for six EU Member States (Austria, Czech Republic, Denmark, Germany, Italy and Sweden), E1 is already a mandatory requirement for all wood-based panels and thus unambitious.

6.2.3 What relevant ecolabel criteria and other green initiatives say

The availability of lower emission resins has led to the publication of more ambitious formaldehyde emission standards in Japan (JIS F-star), California (CARB) and requirements in various ecolabel initiatives (i.e. Nordic Ecolabel, Blue Angel and French NF 217). In response to this, some organisations are calling for the development of a new "E1 plus" or "E0" standard that would be equivalent to around 65% of the current E1 threshold limit but no new standard appears to be forthcoming in the foreseeable future at EU level.

The Blue Angel criteria for low emission wood based furniture and slatted frames (RAL UZ 38: Jan. 2013) permit the use of unfaced E1 panels so long as the final product formaldehyde emissions do not exceed 50% of E1 requirements. This is why two bars (one green and one blue) are plotted. However, with Blue Angel criteria for low emission composite wood panels (RAL UZ 76; Apr. 2011) it is simply stated that panels shall comply with the emission requirements of 50% of E1.

The Nordic Ecolabel criteria for furniture and fitments (Version 4.9), distinguishes between MDF and other wood-based panels based on anecdotal evidence from a major Swedish furniture manufacturer that it is extremely difficult to meet 50% E1 requirements with MDF. The exact reason for this may be a combination of the fact that MDF is traditionally made using urea formaldehyde (the highest residual formaldehyde emitting resin type) and the fact that MDF panels can be of varying thicknesses. The thicker panels may struggle to meet the EN 717-1 limits because this test requires that only a fraction of the panel edges be sealed. This could lead to emissions from edges in thicker panels dominating the final result.

Although a direct comparison of formaldehyde emission limits between the CARB, JIS F-star and E1 systems is difficult, due to the fact that they each use different testing

[50] Kim, S. and Kim, H-J., 2005. Comparison of standard methods and gas chromatography method in determination of formaldehyde emission from MDF bonded with formaldehyde-based resins. Bioresource Technology, 96, p.1457-1464.

methods, research published in the literature where the same products are tested by different methods and the numerical values correlated can allow for an approximate comparison as illustrated in Figure 6 [51,52].

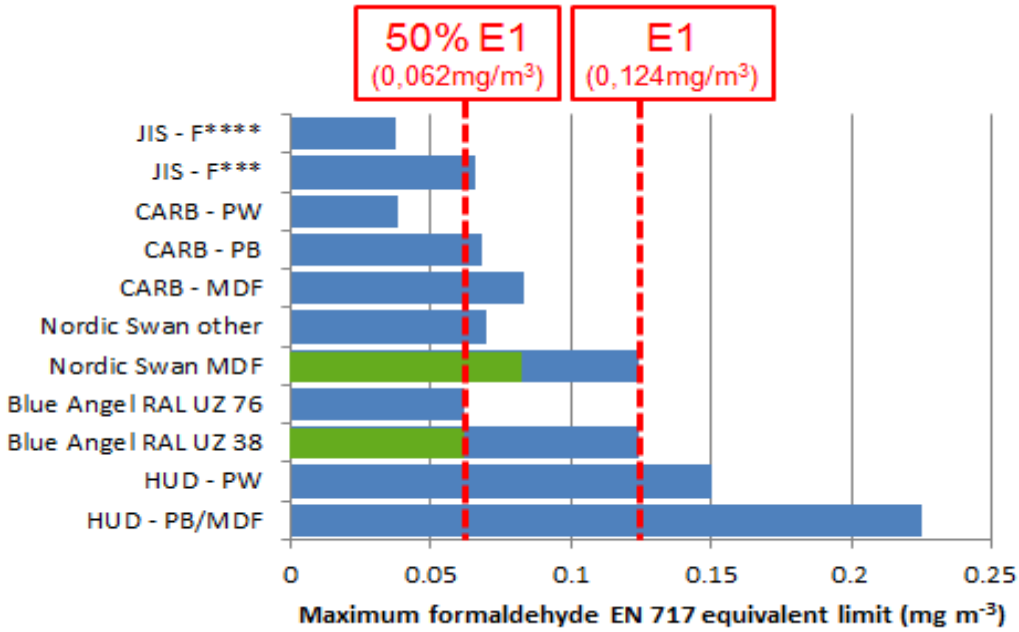

Figure 6. Comparison of formaldehyde emission ambition levels in different schemes for wood-based panels. PW = Plywood; MDF = Medium Density Fibreboard; PB = Particleboard.

The HUD limits are the mandatory maximum formaldehyde emission limits stated in the Housing and Urban Development – Manufactured Home Construction and Safety Standard in place across the US. These are considerably less ambitious (about 80% higher) than E1 although the HUD requirement for plywood (PW) is much closer to the E1 requirement (about 20% higher).

From Figure 6, it is clear that there is a significant discrepancy in formaldehyde emission limits between different schemes and that many of them go far beyond the requirements of E1.

The CARB limits also distinguish between MDF and other panel types but go one step further by also distinguishing plywood from other panels. The CARB Phase II levels are very similar to the Nordic Ecolabel level of 62-63% E1 for MDF and are very close to 50% of E1 for particleboards. With plywood, a stricter limit of around 30% E1 is stated and this can be linked to the fact that plywood manufacture traditionally uses very low emission phenol formaldehyde

The Japanese requirements show that F-3 star levels are roughly equivalent to 50% E1 and the F-4 star level to around 30% E1. The F-4 star level is often considered as the most stringent level for wood based panels constructed with formaldehyde based resins.

EU Ecolabel for furniture (Commission Decision (EU) 2016/1332) set formaldehyde emissions to 50% of E1 for all wood-based panels except for MDF, which is set to 65% of E1. This criterion would only apply to furniture products where wood-based panels account for at least 5% by weight of the final product.

[51] Groah et al., 1991. Comparative response of reconstituted wood products to European and North American test methods for determining formaldehyde emissions. Envi. Sci. Technol., Vol. 25, p.117-122.

[52] Risholm-Sundman et al., 2007. Formaldehyde emission – Comparison of different standard methods. Atmospheric Environment, Vol. 41, p.3193-3202.

6.2.4 Ambition level

The E1 standard has been well established within Europe and there are no problems whatsoever with the markets ability to supply such products. Due to doubts about the market availability of "better than E1" panels, and in particular due to a lack of information about any cost premiums that may or may not be associated with these products, the basic E1 requirement has been included as a core level technical specification.

The 65% of E1 requirement aligns well with the Nordic Ecolabel requirements and would allow a sufficient safety margin for other schemes such as CARB and the Japanese F-3 star and 4 star ratings to be accepted as verification with little doubt as to their scientific validity for meeting the criteria.

To incentivise tenderers to try to use low-formaldehyde emission panels in their furniture products, it is proposed to link this minimum technical specification with associated award criteria with a core level awarding of points for using panels that meet 65% E1 and a comprehensive level awarding of points for using panels that meet 50% E1.

To avoid overly burdensome verification efforts, and due to the practical consideration that any formaldehyde emissions from wood-based panels are directly related to the mass fraction of wood-based panels used in the final furniture product (excluding packaging), a minimum threshold of 5% w/w is set. This approach also aligns with the proposed EU Ecolabel criteria for furniture.

6.2.5 TS2: Criteria proposal for formaldehyde emissions from wood-based panels

Core criteria	**Comprehensive criteria**
TECHNICAL SPECIFICATION	
TS2: Formaldehyde emissions from wood-based panels (*This requirement applies regardless of the weight fraction of wood-based panels in the furniture product*) Formaldehyde emissions from all supplied wood-based panels, in the form that they are used in the furniture product (in other words, unfaced, coated, overlaid, veneered), and which were manufactured using formaldehyde-based resins, shall be equal to or less than the E1 threshold limits for formaldehyde emissions as defined in Annex B of EN 13986. **Verification:** A declaration from the wood-based panel supplier shall be provided, stating that panels supplied are compliant with E1 emission limits, supported by test reports carried out according to either EN 717-1,	**TS2: Formaldehyde emissions from wood-based panels** (*This comprehensive requirement should be considered as of added value if the weight fraction of the wood-based panels in the furniture product exceeds 5%).* Formaldehyde emissions from all supplied wood-based panels, in the form that they are used in the furniture product (in other words, unfaced, coated, overlaid, veneered), and which were manufactured using formaldehyde-based resins, shall be equal to or less than 65% of the E1 threshold limits for formaldehyde emissions as defined in Annex B of EN 13986. **Verification:** A declaration from the wood-based panel supplier shall be provided, stating that the panels supplied are compliant with 65% of E1 emission limits, supported by test

EN 717-2 / EN ISO 12460-3 or EN 120 / EN ISO 12460-5[53]. Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.	reports carried out according to either EN 717-1, EN 717-2 / EN ISO 12460-3 or EN 120 / EN ISO 12460-5 Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.

Summary of rationale:

- Formaldehyde is of concern as an indoor air pollutant because it is slowly released on a continuous basis from wood-based panels due to contact with atmospheric humidity, is volatile and recently classified as a Category 1B carcinogen.
- The E1 standard is included as a basic core minimum technical specification due to doubts about market availability and any possible cost premiums with lower emission panels.
- A more comprehensive requirement of 65% of E1 emissions is also included (if the furniture contains more than 5% w/w of wood based panels) which should of more relevance in the 6 Member States where E1 compliance is already mandatory and would facilitate alignment with a number of other ISO 14024 Type I ecolabels that could be used as verification.

[53] EN ISO 12460-3 and EN ISO 12460-5 were officially adopted in November 2015 and supersede the EN 717-2 and EN 120 standards respectively. However, only minor changes have been made in the new standards to improve the reproducibility of results. For the purposes of verification of compliance with GPP criteria, test reports according to either the older or newer standards will be acceptable.

6.3 Technical Specification 3 & 4: Coating formulation restrictions & Restrictions for metals

6.3.1 Why relevant to GPP?

The surface coating of solid wood, wood-based panels and metal is extremely important to their final aesthetic and technical properties but may involve the use of numerous hazardous substances. The properties of the coating formulation may be hazardous or it may contain certain hazardous ingredients that may or may not be present in sufficient concentrations to impart a hazard classification on the entire formulation.

With solid wood and wood-based materials, the use of certain heavy metals in coating substances can complicate the potential recycling of the wood and wood-based materials if the standard conditions for the delivery of recycled wood, published by the European Panel Federation[54], are considered. The continued use of REACH restricted solvents, biocidal products and other additives may still be the case in non-EU countries.

With metal surfaces, the application of paints is generally to prevent corrosion, this may involve the use of pigments with undesirable hazardous properties. Alternatively, metals can be electroplated with metals such as zinc, cadmium, chromium (III), chromium (VI) or nickel. Such coatings can provide special surface finishes with high scratch resistance, corrosion resistance and desirable aesthetic properties. However, especially cadmium and chromium VI metals present strong environmental hazards.

Another option to improve the corrosion resistance of carbon steels is to alloy the steel with specific additions of chromium and/or nickel in the furnace so that the alloy (i.e. stainless steel) produced has inherent corrosion resistance properties and does not require coating. However, stainless steel is considerably more expensive than carbon steel and it may be cheaper to simply coat or electroplate carbon steel after it has been converted into its final geometric form. With treated metals, especially with nickel, there is a concern that direct skin contact may result in skin sensitization of users.

6.3.2 Stakeholder discussion

Stakeholders were in favour of prohibiting the use of cadmium and chromium VI in the electroplating of metal surfaces. It was stated that chromium III plating is increasing, especially for decorative and protective finishes that are relevant to furniture components. When comparing chromium VI and chromium III electroplating baths, the improved throwing power and lower reject rate resulted in lower operational costs for chromium III. However, to achieve the same colour, chromium III plating rates are slower than those with chromium VI. Significant discussion took place regarding the REACH requirements for nickel, its use in articles and on the interpretation of the term "*direct and prolonged skin contact*" (See Entry 27 of Annex XVII). A definition of prolonged skin contact has been published in the ECHA website[55], and is provided below for reference:

"as 10 minutes on three or more occasions within a two week period or 30 minutes on one or more occasions during a two week period"

While such a definition certainly applies to all jewellery, it may or may not always be directly applicable to furniture. For example, a metal desktop, chair backing or arm rest can easily be considered to meet the criteria but chair legs are not so certain.

When talking about the restriction of hazardous substances in paints and varnishes, stakeholders expressed concern that although many formulations contain some ingredients that present hazardous properties, these are often no longer present in the

[54] "EPF Standard for delivery conditions of recycled wood", October 2002. Can be viewed online at: http://www.europanels.org/upload/EPF-Standard-for-recycled-wood-use.pdf

[55] See: https://echa.europa.eu/documents/10162/13641/nickel_restriction_prolonged_contact_skin_en.pdf

final coating either due to chemical reactions or the evaporation of solvents. Support was expressed for verification efforts focussing on the classification of the formulation and not of all of the ingredients within the formulation, although some stakeholders stated that certain ingredients should also be specifically banned.

Regarding the restriction of ingredients, there was a split opinion amongst stakeholders. Some believed that the existing requirements of REACH were sufficient and need not be repeated while others stated that GPP should go further than REACH in this respect by placing classification restrictions on paints and varnishes because REACH does not apply to paints and varnishes applied to coated articles produced in non-EU countries that are later imported to the EU, unless this may somehow result in the coated article containing more than 0.1% by weight of Substances of Very High Concern (SVHCs), which would trigger communication obligations under Articles 7(2) and 33 of REACH.

6.3.3 What relevant ecolabel criteria and other green initiatives say

The French NF 217 Ecolabel for furniture (version 10, Jan. 2104) does not have a specific criterion regarding coating substances used in furniture components.

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) prohibit the use of formulations labelled with "carcinogenic", "harmful to the reproductive system", "mutagenic", "toxic", "allergenic when inhaled", "harmful to the aquatic environment", "cause heritable genetic damage", "danger of serious damage to health by prolonged exposure" or "possible risks of irreversible effects". They also prohibit the use of coatings that contain >60% VOC content, >0.1% aziridine or >0.4% Cr(VI). The total VOC applied should not exceed 35g/m2 coated surface area.

The Danish GPP requirements are almost identical to those of the FEMB above except that they do not permit VOC content to be greater than 5% and simply state that no Cr(VI) or aziridine shall be present, without specifying impurity thresholds.

The Belgian GPP criteria are very similar to the Danish but also states specific maximum limits for cadmium and lead concentrations of ≤ 50ppm.

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Mar. 2011) distinguish between coatings for metal and wooden surfaces. For metal surfaces, coating formulations must not be classified as "Environmentally hazardous" (basically toxic to the aquatic environment or hazardous to the ozone layer), "highly toxic", "toxic", "carcinogenic", "mutagenic" or "toxic for reproduction". They must also not contain any intentionally added nanoparticles. Electroplating with cadmium, chromium, nickel or zinc is banned although plating with the latter three metals can be permitted in certain exceptional cases. Any chrome plating must be with Cr III and not Cr VI. With wood coatings, they must not be classified as stated above for metal surfaces (i.e. carcinogenic, mutagenic etc.) and must not contain a whole range of other substances, including but not limited to: bisphenol A compounds, PFOS (perfluor octane sulphonic acid and compounds thereof), halogenated organic compounds, phthalates, aziridine and pigments based on lead, tin, cadmium, chromium VI and mercury. Conditions for wooden coatings with regards to VOC content are that the coating must contain ≤5% VOC or if a higher concentration is used, then the total VOC content applied to the surface must be less than 10, 30 or 60g/m2 coated surface depending on the type of furniture used.

The German Blue Angel criteria for low-emission furniture made of wood (RAL UZ 38, Jan. 2013 version) require that the coating compounds do not contain constituents that will remain in the same form in the final coating and that possess "carcinogenic", "mutagenic" or "reprotoxic" properties or be listed as substances of very high concern (SVHC) according to REACH Regulation (No. 1907/2006) Article 59(1). Exemptions are made for impurities or residual monomers.

EU Ecolabel criteria for furniture (Commission Decision (EU) 2016/1332) take a similar approach by focussing on the CLP information to restrict coating formulations, but unlike the EU GPP criteria, they have a broader range of restricted hazards but also the scope to derogate under certain conditions.

6.3.4 Ambition level

For ease of verification, the EU GPP criteria have been set to restrict only those hazards which are accompanied by clear labelling on coating formulation packaging so that a formulation can be quickly screened by looking at the information on containers as per the requirements of the Classification, Labelling and Packaging (CLP) Directive (1272/2008/EU).

A new Global Harmonized System (GHS) of codes and pictograms has been introduced in June 2015. It is proposed that the restrictions should focus primarily on the classifications of highest concern, which are considered as those that are carcinogenic, mutagenic or toxic to reproduction (CMR), those that are acutely toxic and those that can cause specific target organ toxicity (STOT) after a single exposure. The associated codes and pictograms are as follows:

Table 4. Summary of basic CLP hazards to screen for in core and comprehensive criteria.

Type of hazard	Hazard code	Pictogram
Carcinogenic (Category 1A, 1B, 2)	H350, H350i, H351	
Mutagenic (Category 1A, 1B, 2)	H340, H341	
Reproductive toxicity (Category 1A, 1B), (Category 2)	H360, H360F, H360D, H360FD, H361, H361f, H361d, H361fd	
Specific Target Organ Toxicity (Category 1)	H370, H372	
Acute toxicity to aquatic environment	H400	
Acutely Toxic, Oral (Category 1,2,3) Acutely Toxic, Dermal (Category 1,2,3) Acutely Toxic, Inhalation (Category 1,2,3)	H300, H301 H310, H311 H330, H331	

If the coating formulation meets any of the above classifications, this will be reflected both in the pictogram on the packaging and in the Safety Data Sheet (SDS).

In the consultation process for EU Ecolabel paints and varnishes, stakeholders expressed concern about any proposals to reveal information about ingredients present in concentrations <0.1% by weight due to commercial sensitivity of formulations.

The aim of the restriction on hazardous heavy metal-based additives (i.e. cadmium, lead, chromium VI, mercury, arsenic and selenium) is to encourage their non-use in coating formulations in the first place. The 0.01% threshold is a general threshold for impurities agreed for any mixtures in EU Ecolabel products following the work of a specially set-up Chemicals Task Force. Due to the fact that SDSs specifically mention chemicals that are present in mixtures, compliance with the limits for heavy metals, or their non-presence, in coating formulations should be demonstrated by a declaration from the coating supplier and/or by a test report demonstrating the heavy metal levels in the formulation (as % weight).

The technical specifications are split into two parts, one for paints and varnishes, which may be applied to either wooden or metal components, and another for alloy properties and surface treatment that is specific to metals only. This approach is taken because both criteria may not always apply to a particular furniture product.

6.3.5 TS3 & 4: Criteria proposals for "Coating mixture restrictions" and for "Restrictions for metals"

<table>
<tr><th>Core criteria</th><th>Comprehensive criteria</th></tr>
<tr><td colspan="2">TECHNICAL SPECIFICATION</td></tr>
<tr><td></td><td>
TS3: Coating mixture restrictions

Coating mixtures used by the furniture manufacturer to coat any wooden or metal components of the furniture product shall not be classified according to Regulation (EC) No 1272/2008 of the European Parliament and of the Council as:
• Category 1 or 2 carcinogenic, mutagenic or toxic to reproduction.
• Acutely Toxic by oral, dermal or inhalation pathways (categories 1 or 2) or to the aquatic environment (category 1).
• Category 1 for specific target organ toxicity.

And not contain any additives based cadmium, lead, chromium VI, mercury, arsenic or selenium in concentrations exceeding 0.010% by weight.

Verification:

The tenderer shall declare what coating mixtures they have used in the furniture product (if any). This shall be supported by Safety Data Sheets that clearly indicate the hazard classification of the coating mixture (if any) and shows that the coating mixture used is not classified with any of the following classifications:

<table>
<tr><th>Hazard</th><th>Hazard statement</th></tr>
<tr><td>Carcinogenic (Cat. 1A, 1B or 2)</td><td>H350, H350i, H351,</td></tr>
<tr><td>Mutagenic (Cat. 1A, 1B or 2)</td><td>H340, H341,</td></tr>
<tr><td>Toxic to Reproduction (Cat. 1A, 1B or 2)</td><td>H360, H360F, H360D, H360FD, H360Fd, H360Df, H361f, H361d, H361fd, H362</td></tr>
<tr><td>Acute toxicity (Cat.1 or 2)</td><td>H300, H304, H310, H330</td></tr>
<tr><td>Specific Target Organ Toxicity (Cat. 1)</td><td>H370, H372</td></tr>
<tr><td>Hazardous to the aquatic environment (Cat. 1)</td><td>H400, H410</td></tr>
</table>

Additionally, the Safety Data Sheet and/or other documentation shall state whether cadmium, lead, chromium VI, mercury, arsenic or selenium are present at any concentrations exceeding 0.010% by weight.

Furniture products which have been awarded the EU
</td></tr>
</table>

	Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.
	TS4: Restrictions for metals Cadmium shall not be used for electroplating operations of any metal component parts used in the final furniture product. Nickel shall only be permitted in electroplating operations if the nickel release rate from the electroplated component part is less than 0.5 µg/cm^2/week according to EN 1811. **Verification:** The applicant shall provide a declaration from the supplier of the metal component part(s) that no plating treatments involving cadmium or cadmium compounds have been used in any metal component parts. Where nickel has been used in electroplating operations, the applicant shall provide a declaration from the supplier of the metal component part(s), supported by a test report according to EN 1811, where results reveal nickel release rates to be less than 0.5 µg/cm^2/week. Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling these requirements, or using equivalent methods, shall be deemed to comply.

Summary of rationale:

- The requirements are considered as comprehensive because they deal with the toxicological properties of mixtures, an area that is presumed to be beyond the typical range of expertise of procurers. Even still, the requirements are set in as simplified way as possible, where for example a lack of restricted classifications in TS3 can be verified simply by looking at the containers of the coating chemicals used.
- The restriction of additives based on arsenic, cadmium, chromium VI, lead, mercury and their compounds is justified because in general less hazardous alternatives do exist and the ultimate environmental fate of these metals once furniture is landfilled or incinerated at End-of-Life is uncertain.
- Cadmium electroplating is banned and nickel electroplating restricted because compliance can be explicitly tested for in the absence of suitable declarations from suppliers. Chromium VI is not restricted in GPP criteria simply because it is not possible to distinguish whether chromium VI (hazardous) or chromium III (non-hazardous) was used in the electroplating operation simply by testing the final product – as both would be converted into a chromium metal layer.

6.4 Technical Specification 3 (core)/5 (comp.): REACH Candidate List substance reporting

6.4.1 Why relevant to GPP?

Hazardous substances in the EU are regulated by the overarching REACH and CLP Regulations. The registration, evaluation and assessment process for all hazardous chemicals is a lengthy task, with an initial focus prioritising hazardous chemicals used in the EU market in the largest quantities and with the most serious hazards. For furniture products, priority should focus on hazardous chemicals that actually remain in furniture products and components, such as biocidal active substances, flame retardants and plasticisers. Information on the presence of these substances is not generally communicated to customers.

The REACH Candidate List of Substances of Very High Concern (SVHC) consists of hazardous substances that exhibit one or more of the hazards listed in Article 57 of REACH and that have been identified under the procedures set out in Article 59 of REACH. Being placed on the Candidate List is the beginning of a sequential process which could result in the phasing out of those substances and the only possible route to their future use being through obtaining an authorisation from the European Commission for specific use(s) under specific terms and conditions.

Furniture manufacturers, like any other industry operating in the EU, should be aware of the periodic updates to the Candidate List, which are published on the ECHA website. While the use of substances on the Candidate List is not forbidden, it is good practice for industries to screen out the use of such substances as early as possible. This is because there are information obligations (to ECHA, customers and consumers) on the presence of SVHCs in articles. Substances do not just suddenly appear on the Candidate List but are first submitted to the ECHA Registry of Intentions, so it is possible for industry to have a good idea of future developments.

Although furniture produced within the EU should already comply with the latest requirements of REACH and CLP, there is concern that information regarding components or products imported from outside of the EU may not comply or simply not be accompanied by relevant information from the manufacturer regarding what type of biocidal active substances, flame retardants, plasticisers or other potentially hazardous substances that remain in articles, were used.

6.4.2 Stakeholder discussion

Much of the discussion was originally taken in relation to EU Ecolabel criteria for furniture and focussed on the impacts of REACH and CLP legislation.

General discussion about REACH, ECHA and the Candidate List

There are currently (April 2017) 173 substances listed on the ECHA Candidate List. None of these substances should be present in EU Ecolabel products as per Article 6(6) of Regulation (EC) No 66/2010. However, as was discussed during the revision of EU Ecolabel criteria for furniture, the non-presence of a substance can effectively be defined as analysis of the product resulting in a result of zero or below the limit of detection. This would require the definition of test methods for the 163 substances and to ensure that the methods were suitable for use in each of the materials that could be used in furniture products. Furthermore, for many substances, no suitable test method exists. Even if test methods were available and well-defined, they would represent a major cost commitment to applicants and/or their suppliers. Furthermore, with furniture manufacturers, who essentially assemble component parts, it would be difficult to guarantee the continuous compliance of supplied components without repeated testing.

Guidance from ECHA emphasizes the need to minimize testing, preferring disclosure by suppliers instead. The notion of avoiding the use of hazardous substances at source should be prioritised. The environmental improvement potential must also be balanced against the relative importance of the other EU Ecolabel criteria and the capacity of industry to respond.

The basic approach proposed requires manufacturers and suppliers to screen the Hazard Statements of their production recipes based primarily on Safety Data Sheet information. If none of the Safety Data Sheets of substances or mixtures used during furniture or component part/material production process identify SVHCs, then it can be reasonably deduced that the chemical product is free of SVHCs.

As per articles 7 and 33 of REACH, suppliers are required to communicate to the recipient of the product or, upon request, to the final consumer, information about any SVHCs that are present in the product in concentrations greater than 0.1%. Previous doubts about how the 0.1% limit should apply to complex articles were dispelled with the European Court of Justice ruling on case 106/14 in September 2015. The ruling made it clear that the 0.1% threshold limit for SVHCs should apply to individual articles within a complex article and not based on the entire complex article.

Many furniture products can be considered as complex articles. The EU Ecolabel criteria for furniture go beyond the REACH communication obligation by requiring declarations of ***non-presence*** of SVHCs at levels >0.1% in all component parts and materials. This should not be an obstacle for applicants since, if a supplier is legally obliged to know and communicate whether his product has more than 0.1% SVHCs, he should be perfectly well placed to simply confirm if it is actually below 0.1% too.

Discussions about flame retardants, biocidal products and plasticisers

With regards to flame retardants, some stakeholders wanted a specific ban on all halogenated flame retardants although it was countered that any restrictions should be based on the hazard classification of substances and not on specific atoms present in molecules (i.e. grouping all halogenated compounds together). Mention was made of the potential to "design out" the need for flame retardants by introducing barriers to flame propagation within upholstered furniture. However, due to strict fire safety regulations in many MSs and the responsibility of public organisations to adhere to these regulations, it was deemed most appropriate that the only restriction to flame retardants in GPP should be at the level of SVHCs (Please see more details in section 8.3).

Regarding biocidal active substances, many stakeholders supported the non-use of biocidal active substances in indoor furniture for the purposes of adding a final disinfective effect although some opposition was expressed by industry representatives in the special cases of hospital and catering furniture. It was generally agreed that biocidal active substances could be accepted as in-can preservatives in water-borne coating formulations because the function was to preserve the coating formulation while it was in its liquid state "in the can" and not once present as a solid film in the furniture product. The need for biocidal active substances in outdoor furniture was generally accepted wherever this would improve the durability of the product although, due to concerns about the possible import to the EU of furniture components treated with biocidal active substances otherwise banned in the EU, it was requested that any biocidal formulations used should be approved under the Biocidal Products Regulation (EC) No 528/2012. However, a review of the BPR revealed under point 52 of the recitals that:

"To protect human health, animal health and the environment, and to avoid discrimination between treated articles originating in the Union and treated articles imported from third countries, all treated articles placed on the internal market should contain only approved active substances."

Consequently, it can be interpreted that any requirement to only use BPR approved biocidal products in GPP criteria may represent an unnecessary duplication of a legal requirement.

With plasticisers, these substances are normally added to PVC or polyurethane polymers to modify their physical properties. A number of plasticisers have been placed on the ECHA candidate list and will be phased out in the EU. Most of these compounds belong to the phthalate group and can demonstrate endocrine disrupting effects and/or behave as reproductive toxins.

Industry stakeholders emphasised that it is important to distinguish between low molecular weight phthalates (such as DEHP, DBP, DIBP and BBP) which have been recognised as SVHCs for some time and high molecular weight phthalates (such as DINP, DIDP and DPHP) which are not REACH restricted because they have different toxicity profiles. However, the primary distinction in the industry definition of high and low weight phthalates is arbitrarily based on the length of the carbon backbone (*low weight* being <6 and *high weight* being >6). Furthermore, REACH restrictions are primarily based on risks to heath, and toxicity profiles are only one part, albeit an important one, of the overall risk assessment. Current Candidate List phthalates are given in Table 5.

Table 5. List of phthalates currently (June 2015) included on the REACH Candidate List

(Abbreviation) name	CAS No	Weight (g/mol)	C-backbone	Properties	Date
(DEHP) Bis(2-ethylhexyl)phthalate	117-81-7	390.56	6	57c + 57f	17-Dec-2014
(DHP) Dihexyl phthalate	84-75-3	334.45	7	57c	16-Dec-2013
(DPP) Dipentyl phthalate	131-18-0	306.40	5	57c	20-Jun-2013
(DIPP) Diisopentylphthalate	605-50-5	306.40	4	57c	19-Dec-2012
(PIPP) N-pentyl-isopentylphthalate	776297-69-9	306	4 and 5	57c	19-Dec-2012
(DMEP) Bis(2-methoxyethyl) phthalate	117-82-8	282.29	2	57c	19-Dec-2011
(DIBP) Diisobutyl phthalate	84-69-5	278.34	3	57c	13-Jan-2010
(BBP) Benzyl butyl phthalate	85-68-7	312.36	4 and 7	57c	28-Oct-2008
(DBP) Dibutyl phthalate	84-74-2	278.34	4	57c	28-Oct-2008

Some stakeholders argued that DINP, DIDP and DPHP (carbon backbones of 9, 10 and 7 respectively) are restricted under entry 52 of Annex XVII to REACH in toys and childcare articles and that the same risk could potentially apply to some furniture articles, so the precautionary principle could be applied. Industry stakeholders generally disagreed, stating that extending the restriction of DIDP and DINP to other articles like furniture would be at odds with the risk assessment underpinning this restriction, which also found that DIDP and DINP did not represent significant risks to users when used in erasers, food containers, plastic bags, shower curtains and sex toys[56].

[56] See the ECHA "Evaluation of new scientific evidence concerning DINP and DIDP in relation to entry 52 of Annex XVII to REACH Regulation (EC) No 1907/2006" online here.

6.4.3 What relevant ecolabel criteria and other green initiatives say

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires that any flame retardants used are not listed on the Candidate List, listed in the Restricted Substances List or forbidden for use in OEKOTEX 100 class IV products. Regarding phthalates, the criteria specifically excludes DNOP, DINP and DIDP as well as any other phthalates with the hazardous properties R60, R61, R62, R50, R51, R52, R50, R50/53, R51/53 or R52/53.

The Danish GPP requirements state that any outdoor wooden furniture classified as durability class 1 or 2 must not be treated with preservatives and that any other outdoor wooden furniture must not use substances that are not classified as "carcinogenic", "toxic for reproduction", "mutagenic" or "allergenic when inhaled". They must also not be based on arsenic, chromium or organic compounds.

The Belgian GPP criteria are very similar to the Danish but also specifically mention the exclusion of organo-tin based preservatives.

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) exclude the use of biocides to provide a disinfective or antibacterial effect and that no halogenated compounds can be used in flame retardants or biocides with the notable exception 3:1 mixtures of CMIT/MIT if the in-can concentration is less than 0.0015% by weight.

The German Blue Angel criteria for low-emission furniture made of wood (RAL UZ 38, Jan. 2013 version) prohibit the use of halogenated flame retardants but permit others such as ammonium phosphates, dehydrating minerals such as aluminium hydroxide and expandable graphite. Biocides are not permitted except as in-can preservatives in water-based coating formulations.

6.4.4 Ambition level

The comprehensive level criterion corresponds to the ambition level set out in the equivalent criteria for EU Ecolabel furniture (Commission Decision (EU) 2016/1332), which limits the concentration of any Candidate List substance in the final product, or component parts/materials thereof, to 0.1% by weight.

The core level criterion is considerably less ambitious in that no practical concentration limit is placed on Candidate List substances. However, simply reporting on the presence or non-presence of Candidate List substances is already more proactive than the current practice carried out by most furniture manufacturers.

6.4.5 TS5: Criteria proposals for REACH Candidate List substance reporting

Core criteria	**Comprehensive criteria**
TECHNICAL SPECIFICATION	
TS3: REACH Candidate List substance reporting The tenderer shall declare the presence of any REACH Candidate List[57] substances that are present at a concentration of	**TS5: REACH Candidate List substance restrictions** The product and any component parts/materials thereof shall not contain any REACH Candidate List substances that

[57] Candidate List of substances of very high concern for Authorisation published in accordance with Article 59(10) of the REACH Regulation https://echa.europa.eu/candidate-list-table

greater than 0.1% (weight by weight) in the product and any component parts/materials thereof. **Verification:** The tenderer shall provide a declaration identifying specific REACH Candidate List substances that are present according to the latest version of the Candidate List at the date of publication of the invitation to tender.	are present at a concentration of greater than 0.1% (weight by weight). **Verification:** The tenderer shall provide a declaration stating that the furniture product and component parts/materials thereof do not contain any specific REACH Candidate list substances in quantities greater than 0.10% (weight by weight) according to the latest version of the Candidate List at the date of publication of the invitation to tender. This declaration shall be supported by similar declarations from all suppliers of component parts[58] and component materials[59] that remain in the final product. Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling these requirements, or using equivalent methods, shall be deemed to comply.

Summary of rationale:

- No chemicals that are expected to remain in the final product (e.g. biocides, flame retardants or plasticisers) should be used in quantities greater than 0.1% by weight in comprehensive level GPP furniture if they have been identified as substances of very high concern and have been subsequently placed on the ECHA Candidate List.
- Both core and comprehensive level criteria require the proactive reporting of the presence or non-presence of Candidate List substances if present in concentrations greater than 0.1% by weight – which is an improvement on current practice.

[58] "Component parts" are considered as rigid and discrete units whose shape and form does not need to be altered prior to assembly of the final product in its fully functional form, although its position may change during use of the final product.

[59] "Component materials" are considered as non-rigid materials whose shape and form may change prior to furniture assembly or during use of the furniture product. Obvious examples include upholstery material but also potentially timber, which may be considered as a component material but be later sawn and treated to be converted into a component part.

6.5 Technical Specification 6: Durable upholstery coverings

6.5.1 Why relevant to GPP?

The same arguments have been presented earlier with the criteria for durable upholstery coverings under Approach A for the procurement of furniture refurbishment services. Therefore the reader is referred to section 5.2.

6.5.2 Stakeholder discussion

The same discussion has been presented earlier with the criteria for durable upholstery coverings under Approach A for the procurement of furniture refurbishment services. Therefore the reader is referred to section 5.2.

6.5.3 What relevant ecolabel criteria and other green initiatives say

The same text has been presented earlier with the criteria for durable upholstery coverings under Approach A for the procurement of furniture refurbishment services. Therefore the reader is referred to section 5.2.

6.5.4 Ambition level

The ambition level is the same as presented earlier in section 5.2 under Approach A for furniture refurbishment services

6.5.5 TS6: Criteria proposals for Durable upholstery coverings

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
	TS6: Durable upholstery coverings *(only applicable to upholstered furniture)* Where upholstery covering materials that are based on either leather, textile fabrics or coated fabrics are used, they shall comply with all of the physical quality requirements set out in Table 7, Table 8 or Table 9 of Appendix I as appropriate. **Verification:** The tenderer shall provide a declaration from the leather supplier, textile fabric supplier or coated fabric supplier as appropriate, supported by relevant test reports, that the upholstery covering material meets the physical requirements for leather, textile fabrics or coated fabrics as specified in Table 7, Table 8 or Table 9 of Appendix I respectively. Upholstered furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332, textile based upholstery which have been awarded the EU Ecolabel for textiles, as established in Commission Decision 2014/350/EU or upholstery coverings that have been awarded other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.

Summary of rationale:

- Low quality (and cheaper) upholstery coverings can lead to premature end of life of the entire furniture product. It is necessary to incentivise the use of more durable and higher quality upholstery coverings, so that they can be competitive in invitations to tender.
- Physical requirements follow industry guidance for leather and for coated fabrics.
- Minimum requirements for textile fabrics are covered by Nordic Ecolabel and EU Ecolabel criteria.

6.6 Technical Specification 4 (core) /7 (comp.): Blowing agents

6.6.1 Why relevant to GPP?

The same arguments have been presented earlier with the criteria for durable upholstery coverings under Approach A for the procurement of furniture refurbishment services. Therefore the reader is referred to section 5.3.

6.6.2 Stakeholder discussion

The same discussion has been presented earlier with the criteria for durable upholstery coverings under Approach A for the procurement of furniture refurbishment services. Therefore the reader is referred to section 5.3.

6.6.3 What relevant ecolabel criteria and other green initiatives say

The same text has been presented earlier with the criteria for durable upholstery coverings under Approach A for the procurement of furniture refurbishment services. Therefore the reader is referred to section 5.3.

6.6.4 Ambition level

The ambition level is the same as presented earlier in section 5.3 under Approach A for furniture refurbishment services

6.6.5 TS4 (core)/7(comp.): Criteria proposals for Blowing agents

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS4 / 7: Blowing agents ***(only applicable to upholstered furniture)*** ***(same for core and comprehensive)*** Where foam padding materials are used in furniture upholstery, halogenated organic compounds shall not be used as blowing agents or as auxiliary blowing agents in the manufacture of such padding materials. **Verification:** The tenderer shall provide a declaration of non-use from the manufacturer of the foam padding material. Upholstered furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.	

Summary of rationale:

- CFCs and HCFCs have a considerable potential to both deplete the ozone layer and contribute to global warming. The use of HCFCs will not be phased out until 2030, so they should be specifically excluded now under GPP criteria.
- HFCs are better alternatives (negligible ozone depletion potential) but have a large global warming potential and so should be avoided too. There are currently no international and binding agreements about phasing out their use.
- Industry has shown that alternatives to halogenated blowing agents (e.g. CFCs, HCFCs and HFCs) can be used and so they should be actively encouraged via GPP criteria.

6.7 Technical Specification 5 (core)/8(comp.): Fitness for use

6.7.1 Why relevant to GPP?

The main conclusion from life cycle studies regarding furniture in general is that the majority of the environmental impacts are associated with the production of the materials, components and substances used in the manufacture of the product. Consequently, much of the criteria are focused on materials.

However, the impacts associated with materials are spread across the useable lifetime of the furniture product. If a product is not considered fit for its purpose, then it likely that it will have a much shorter lifetime than other, fit for purpose alternatives made of the same materials. Fitness for use is not only about the minimum required quality of materials but also about how they come together, potentially with moving parts as well, to create a fully functional piece of furniture.

Fitness for use is to some degree a subjective consideration but the furniture industry has undertaken considerable work to produce a serious of EN standards that present a harmonised approach to considering the fitness for use of a diverse range of furniture products.

6.7.2 Stakeholder discussion

A very clear message from industry stakeholders was to not propose criteria that relate to individual materials but instead that apply to the final assembled product. A long list of EN standards related to the fitness for use of certain furniture products is listed in Appendix III. It should be noted that only a small number of these standards may actually apply to any one particular furniture product.

When asking what exactly does the term "fit for use" mean, stakeholders considered this to relate to factors such as strength, safety, durability and ergonomics. The relevance of safety and ergonomics to environmental considerations was questioned although it was responded that these would be relevant if poor safety or ergonomics would result in a premature End-of-Life of the product.

Unlike many other products, most furniture is not sold with a CE marking and so the fact that it is available on the EU market cannot be assumed as proof of compliance with any relevant EN standards.

6.7.3 What relevant ecolabel criteria and other green initiatives say

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) states that furniture should comply with any relevant EN or ISO standards related to durability.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires fitness for use reports or certificates to be submitted for furniture products .but does not specify relevant standards.

The Danish GPP requirements state that any office work chairs or office work desks meet the requirements for Type A products as defined in EN 1335-1 and EN 527-1 respectively. This is in compliance with Danish legislation and it should be noted that a similar basic legal requirement is in place in the Netherlands. Danish GPP requirements also refer to other appropriate quality standards based on safety, wear resistance, tensile strength, colour fastness, etc.

The Belgian GPP criteria refer to the provision of any relevant documents relating to durability, reparability, safety and ergonomics.

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) refer to mandatory compliance with any relevant EN and ISO technical standards for assessing the durability, strength, safety and stability of seating, tables, internal doors, kitchen cabinets and other cabinets. Where no specific EN or ISO standard exists, provision is made for the use of other similar tests and standards. In addition to final product standards, where a significant quantity of VOCs have been used in the application of surface coatings (i.e. 30 – 60 g/m2) compliance with defined surface properties must be demonstrated (such as scratch resistance and resistance to dry or wet heat).

6.7.4 Ambition level

Given the fundamental importance of this criterion, it is proposed that both core and comprehensive level EU GPP criteria should align with the EU Ecolabel for furniture as set out in Commission Decision (EU) 2016/1332.

The list of standards provided in Appendix IV was developed following consultation with stakeholders but may not be exhaustive and so procurers are encouraged to seek feedback from the market prior to publishing Invitations to Tender.

With regards to fire safety standards for upholstered furniture, it should be noted that the public authority has to take into account relevant national legislation or mandatory standards relating to required levels of flame retardancy in furniture when writing the tender documents. If no binding rules/standards exist, the public authority is not bound to adhere to any specific voluntary standard. In the case of the standards listed in Appendix IV, EN 1021-2 requires a higher level of flame retardancy than EN 1021-1. This can lead to cost increases and is likely to require the use of different materials/substances, some of which might have hazardous properties. The use of these substances may have an influence on the cost for recycling as well as on reuse opportunities. The public authority should therefore consider, according to the intended use and location of the furniture items, what levels of flame retardancy it wants to require.

6.7.5 TS5(core)/8(comp.): Criteria proposal for Fitness for use

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS5 / 8: Fitness for use *(same for core and comprehensive)* The furniture product shall comply with the requirements set out in the latest versions of the following relevant EN standards that may relate to the durability, dimensional requirements, safety and strength of the product: *(contracting authority to make reference to specific standards from Appendix IV or other sources that are most relevant to the furniture being procured)* **Verification:** The tenderer shall provide a declaration of compliance with any relevant EN standards, supported by test reports from either the furniture manufacturer or component part/material suppliers, as appropriate. Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.	

Summary of rationale:

- Compliance with fitness for use standards ensures that products meet minimum quality requirements that can be linked to more durable products.
- Without such criteria, cheaper (but lower quality and less durable) products may win the tender and result in a premature End-of-Life and increased overall life cycle cost to the contracting authority.

6.8 Technical Specification 6(core)/9(comp.): Design for disassembly and repair

6.8.1 Why relevant to GPP?

The main conclusion from life cycle studies regarding furniture in general is that the majority of the environmental impacts are associated with the production of the materials, components and substances used in the manufacture of the product. Consequently, much of the criteria are focused on materials.

However, the impacts associated with materials are spread across the useable lifetime of the furniture product. Like many products, the End-of-Life of a furniture product can arise due to damage or failure of just one part of the product, despite the fact that the vast majority of the rest of the product is in good order.

Many furniture products are designed in such a way that repair is simply not possible or practical. To maximise the potential to extend the useable lifetime of furniture products, it is essential that products are designed with ample consideration given to the potential to both disassemble and repair the product.

6.8.2 Stakeholder discussion

Stakeholders generally agreed about the environmental benefits of products that are designed for disassembly, not only for the purposes of repair, but also maximising the potential for the adequate disposal of different furniture materials.

Relatively little discussion took place on this topic because most stakeholders represented companies that produced new furniture products on a large scale and were not particularly experienced with repair services, which is dominated by small to medium enterprises.

From the limited feedback received, a clear message was that solid wood was much more amenable to repair and reuse than wood-based panels (i.e. wood chips and fibres bound together by thermosetting resins and covered with a layer of veneer) because they could be easily cut, shaved have screws reinserted into existing holes. In most cases, the aforementioned operations were impossible to carry out with wood based panels.

6.8.3 What relevant ecolabel criteria and other green initiatives say

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires that any parts greater than 50g in weight should be separable at End-of-Life.

The Belgian GPP criteria refer to the provision of any relevant documents relating to durability, *reparability*, safety and ergonomics.

6.8.4 Ambition level

Given the fundamental importance of this criterion, it is proposed that both core and comprehensive level EU GPP criteria should align with the EU Ecolabel for furniture as set out in Commission Decision (EU) 2016/1332.

6.8.5 TS6(core)/9(comp.): Criteria proposal for Design for disassembly and repair

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS6 / 9: Design for disassembly and repair *(same for core and comprehensive)* The tenderer shall provide clear disassembly and repair instructions (e.g. paper or electronic copy, video) to enable a non-destructive disassembly of the furniture product for the purpose of replacing component parts/materials. Instructions shall be provided in a hard copy together with the product and/or in electronic copy via the manufacturer's website. Disassembly and replacement operations should be capable of being carried out using common and basic manual tools and unskilled labour. **Verification:** A manual shall be provided by the tenderer which shall include an exploded diagram of the product, illustrating the parts that can be removed and replaced and the tools required. Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.	

Summary of rationale:

- Criteria relating to design for disassembly help ensure that the product can be easily refurbished, remanufactured or remodelled in the future and that distinct materials can easily be separated from each other for recycling or energy recovery
- The full value of this criterion can only be realised when used in conjunction of other requirements such as the provision of spare parts and warranties.

6.9 Technical Specification 7(core)/10(comp.): Product warranty and spare parts

6.9.1 Why relevant to GPP?

The main conclusion from life cycle studies regarding furniture in general is that the majority of the environmental impacts are associated with the production of the materials, components and substances used in the manufacture of the product. Consequently, much of the criteria are focused on materials.

However, the impacts associated with materials are spread across the useable lifetime of the furniture product. Like many products, the End-of-Life of a furniture product can arise due to damage or failure of just one part of the product, despite the fact that the vast majority of the rest of the product is in good order.

Even when furniture products are designed in such a way that repair is possible, efforts to extend the useable lifetime of the product can be greatly hampered by the lack of availability of suitable spare parts. To maximise the potential to extend the useable lifetime of furniture products, it is essential that furniture suppliers commit to providing spare parts for a specified time after sale of the product.

6.9.2 Stakeholder discussion

Some split views were expressed by stakeholders. On the one hand, some claimed that the proposed warranties were considerably shorter than those observed in typical UK contracts, which were around 10 years. On the other hand, caution was urged against long periods of guaranteeing the availability of spare parts because these could often be out of the control when supplied by third parties, who may cease trading or simply stop manufacturing or storing those particular spare parts. In these cases, there would be a risk of more "honest" companies being at a disadvantage if they admitted that they could not fully guarantee the availability of spare parts during a five year period.

Counter arguments were that as far as possible, standardised parts and fittings should be used for those components most likely to fail or be damaged within 5 years and that the furniture supplier themselves should take charge and maintain some inventory of spare parts that they use and which are supplied by third parties.

To be clear that spare parts to not necessarily need to be from the same original supplier or be absolutely identical to the original part, stakeholders requested that the following wording be used:

"…spare parts or elements which achieve an equivalent function…"

6.9.3 What relevant ecolabel criteria and other green initiatives say

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) have two ambition levels. The entry level pre-requisite is a 5 year commercial warranty coupled with 5 year availability of *"…spare parts or elements which achieve an equivalent function…"*. The more ambitious requirement increases the periods for both commercial warranty and spare part availability to 10 years.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires that spare parts should be made available for a period of 5 years after the date of purchase.

The Blue Angel RAL UZ 117 (Sept. 2009) criteria for low emission upholstered furniture require that "*…functionally compatible replacements shall be guaranteed for a period of at least five years…*".

The EU Ecolabel for furniture (Commission Decision (EU) 2016/1332 requires that a 5 year product warranty is provided as well as making spare parts available for 5 years after the date of purchase.

6.9.4 Ambition level

The comprehensive level EU GPP criteria align with the EU Ecolabel for furniture as set out in Commission Decision (EU) 2016/1332 (i.e. 5 year warranty and 5 year spare part availability). Core criteria require a less ambitious minimum level of 3 years for the product warranty but continue to require spare part availability for 5 years.

6.9.5 TS7(core)/10(comp.): Criteria proposal for Product warranty and spare parts

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS7: Product warranty and spare parts The tenderer shall provide a minimum three-year warranty effective from the date of delivery of the product. This warranty shall cover repair or replacement and include a service agreement with options for pick-up and return or on-site repairs. The warranty shall guarantee that the goods are in conformity with the contract specifications at no additional cost. The tenderer shall guarantee the availability of spare parts, or elements which achieve an equivalent function, for a period of at least three years from the date of delivery of the furniture product. Contact details that should be used in order to arrange the delivery of spare parts shall be provided. **Verification:** The tenderer shall provide a written declaration detailing the offered period and stating that it covers the conformity of the goods with the contract specifications, including all indicated usage. The tenderer shall provide a declaration that compatible spare parts will be made available to the contracting authority or through a service provider. Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024	**TS10: Product warranty and spare parts** The tenderer shall provide a minimum five-year warranty effective from the date of delivery of the product. This warranty shall cover repair or replacement and include a service agreement with options for pick-up and return or on-site repairs. The warranty shall guarantee that the goods are in conformity with the contract specifications at no additional cost. The tenderer shall guarantee the availability of spare parts, or elements which achieve an equivalent function, for a period of at least five years from the date of delivery of the furniture product. Contact details that should be used in order to arrange the delivery of spare parts shall be provided. **Verification:** The tenderer shall provide a written declaration detailing the offered period and stating that it covers the conformity of the goods with the contract specifications, including all indicated usage. The tenderer shall provide a declaration that compatible spare parts will be made available to the contracting authority or through a service provider. Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU)

Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.	2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.

Summary of rationale:

- The availability of spare parts is a widely practised in the furniture industry and is an essential requirement to ensure that the useable lifetime of products can be maximised.
- Product warranties that extend beyond the minimum legal requirements of 2 years that generally apply for consumer goods is a proxy measure of products of good quality and which are likely to be fit for use and exhibit good durability characteristics.

6.10 Award criterion 1: Formaldehyde emission levels from wood-based panels

6.10.1 Why relevant to GPP?

The reader is referred to section 6.2 where the main reasons have previously been described.

6.10.2 Stakeholder discussion

The reader is again referred to section 6.2 where stakeholder discussion has already been summarised.

6.10.3 What relevant ecolabel criteria and other green initiatives say

The reader is yet again referred to section 6.2 where the main details about several relevant ecolabels and green initiatives have been presented.

6.10.4 Ambition level

The ambition level is higher for the award criteria than for the equivalent criteria set out as a minimum technical specification in section 6.2.

Across Europe, there are different baseline performance levels. There are 6 Member States where the E1 emission level is a mandatory legal requirement.

For these countries, it would make sense for the comprehensive ambition levels to be used (i.e. 65% of E1 emission level as a minimum technical specification and 50% of E1 emission level as an award criterion).

In other EU countries, it would be more practical to follow the core ambition levels (i.e. E1 emission level as a minimum technical specification and 65% of E1 emission level as an award criterion).

6.10.5 AC1: Criteria proposal for formaldehyde emissions from wood-based panels

Core criteria	Comprehensive criteria
AWARD CRITERION	
AC1: Formaldehyde emissions from wood-based panels Points shall be awarded when all wood-based panels used in the furniture product are shown to have formaldehyde emission rates that comply with 65% of the E1 threshold limits for formaldehyde emissions as defined in Annex B of EN 13986. **Verification:** Compliance with 65% of E1 emission limits to be shown as described in section 6.2 (TS2) above.	**AC1: Formaldehyde emissions from wood-based panels** Points shall be awarded when all wood-based panels used in the furniture product are shown to have formaldehyde emission rates that comply with 50% of the E1 threshold limits for formaldehyde emissions as defined in Annex B of EN 13986. **Verification:** Compliance with 50% of E1 emission limits to be shown as described in section 6.2 (TS2) above.

Summary of rationale:

- Where core level requirements are set, the minimum technical specification shall be compliance with E1 with award points for meeting 65% of E1. This will allow all wood-based panels (i.e. including particleboards) to potentially achieve award points.
- Where comprehensive level requirements are set, the minimum technical specification shall be compliance with 65% of E1 with award points for meeting 50% of E1. This does not exclude any type of wood-based panel from the product per se, but makes it very difficult for furniture using MDF to gain award points.

6.11 Award criterion 2: Plastic marking

6.11.1 Why relevant to GPP?

The correct marking of plastic parts provides useful information for users but the main purpose is so that plastic can be separated and recycled in the optimum way at the end of life.

6.11.2 Stakeholder discussion

This criteria area was discussed in some detail during stakeholder meetings. Opinions against this requirement were based on the argument that marking of a plastic component has little or no consequence on whether or not it will actually be recycled, since most furniture is sent to landfill or incinerators and even if plastics are recycled, they are generally sorted and separated by automated systems based on infra-red technology and/or floatation and sedimentation processes. Some other stakeholders stated that plastic marking is often incorrect and for that reason there is a need to use automated systems.

Arguments in favour of the marking scheme were that this is useful information to the customer and, if different, the end user. Large plastic parts may be manually separated during pre-sorting, which is more efficient that mixing with all sorts of different plastics, shredding them together and separating the shreds according to their physical properties via automated systems. It was also stated that marking of PVC could help divert this waste from incinerators or energy from waste plants where it can, due to its high chloride content, contribute to potential increases in dioxin emissions either in the exhaust gas or via ash residues and will cause problems due to the formation of hydrochloric acid vapours, increase the cost of neutralisation chemicals needed and increase the quantity of hazardous air pollution control residues generated during exhaust gas abatement.

Feedback from plastics recyclers stated that there were some problems with automated systems due to the addition of fillers and other additives in plastics (generally in quantities above 10% w/w) changing the density of the materials and causing it to be separated with the wrong type of polymer, contaminating the recyclate batch and lowering its market value considerably. This was a particular concern with PVC contaminating PET batches and a lesser concern with PP entering into PE batches and vice versa. Therefore it would be considered useful to plastic recyclers if large plastic components, which can be manually pre-sorted, would be labelled to indicate the type of filler or any other additives used, such as flame retardants or plasticisers.

Caution was urged against any mandatory requirement for plastic marking since furniture may contain plastic parts that are not suitable for marking either because they were extruded instead of injection moulded, that there is not sufficient clear and flat surface area available or for aesthetic reasons.

6.11.3 What relevant ecolabel criteria and other green initiatives say

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) require that all plastic parts >50g be marked for recycling according to ISO 11469 or equivalent and do not contain additions of other materials that may hinder their recycling although exemption from marking requirements is made for certain components on the basis of aesthetic reasons so long as the marking information is included in the user manual of similar documentation.

The Italian GPP criteria also require marking of plastic components >50g according to ISO 11469 but do not mention any exemptions to marking for technical or aesthetic reasons.

The Danish GPP criteria are the same as the Italian criteria but specifically mention that no additives that would impede plastic recycling should be added.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires that all plastic components >50g and any plastic components that may weigh less than 50g but whose combined weight adds up to more than 100g in the furniture product, must be marked in accordance with ISO 11469 and ISO 1043. Furthermore, plastic components must not contain any pigments based on cadmium, chromium VI or mercury and the polymer type must be suitable for recycling.

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) states that plastic parts >50g must be marked according to ISO 11469, including details of any fillers and reinforcements used. Furthermore, surface treatment of plastics shall only be permitted if it does not adversely affect the recyclability of the plastic. No PVC plastic is permitted in Nordic Ecolabel furniture.

6.11.4 Ambition level

By setting the requirement as an award criterion, there are no concerns about possible exclusion of furniture products from ITTs but producers who make the effort to mark the plastic components can be rewarded. In terms of plastic marking, there are two main choices for which system to use:

- The system developed by the Society of the Plastics Industry (SPI) or
- The system set out in ISO 11469 and supported by ISO 1043.

The SPI system is widely known to consumers due to its widespread use in food and beverage containers but only provides specific information about the six polymers i.e. polyethylene terephthalate (PETE), high-density polyethylene (HDPE), polyvinyl chloride (PVC), low-density polyethylene (LDPE), polypropylene (PP) or polystyrene (PS). This labelling scheme is not helpful if co-polymers are used, if other single polymers are used or if significant quantities of additives are used.

ISO 11469 and ISO 1043 (parts 1-4) provide polymer abbreviations for all commercially important polymers and co-polymers and also have lists of codes for fillers, reinforcing materials, plasticisers and flame retardants that may be added to the plastic (see Appendix V). An example of the greater level of detail afforded by the ISO 11469 / ISO 1043 system is illustrated in Figure 7 below.

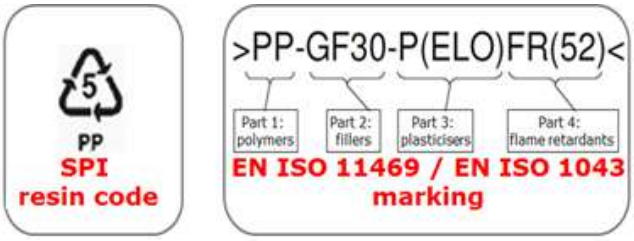

Figure 7. Comparison of the marking that would be required for a polypropylene plastic with 30% glass fibre filler content, epoxidised linseed oil plasticiser and red phosphorus flame retardant according to the SPI standard (left) and the ISO 11469 / ISO 1043 standards (right).

Clearly it can been seen that the marking requirements under ISO 11469 / ISO 1043 can lead to much more complicated codes/labels than those specified under the SPI system.

Thus it is proposed that the threshold for plastic marking be raised to 100g rather than 50g.

It is important to understand that the inclusion of recycled plastic may unintentionally introduce certain impurities. For this reason, the marking criteria for fillers, reinforcing materials, plasticisers and flame retardants should only refer to such substances that are "intentionally added".

The ISO 11469 and 1043 standards do not specify minimum heights for lettering, although based on examples of companies that have introduced mandatory plastic marking for components as small as 25g, it seems that a minimum letter height of 2.5mm is appropriate for visual identification.

6.11.5 AC2: Criteria proposal for plastic marking

Core criteria	Comprehensive criteria
AWARD CRITERION	
AC2: Plastic marking ***(same for core and comprehensive)*** Points shall be awarded when plastic parts with a mass greater than 100g shall be marked in accordance with EN ISO 11469 and EN ISO 1043 (parts 1-4). The lettering used in markings should be at least 2.5 mm high. Where any fillers, flame retardants or plasticisers are intentionally incorporated into the plastic in proportions greater than 1 % w/w, their presence should also be reflected in the marking as per EN ISO 1043 parts 2-4. In exceptional cases, non-marking of plastic parts with a weight greater than 100g may be permitted if: • Marking would adversely impact on the performance or functionality of the plastic part; • Where marking is not technically possible due to the production method; • Where parts cannot be marked because of insufficient appropriate surface area available for the marking to be of a legible size to be identified by a recycling operator. In the above cases, where non-marking is justified, further details about the polymer type and any additives as per the requirements of EN ISO 11469 and EN ISO 1043 (parts 1-4) shall be provided in written form. ***Assessment and verification**:* The tenderer shall provide a declaration of compliance with this criterion, listing all the plastic components with a weight greater than 100g in the furniture product and stating whether or not they have been marked according to EN ISO 11469 and EN ISO 1043 (parts 1-4). The marking of any plastic components shall be clearly visible upon visual examination of the plastic component. Marking does not necessarily need to be clearly visible in the final assembled furniture product. In the case of non-marking of any plastic parts with a weight greater that 100g, the tenderer shall provide justifications and relevant information. Furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other relevant ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.	

Summary of rationale:

- Marking of plastic parts according to ISO 11468 / ISO 1043 instead of the SPI system may provide a lot more information of potential interest users and plastic recyclers.
- Due to longer marking codes being required and the fact that manual pre-sorting is most likely to occur with larger pieces the 50g threshold has been raised to 100g.

6.12 Award criterion 3: Low chemical residue upholstery coverings

6.12.1 Why relevant to GPP?

The reader is referred to section 5.5, where the main reasons have previously been described.

6.12.2 Stakeholder discussion

The reader is again referred to section 5.5, where stakeholder discussion has already been summarised.

6.12.3 What relevant ecolabel criteria and other green initiatives say

The reader is yet again referred to section 5.5, where the main details about several relevant ecolabels and green initiatives have been presented.

6.12.4 Ambition level

The ambition level is the same as described earlier in section 5.5.

6.12.5 AC3: Criteria proposal for low chemical residue upholstery coverings

Core criteria	Comprehensive criteria
AWARD CRITERION	
	AC3: Low chemical residue upholstery coverings ***(only applicable to upholstered furniture)*** Points shall be awarded where the upholstery covering material is shown to comply, as appropriate, with the limits for restricted arylamine dyes, extractable heavy metals and free formaldehyde set out below. For textile fabrics and coated fabrics: • No restricted arylamines (see Appendix II) present above 30 mg/kg (limit applies to each individual amine) according to EN ISO 14362-1 and 14362-3. • Free and partly hydrolysable formaldehyde ≤ 75 mg/kg according to EN ISO 14184-1. • Extractable heavy metals determined according to EN ISO 105-E04 being less than the following limits (in mg/kg): antimony ≤ 30.0; arsenic ≤ 1.0; cadmium ≤ 0.1; chromium ≤ 2.0; cobalt ≤ 4.0; copper ≤ 50.0; lead ≤ 1.0; mercury ≤ 0.02 and nickel ≤ 1.0. For leather: • No restricted arylamines (see Appendix II) present above 30 mg/kg (limit applies to each individual amine) according to EN ISO 17234-1. and EN ISO 17234-2. • Chromium VI should not exceed 3 mg/kg according to EN ISO 17075 (detection limit). • Free and partly hydrolysable formaldehyde ≤ 300 mg/kg according to EN ISO 17226-1. • Extractable heavy metals determined according to EN ISO 17072-1 being less than the following limits (in mg/kg): antimony ≤30.0; arsenic ≤1.0; cadmium ≤0.1; chromium ≤200.0; cobalt ≤ 4.0; copper ≤ 50.0; lead ≤ 1.0; mercury ≤ 0.02 and nickel ≤ 1.0. **Verification:** Points shall be awarded to tenderers that provide a declaration that the leather, textile fabric or coated fabric upholstery covering material, as appropriate, complies with the above limits, supported by results from relevant test methods either commissioned by the tenderer themselves or the material supplier. Upholstered furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or textile fabrics which have been

	awarded the EU Ecolabel for textiles, as established in Commission Decision 2014/350/EU, or upholstery materials that have been awarded other ISO 14024 Type I ecolabels directly fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.

Summary of rationale:

- Chemical residues are inevitable in textile, coated fabric and leather, but should be minimised in materials that can come into direct skin contact, such as furniture upholstery.
- The arylamine dyes, extractable heavy metals and free formaldehyde are common chemical residues of concern in these types of materials.
- The requirements stated in this award criterion align with OEKO-TEX 100, EU Ecolabel textiles and EU Ecolabel furniture and help reinforce these schemes, by incentivising furniture refurbishers to try to source them in order to make their bids more competitive.

6.13 Award criterion 4: Low VOC emission furniture

6.13.1 Why relevant to GPP?

Many different chemical mixtures and formulations can be used during the production and finishing treatment of furniture that contain significant contents of VOCs. This can result in the emission of small but not insignificant quantities of VOCs from the final furniture product once it is unpackaged and installed at the site of the contracting authority. For indoor furniture, VOC emissions may be sufficient to cause adverse health effects on occupants of the building. The EU LCI Working Group has published a list of approximately 85 VOCs of concern and set LCI limits relating to their emission from products. The substances on the list and their associated LCI limits are updated on a periodical basis as new supporting toxicological evidence is produced.

The importance of VOC emissions from products in indoor environments is reflected by "EC Mandate 366, a horizontal approach to indoor VOC emissions", which is currently being implemented under the Construction Products Regulation (EC) No 305/2011, although it must be added that furniture does not fall within the scope of the mandate.

6.13.2 Stakeholder discussion

The subject of VOCs was debated in detail amongst furniture stakeholders. The first issue to mention would be to decide at what stage of the furniture life cycle VOCs should be tackled in GPP criteria. Industry stakeholders were concerned about strict limits on maximum VOC contents of formulations because this could result in products with inadequate technical properties, particularly in the case of public furniture subject to high wear. Nonetheless, one industry stakeholder stated that they could currently comply with a limit of 6% VOC content. Stakeholders in favour of requirements for low-VOC content coatings cited the advances in powder coating and UV-cured coating technologies which can reach almost zero VOC content and easily below an arbitrary limit of say, 5%.

Arguments in favour of final product testing stated that this was far more relevant to the overall aim of reducing user exposure to VOCs and that just because high VOC content formulations may or may not be used during production, this does not automatically translate into a final product with high VOC emissions – ultimately it will depend on the quantities involved and the curing and drying steps involved. Stakeholders who were against final testing requirements mentioned the high costs of testing, which can range from €2000-5000 for ISO 16000 chamber testing with results after 3 days and 28 days. The lack of a standard EU method for final product testing for furniture was also mentioned. Due to this lack, there would be doubts about what exactly would be considered as an acceptable limit to apply and what would be an acceptable loading rate in the chamber. Stakeholders in favour of final product emission testing pointed out the BIFMA (in the US) and Blue Angel have VOC emission limits that are set to final furniture products and that it would be possible to also apply ISO 16000 or CEN/TS 16516 limits and loading rates specifically to wood-based panels used in furniture if this was desired.

6.13.3 What relevant ecolabel criteria and other green initiatives say

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) place an upper limit of 60% VOC content for coating formulations. For adhesives, the basic requirements are that any water-based formulations must be ≤10% VOC content or ≤30% VOC content for solvent-based

formulations. The advanced requirement states that all adhesives used must have a VOC content less than 10%.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2104) does not have any requirements on the VOC content of coating formulations or adhesives or on final product VOC emission. However, the future intention to have final product VOC emission criteria is explicitly mentioned.

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) do not address final product VOC emissions but instead the quantity of VOCs in coating formulations or applied to the furniture. Where components are coated and these components account for at least 5% of the furniture weight, one of the following conditions in the second or third columns of the table below must apply.

Table 6. Nordic Ecolabel approach to VOCs in coating formulations applied to furniture

Furniture type	Quantity VOC applied	if	VOC content of coating formulation
Bedroom furniture, reception room furniture, doors, MDF panels and contoured surfaces	≤ 10 g/m^2		> 5%
Tables, chairs and other product groups	≤ 30 g/m^2		> 5%
Contract furniture and furniture of high quality	≤ 60 g/m^2		> 5%

The Blue Angel criteria for low emission upholstered furniture (RAL UZ 117, Sept. 2009 version) define specific chamber test conditions that can be applied to a textile covered armchair or pieces of leather upholstery and associated air concentrations limits for formaldehyde (60 µg/m^3), other aldehydes ((60 µg/m^3)), total VOCs (450 µg/m^3), total SVOCs (80 µg/m^3) and carcinogenic VOCs (1 µg/m^3 per substance). The Blue Angel also permits the use of emission rate limits (with units in µg/h instead of chamber air concentrations (in µg/m^3) when the whole armchair is tested.

In the US, the BIFMA scheme (set out in the ANSI/BIFMA M7.1-2011 standard) has been set up for VOC emission testing of office furniture and defines two product groups "systems furniture", and "seating". Emissions are measured in a ventilated chamber test and a series of measurements are taken at periods between 3 and 14 days after placement in the chamber. Emission rates can be calculated (µg/m^2.h) or (µg/m^3.h) depending on how the product being tested is defined, and 7 day limits for TVOC, formaldehyde, total aldehydes and 4-phenylcyclohexane are set in the ANSI/BIFMA M7.1-2011 standard.

6.13.4 Ambition level

Due to doubts about the market availability of low-VOC emission furniture products, it was considered that VOC-related criteria would be best addressed as a comprehensive award criterion only.

Requirements relating to the use of low VOC coatings or quantitative limits on the VOCs applied in coatings which are provide in both the Nordic Ecolabel and EU Ecolabel for Furniture would not be easy or practical to assess and verify in EU GPP criteria. Thus it is considered more appropriate to simply focus on emissions from the final furniture product or from specific parts (i.e. leather upholstery) that are considered to be the major sources of VOC emissions.

The ambition level generally aligns with that for the Blue Angel RAL UZ 117 for low emission upholstered furniture and the EU Ecolabel for furniture.

6.13.5 AC4: Criteria proposal for low VOC emission furniture

<table>
<tr><th>Core criteria</th><th>Comprehensive criteria</th></tr>
<tr><td colspan="2">AWARD CRITERION</td></tr>
<tr><td></td><td>
AC4: Low VOC emission furniture

(only applicable to upholstered furniture)

Points will be awarded for demonstrating that the Total Volatile Organic Compound (TVOC) emissions from the entire upholstered furniture product (such as armchairs, sofas or office chairs), or from testing of the upholstery material alone (when this is considered to be the most significant source of VOC emissions from the furniture product (e.g. leather or coated fabrics) result in chamber concentrations of TVOCs of less than 500 µg/m^3 after 28 days testing according to ISO 16000 or equivalent standards under the following loading and ventilation rates:
<table>
<tr><th>Test element</th><th>Chamber volume and loading rate</th><th>Ventilation rate</th></tr>
<tr><td>Armchairs and sofas</td><td rowspan="2">2-10m^3 test chamber with at least 25% of volume occupied by product</td><td>4.0 m^3/h</td></tr>
<tr><td>Office chairs</td><td>2.0 m^3/h</td></tr>
<tr><td>Leather and coated fabric upholstery materials</td><td>≥20 L chamber volume (loading rate linked to ventilation rate)</td><td>1.5 m^3/m^2/h</td></tr>
</table>
Verification:

The tenderer shall provide a copy of a chamber test report carried out in accordance with the requirements of the ISO 16000 series of standards or equivalent standards. If the chamber concentration limit specified at 28 days can be met earlier, then the test may be stopped prematurely.

The tenderer shall make it clear whether the test was applied to the entire furniture product or only to defined components materials.

Upholstered furniture products which have been awarded the EU Ecolabel for furniture, as established in Commission Decision (EU) 2016/1332 or other ISO 14024 Type I ecolabels fulfilling the listed requirements, or using equivalent methods, shall be deemed to comply.
</td></tr>
</table>

Summary of rationale:

- VOC emissions from furniture products are of direct relevance to indoor air quality and potential adverse health effects on users.
- Due to the high costs associated with testing, this requirement is only considered as a comprehensive award criterion.

6.14 Award criterion 3(core)/5(comp.): Extended warranty periods

6.14.1 Why relevant to GPP?

The reader is referred to sections 5.8 and 6.9, where the main reasons have previously been described.

6.14.2 Stakeholder discussion

The reader is again referred to sections 5.8 and 6.9, where stakeholder discussion has already been summarised.

6.14.3 What relevant ecolabel criteria and other green initiatives say

The reader is yet again referred to section 6.9, where the main details about several relevant ecolabels and green initiatives have been presented.

6.14.4 Ambition level

Due to the fact that this is an award criterion, the ambition level is quite open-ended in order to encourage longer warranties although maximum points shall be awarded for any length of warranty that is 4 or more years longer than that specified for the minimum technical specification to prevent unrealistic warranties being offered simply to make bids more competitive.

6.14.5 AC3(core)/5(comp.): Criteria proposal for extended product warranty

Core criteria	Comprehensive criteria
AWARD CRITERION	
AC3 / 5: Extended warranty periods ***(same for core and comprehensive)*** A maximum of X additional points shall be awarded for each additional year of warranty and service agreement offered that is more than the minimum technical specification (see TS 7/10 above) as follows: - +4 or more years extra warranty: x points - +3 years extra warranty: 0.75x points - +2 years extra warranty: 0.5x points - +1 year extra warranty: 0.25x points **Verification:** The tenderer shall provide a written declaration detailing the offered period and stating that it covers the conformity of the goods with the contract specifications, including all indicated usage.	

Summary of rationale:

- Extended product warranties are a very relevant proxy measure for durable and robust products with a longer expected lifetime than other products with shorter warranties.
- The increased risk to tenderers of future repair and replacement costs caused by an extended warranty is likely to result in an increased cost of the furniture product. For this reason, if the contracting authority wishes to encourage products with longer warranties to be more competitive with other equivalent products with shorter warranties, then an award criterion should be used.

6.15Award criterion 6: Low chemical residue padding materials

6.15.1 Why relevant to GPP?

The reader is referred to section 5.6, where the main reasons have previously been described.

6.15.2 Stakeholder discussion

The reader is again referred to section 5.6, where stakeholder discussion has already been summarised.

6.15.3 What relevant ecolabel criteria and other green initiatives say

The reader is yet again referred to section 5.6, where the main details about several relevant ecolabels and green initiatives have been presented.

6.15.4 Ambition level

The ambition level is the same as set for AC2 in Approach A for the procurement of furniture refurbishment services as set out in section 5.6.

6.15.5 AC6: Award criterion 6: Low chemical residue padding materials

Core criteria	Comprehensive criteria
AWARD CRITERION	
	AC6: Low chemical residue padding materials[60] *(only applicable to upholstered furniture)* Where latex foam is used as a padding material in furniture upholstery, points shall be awarded if the foam complies with the requirements for chlorophenols, heavy metals, pesticides and butadiene listed in Table 12 of Appendix III, in accordance with the corresponding test method (A-D) listed in the same table. Where polyurethane foam is used as a padding material in furniture upholstery, points shall be awarded if the foam complies with the requirements for heavy metals, plasticisers, TDA, MDA, tinorganic substances and other specific substances listed in Table 13 of Appendix III in accordance with the corresponding test method (A-E) listed in the same table. Where other padding materials are used, points shall be awarded if compliance with the chemical residue limits set out in either Table 12 or Table 13 of Appendix III can be demonstrated. **Verification:** **For latex foams:** The tenderer shall provide a declaration of compliance with this criterion, supported by test reports according to the following methods: A. For chlorophenols the tenderer shall provide a report presenting the results of the following test procedure. 5 g of sample shall be milled and chlorophenols shall be extracted in the form of phenol (PCP), sodium salt (SPP) or esters. The extracts shall be analysed by means of gas chromatography (GC). Detection shall be made with mass spectrometer or electron capture detector (ECD). B. For heavy metals the tenderer shall provide a report presenting the results of the following test procedure. Milled sample material is eluted in accordance with DIN 38414-S4 or equivalent in a ratio of 1:10. The resultant filtrate shall be passed through a 0.45 µm membrane filter (if necessary by pressure filtration). The solution obtained shall be examined for the

[60] Note that chemical residue testing requirements for latex foam and polyurethane foams have been established by industry-led voluntary schemes such as the EuroLatex ECO Standard and the CertiPUR standard. At the time of writing, these schemes were considered to provide a sufficient level of assurance.

	content of heavy metals by inductively coupled plasma optical emission spectrometry (ICP-OES), also known as inductively coupled plasma atomic emission spectrometry (ICP-AES), or by atomic absorption spectrometry using a hydride or cold vapour process. C. For pesticides the tenderer shall provide a report presenting the results of the following test procedure. 2 g of sample is extracted in an ultrasonic bath with a hexane/dichloromethane mixture (85/15). The extract is cleaned up by acetonitrile agitation or by adsorption chromatography over florisil. Measurement and quantification are determined by gas chromatography with detection on an electron capture detector or by coupled gas chromatography/mass spectrometry. The testing on pesticides is requested for latex foams with a content of at least 20 % natural latex. D. For butadiene the tenderer shall provide a report presenting the results of the following test procedure. Following milling and weighing of the latex foam, headspace sampling shall be performed. Butadiene content shall be determined by gas chromatography with detection by flame ionisation. **For polyurethane foams:** The tenderer shall provide a declaration of compliance with this criterion, supported by test reports that demonstrate compliance with the limits in Table 13 of Appendix III. For methods B, C, D and E, 6 composite samples shall be taken from a maximum depth of up to 2 cm from the surface faces of the material sent to the relevant laboratory. A. For phthalates and other specific substances listed in Table 13 of Appendix III, the tenderer shall provide a declaration supported by declarations from suppliers of the foam confirming that they have not been added intentionally to the foam formulation. B. For heavy metals the tenderer shall provide a report presenting the results of the following test procedure. Milled sample material is eluted in accordance with DIN 38414-S4 or equivalent in a ratio of 1:10. The resultant filtrate shall be passed through a 0.45 µm membrane filter (if necessary by pressure filtration). The solution obtained shall be examined for the content of heavy metals by atomic emission spectrometry with inductively coupled plasma (ICP-AES or ICP-OES) or by atomic absorption spectrometry using a hydride or cold vapour process. C. For the total amount of plasticizers the tenderer shall provide a report presenting the results of the following test procedure. Extraction shall be performed using a validated method such as the subsonic extraction of 0.3 g of sample in a vial with 9 ml of t-Butylmethylether during 1 hour followed by the determination of phthalates by GC using a single ion

	monitoring mass selective detector (SIM Modus). D. For TDA and MDA the tenderer shall provide a report presenting the results of the following test procedure. Extraction of a 0.5 g composite sample in a 5 ml syringe shall be performed with 2.5 ml of 1 % aqueous acetic acid solution. The syringe is squeezed and the liquid returned to the syringe. After repeating this operation 20 times, the final extract is kept for analysis. A new 2.5 ml of 1% aqueous acetic acid is then added to the syringe and another 20 cycles repeated. After this, the extract is combined with the first extract and diluted to 10 ml in a volumetric flask with acetic acid. The extracts shall be analysed by high-performance liquid chromatography (HPLC-UV) or HPLC-MS. If HPLC-UV is performed and interference is suspected, reanalysis with high performance liquid chromatography–mass spectrometry (HPLC-MS) shall be performed. E. For tinorganic substances the tenderer shall provide a report presenting the results of the following test procedure. A composite sample of 1-2 g weight shall be mixed with at least 30ml of extracting agent during 1 hour in an ultrasonic bath at room temperature. The extracting agent shall be a mixture composed as follows: 1750 ml methanol + 300 ml acetic acid + 250 ml buffer (pH 4.5). The buffer shall be a solution of 164 g of sodium acetate in 1200 ml of water and 165 ml acetic acid, to be diluted with water to a volume of 2000 ml. After extraction the alkyl tin species shall be derivatised by adding 100 µl of sodium tetraethylborate in tetrahydrofuran (THF) (200 mg/ml THF). The derivative shall be extracted with n-hexane and the sample shall be submitted to a second extraction procedure. Both hexane extracts shall be combined and further used to determine the organotin compounds by gas chromatography with mass selective detection in SIM modus.

Summary of rationale:

- Latex and PUR foams are the dominant padding materials used in furniture (more than 90% of the market) and their production involves the use of a number of hazardous substances.
- Chemical residues are inevitable in padding materials and by limiting their content, risks or harmful effects of exposure both during use and after End-of-Life are minimised.
- The ambition level here reflects current best practice by industry and aligns closely with relevant EU Ecolabel criteria for bed mattresses and for furniture – offering several simplified routes to demonstrating compliance.

6.16 Award criterion 7: Low emission padding materials

6.16.1 Why relevant to GPP?

The reader is referred to section 5.7, where the main reasons have previously been described.

6.16.2 Stakeholder discussion

The reader is again referred to section 5.7, where stakeholder discussion has already been summarised.

6.16.3 What relevant ecolabel criteria and other green initiatives say

The reader is yet again referred to section 5.7, where the main details about several relevant ecolabels and green initiatives have been presented.

6.16.4 Ambition level

The ambition level is the same as set for AC3 in Approach A for the procurement of furniture refurbishment services as set out in section 5.7.

6.16.5 AC7: Low emission padding materials[61]

<table>
<tr><th>Core criteria</th><th>Comprehensive criteria</th></tr>
<tr><td colspan="2">AWARD CRITERION</td></tr>
<tr><td></td><td>
AC7.1: Low emission latex foam padding materials
(only applicable to upholstered furniture)
Where latex foam is used as a padding material in furniture upholstery, points shall be awarded if the foam complies with the requirements for VOC emissions as listed below.
<table>
<tr><th>Substance</th><th>Limit value (mg/m³)</th></tr>
<tr><td>1,1,1 – trichloroethane</td><td>0.2</td></tr>
<tr><td>4-Phenylcyclohexene</td><td>0.02</td></tr>
<tr><td>Formaldehyde</td><td>0.01</td></tr>
<tr><td>Nitrosamines*</td><td>0.001</td></tr>
<tr><td>Styrene</td><td>0.01</td></tr>
<tr><td>Tetrachloroethylene</td><td>0.15</td></tr>
<tr><td>Toluene</td><td>0.1</td></tr>
<tr><td>Trichlorethylene</td><td>0.05</td></tr>
<tr><td>Vinyl chloride</td><td>0.0001</td></tr>
<tr><td>Vinyl cyclohexene</td><td>0.002</td></tr>
<tr><td>Aromatic hydrocarbons (total)</td><td>0.3</td></tr>
<tr><td>VOCs (total)</td><td>0.5</td></tr>
<tr><td colspan="2">* N-nitrosodimethylamine (NDMA), N-nitrosodiethylamine (NDEA), N-nitrosomethylethylamine (NMEA), N-nitrosodi-i-propylamine (NDIPA), N-nitrosodi-n- propylamine (NDPA), N-nitrosodi-n-butylamine (NDBA), N-nitrosopyrrolidinone (NPYR), N-nitrosopiperidine (NPIP), N-nitrosomorpholine (NMOR).</td></tr>
</table>
Where other padding materials are used, points can also be awarded if compliance with the VOC emission limits set out above can be demonstrated.
Verification:
The tenderer shall provide a declaration of compliance with this criterion, supported by a test report presenting the results of chamber test analysis in accordance with ISO 16000-9 or equivalent tests.
The wrapped sample shall be stored at room temperature at least for 24 hours. After this period the sample shall be unwrapped and immediately transferred into the test chamber. The sample shall be placed on a sample holder, which allows air access from all sides. The climatic factors shall be adjusted according to ISO 16000-9. For comparison of test results, the area specific ventilation rate (q=n/l) shall be 1. The ventilation rate shall be between 0.5 and 1. The air sampling shall be done 24±1 h after loading of the chamber during 1 hour on DNPH cartridges for the analysis of formaldehyde and other aldehydes and on Tenax TA for the analysis of other volatile organic compounds. Sampling duration for other compounds
</td></tr>
</table>

[61] Note that VOC emission testing requirements for latex foam and polyurethane foams have been established by industry-led voluntary schemes such as the EuroLatex ECO Standard and the CertiPUR standard. At the time of writing, these schemes were considered to provide a sufficient level of assurance.

may be longer but shall be completed before 30 hours.

The analysis of formaldehyde and other aldehydes shall comply with the standard ISO 16000-3 or equivalent tests. Unless specified differently, the analysis of other volatile organic compounds shall comply with the standard ISO 16000-6.

The analysis of nitrosamines shall be done by means of gas chromatography in combination with a thermal energy analysis detector (GC-TEA), in accordance with the BGI 505-23 method (formerly: ZH 1/120.23) or equivalent.

AC7.2: Low emission polyurethane foam padding materials

(only applicable to upholstered furniture)

Where polyurethane foam is used as a padding material in furniture upholstery, points shall be awarded if the foam complies with the requirements for VOC emissions listed below.

Substance (CAS number)	Limit value (mg/m^3)
Formaldehyde (50-00-0)	0.01
Toluene (108-88-3)	0.1
Styrene (100-42-5)	0.005
Each detectable compound classified as categories C1A or C1B according to the Regulation (EC) No 1272/2008 of the European Parliament and of the Council	0.005
Sum of all detectable compound classified as categories C1A or C1B according to Regulation (EC) No 1272/2008	0.04
Aromatic hydrocarbons	0.5
VOCs (total)	0.5

Verification:

The tenderer shall provide a declaration of compliance with this criterion, supported by test results that show compliance with the limits stated above. The test sample/chamber combination shall be either:

1 sample of 25x20x15 cm dimensions is placed in a 0.5 m^3 test chamber or

2 samples of 25x20x15 cm dimensions are placed in a 1.0 m^3 test chamber.

The foam sample shall be placed on the bottom of an emission test chamber and conditioned for 3 days at 23 °C and 50 % relative humidity, applying an air exchange rate n of 0.5 per hour and a chamber loading L of 0.4 m^2/m^3 (= total exposed surface of sample in relation to chamber dimensions without sealing edges and back) in accordance with ISO 16000-9 and ISO 16000-11 or equivalent tests.

Sampling shall be done 72 ± 2 h after loading of the chamber during 1 hour via Tenax TA and DNPH cartridges for VOC and formaldehyde analysis respectively. The emissions of VOC are being trapped on Tenax TA sorbent tubes and subsequently analysed by means of thermo-desorption-GC-MS in accordance to ISO 16000-6 or equivalent tests.

	Results are semi-quantitatively expressed as toluene equivalents. All specified individual analytes are reported from a concentration limit ≥ 1 µg/m³. Total VOC value is the sum of all analytes with a concentration ≥ 1 µg/m³ and eluting within the retention time window from n-hexane (C6) to n-hexadecane (C16), both included. The sum of all detectable compounds classified as categories C1A or C1B according to Regulation (EC) No 1272/2008 is the sum of all these substances with a concentration ≥ 1 µg/m³. In case the test results exceed the standard limits, substance specific quantification needs to be performed. Formaldehyde can be determined by collection of the sampled air onto DNPH cartridge and subsequent analysis by HPLC/UV in accordance with ISO 16000-3 or equivalent tests.

Summary of rationale:

- Latex and PUR foams are the dominant padding materials used in furniture (more than 90% of the market) and their production involves the use of a number of chemicals that will result in VOC emissions from the foam product.
- The potential adverse health effects caused by prolonged exposure to many VOCs are becoming a larger concern and measures are best taken to minimise emissions in the first place rather than looking to improve the ventilation of rooms.
- The ambition level here reflects current best practice by industry and aligns closely with relevant EU Ecolabel criteria for bed mattresses and for furniture – offering several simplified routes to demonstrating compliance.

7. Approach C. Procurement of furniture End-of-Life services

When a piece of furniture reaches the end of its useful life, either due to it no longer being required by the user or because it is in need of refurbishment, it is typically disposed of by the route that is most convenient for the user.

When refurbishment is needed *and* the owner wishes to keep the furniture – Approach A is recommended (see section 5). However, when it is possible that refurbishment is need *but* the owner does not wish to keep the furniture – Approach C is recommended (this section).

Both approaches are significantly different and so it is recommended to distinguish between them in this document.

Many furniture products are complex and contain many different types of material but are not typically disassembled by users prior to disposal, which prevents their optimum recycling. In many regions, large and bulky pieces of furniture are collected in a separate collection service provided by local authorities, which may entail an additional cost.

Furniture may become obsolete simply due to aesthetic reasons, new tenants or due to larger scale refurbishment of offices and public buildings. In many cases, the furniture will still be adequate for further use so long as it is properly handled, stored and transported.

7.1 Technical Specification 1: Collection and reuse of existing furniture stock

7.1.1 Why relevant to GPP?

When new furniture is procured, it is quite likely that it will be to directly replace some old furniture, which is considered as no longer fit for purpose by the contracting authority. This may be due to fundamental functional issues due to the furniture being damaged or the office layout being significantly changed or due to more subjective issues such as redecoration of office facilities.

Furniture items are bulky and in their fully functional form, occupy significant volumes during transport. There is a clear opportunity to make optimum use of environmental and economic costs related to transport if the same vehicle that delivers new furniture can be used to collect old and obsolete furniture.

The collection and EoL management of furniture that has reached the end of its service life is of no additional environmental benefit if it is simply disposed of to a landfill or a municipal solid waste incinerator. However, obvious environmental benefits and possible social benefits arise if the furniture is reused directly or refurbished prior to further reuse. Such an approach has clear links to the EU-wide objective of shifting towards a circular economy and the procurement approach should directly target companies that specialise in furniture collection, refurbishment, reuse and disposal – which in many cases are small to medium enterprises in the local area.

Because the true value of furniture is not in the materials present but rather in the specific dimensions of furniture components and how they come together into a functional unit, simple recycling of components is of much lower added-value than reuse or refurbishment approaches.

7.1.2 Stakeholder discussion

Support was expressed for criteria relating to the EoL management of furniture although it was noted that this will generally imply an added cost to the contracting authority in the majority of cases. For this reason, there was uncertainty whether this should only be considered as an award criterion or as a minimum technical specification. It was stated that in Finland, it is common practice to include any related costs for furniture take-back in the tender.

Some experience with EoL furniture contracts with not-for-profit organisations revealed that arrangements would typically offer the used furniture for free and that the procurer would pay a fee to cover transport costs so long as the receiving organisation agreed to use the furniture for "humanitarian purposes", which is considered as making the furniture available to the most impoverished people in society, either in a local, national or international context.

Other stakeholders pointed out the potential financial value of used furniture items, citing the example of one Dutch company which guarantees at least €50 for buying back any one of its range of office chairs. It was assumed that the client would have to bring the chair to a designated location.

7.1.3 What relevant ecolabel criteria and other green initiatives say

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) only state that relevant national rules, statutes and/or industry specific agreements concerning recycling schemes for products and packaging must be fulfilled in the country where the product is placed on the market.

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) consider the award of points to tenderers that provide information regarding the highest value recovery opportunities for its legacy product lines and the materials that comprise them. The requirements also make provision for the award of points if tenderers demonstrate the implementation and use of buy-back or take-back programmes as part of its strategic sales strategy for furniture products that they sell or lease.

7.1.4 Ambition level

Like Approach A, this criterion is a different approach to other ecolabels in the sense that it targets furniture at the end of its useful life instead of new furniture. There are no references with which to compare the ambition level.

It is impossible to actually propose a certain minimum reuse or recycling rate for collected furniture in EU GPP criteria because this will be strongly influenced by the complexity of the furniture products collected, the state they are in, the local and regional recycling network and the availability of local skilled labour that can carry out refurbishment operations if deemed necessary.

As a simple and purely arbitrary example, a figure of 50% by weight of collected furniture materials being reused is set.

7.1.5 TS1: Criteria proposal for Collection and reuse of existing furniture stock

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
TS1: Collection and reuse of existing furniture stock *An assessment of the condition of the furniture to be collected shall be provided by the contracting authority (CA) in the ITT which also may define a minimum reuse target to be met (e.g. 50% of provided furniture). Bed mattresses should be excluded from any minimum reuse targets due to hygiene reasons.* Tenderers shall collect the furniture directly from a site specified by the contracting authority and provide a reuse and recycling service for furniture that has reached the end of its service life. The tenderer shall provide a description of how they will extend the service life of the furniture by supplying it for reuse. Furniture items/parts that are considered not suitable to reuse, and according to the knowledge of the CA about appropriate recycling facilities in the region, one of the following options shall be chosen: **Option a.** Furniture items/parts that are not possible to reuse shall be disassembled into different material streams, as a minimum plastics, metals, textiles and wood before being sent to different recycling facilities[62]. Any remaining materials shall be sent to energy recovery facilities, wherever these are available at the regional level. **Option b.** Metal parts from furniture items/parts that are not possible to reuse shall be recycled and the remainder of the furniture product shall be sent to energy recovery facilities, wherever these are available at the regional level. **Verification:** The tenderer shall provide details of the arrangements for the collection of the furniture, as well as reuse and recycling routes to be used. This shall include the	**TS1: Collection and reuse of existing furniture stock** *An assessment of the condition of the furniture to be collected shall be provided by the contracting authority (CA) in the ITT which also may define a minimum reuse target to be met (e.g. 50% of provided furniture). Bed mattresses should be excluded from any minimum reuse targets due to hygiene reasons.* Tenderers shall collect the furniture directly from a site specified by the contracting authority and provide a reuse and recycling service for furniture that has reached the end of its service life. The tenderer shall provide a description of how they will extend the service life of the furniture by supplying it for reuse. Furniture items/parts that are not possible to re-use shall be disassembled into different material streams, as a minimum plastics, metals, textiles and wood before being sent to different recycling facilities[63]. Any remaining materials shall be sent to energy recovery facilities, wherever these are available at the regional level. **Verification:** The tenderer shall provide details of the arrangements for the collection of the furniture, as well as reuse and recycling routes to be used. This shall include the details of all involved parties in the reuse and recycling of the furniture.

[62] All recycling facilities shall be permitted in compliance with Article 23 of Directive 2008/98/EC.

[63] All recycling facilities shall be permitted in compliance with Article 23 of Directive 2008/98/EC.

details of all involved parties in the reuse and recycling of the furniture.	

Summary of rationale:

- From an environmental point of view, and in line with the waste hierarchy, reuse or refurbishment of furniture has a higher environmental benefit than recycling.
- The criterion strongly supports efforts to move towards a circular economy based approach.
- When procurement of new furniture results obsolete old furniture, delivery trucks could be used to both deliver the new furniture and collect the old furniture in a single round trip.

7.2 Award criterion 1: Improvement in the reuse targets

7.2.1 Why relevant to GPP?

The reader is referred to section 7.1, where the main reasons have previously been described.

7.2.2 Stakeholder discussion

The reader is again referred to section 7.1, where stakeholder discussion has already been summarised.

7.2.3 What relevant ecolabel criteria and other green initiatives say

The reader is yet again referred to section 7.1, where the main details about several relevant ecolabels and green initiatives have been presented.

7.2.4 Ambition level

The ambition level is left open ended so that any reuse rate greater than the minimum technical specification and up to a maximum of 100% of furniture reuse shall be rewarded with points.

7.2.5 TS1: Criteria proposal for Collection and reuse of existing furniture stock

Core criteria	Comprehensive criteria
TECHNICAL SPECIFICATION	
AC1: Improvement in the re-use targets Points shall be awarded to tenderers offering higher levels of re-use than those stated in the Technical Specification. **Verification:** The tenderer shall provide details of how the additional level of re-use will be achieved.	

Summary of rationale:

- Higher levels of reuse than the minimum requirements are rewarded in proportion to the additional level of reuse that is committed to.

8. Other criteria of potential interest but not recommended in EU GPP

The purpose of this section is simply to make procurers aware of other criteria which were discussed during the revision process but which were not included in the final recommended EU GPP criteria.

It is possible that while it was not considered appropriate for the criteria to be promoted at the EU level, that they are very relevant for individual procurers in certain circumstances.

In these cases it would be of added value to explain the supporting arguments for such criteria, the stakeholder discussion that ensured and a brief explanation of why the criteria were not recommended in the end.

8.1 Sourcing of sustainable timber for furniture production

8.1.1 Why relevant to GPP?

Environmental impacts

Sustainable forestry and the adverse environmental impacts of deforestation originally came to the fore around 1990. Since then, a political commitment at the ministerial level in Europe to the definition, monitoring, understanding and promotion of sustainable forestry has become well established under the voluntary Forest Europe initiative, to which 46 European countries have now signed up.

The environmental impact of wood harvesting from forests or plantations can vary significantly depending on how the whole process is carried out and how the forest or plantation is managed in the long term. In terms of LCA impact categories, the harvesting of wood has a strong influence on global warming potential and land use as well as impacts on biodiversity.

Positive impacts on climate change due to the sequestration of carbon in the wood biomass and in forest/plantation soil are obvious although these short term positive impacts are meaningless in the long term if the harvesting operation results in net deforestation or forest degradation.

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC, 2014) quotes forestry and land use as the second most important source of anthropogenic carbon dioxide (fossil fuel combustion being the first). These conclusions are supported by other independent scientific studies, *e.g.*, the work carried out by van der Werf et al., (2009). The subject is sufficiently important to have been addressed specifically in an IPCC special report (IPCC, 2000) and the development of the "United Nations Reducing Emissions from Deforestation and forest Degradation" UN-REDD initiative.

Land use impacts are generally negative due to the need for building access roads and clear-cutting operations but the latter impact can be minimised over the longer term when the harvested area is replanted and the forest or plantation is managed in a manner that maintains or enhances the levels of growing stock in the forest/plantation. Land use change relating to forestry operations can in some limited cases be positive (due to land reclamation or the conversion of intensive agricultural land to plantations) but can also be negative (due to the conversion of naturally regenerated or primary forests to plantations).

Threats to biodiversity caused by forestry activities are evident if care is not taken to maintain minimum levels of deadwood and a minimum spread of different tree species and ages in the forest unit.

Definition of sustainable forestry

Further investigation of the basis for both European sustainable forestry policy[64] and certification schemes for sustainable forestry[65] confirms their basis in the UNEP and FAO principles of Sustainable Forestry Management (SFM) established at the Rio Earth Summit in 1992[66]. These principles, although not defined in specific detail in UNEP or FAO literature, provide an internationally agreed reference point which is used by certification schemes. The conformance of schemes with ISO/IEC 17065 is also a consideration in relation to the quality and assurance provided by the verification systems used[67].

In terms of market share the two most significant certification schemes are those operated by the Forestry Stewardship Council (FSC)[68] and the Programme for the Endorsement of Forestry Certification (PEFC)[69]. FSC is an NGO-initiated scheme which was formally established following the Rio Earth Summit 1992. The PEFC scheme was founded by national organisations from 11 countries in 1999 and now incorporates the Sustainable Forestry Initiative (SFI), the Malaysian Timber Certification Council (MTCC) and American Tree Farm System (ATFS).

In 2009 these schemes accounted for 9% of global forestry and 26% of industrial timber supplies[70]. PEFC is the most significant scheme, accounting for over two thirds of certified timber on the world market. The majority (over 90%) of certified timber originates from Europe and North America.

Of direct relevance to procurers

Belgium[71], Denmark, Germany[72], the UK[73] and the Netherlands[74] are notable for their detailed monitoring and evaluation of forestry certification schemes in support of Green Public Procurement (GPP)[75]. These Member States use their own adapted criteria and processes to determine whether certification schemes provide sufficient assurance. The current consensus of these Member States is that, in general, FSC and PEFC provide sufficient levels of assurance based on their national criteria. Denmark, Germany, the Netherlands and the UK are currently working together to identify the common ground of their respective timber procurement policies.

At the practical level for procurers, two assessment and certification schemes have come to dominate the market for auditing of forest management practices and the chain of custody of harvested materials all the way through the supply chain to the final product. Importantly, both the FSC and PEFC schemes offer the possibility for final products to be

[64] European Commission, *EU forests and forest related products*, http://ec.europa.eu/environment/forests/home_en.htm

[65] Rametsteiner, E and M, Simula, *Forest certification—an instrument to promote sustainable forest management?* Journal of Environmental Management 67 (2003) 87–98

[66] Castaneda, F. *Criteria and indicators for sustainable forestry management.* UN FAO, http://www.fao.org/docrep/x8080e/x8080e06.htm#TopOfPage

[67] ISO/IEC 17065: 2012, Conformity assessment – requirements for bodies certifying products, processes or services.

[68] Forestry Stewardship Council, http://www.fsc.org/

[69] Programme for the Endorsement of Forestry Certification, http://www.pefc.org/

[70] UNECE and FAO (2010) *Forest products annual market review 2009-2010*

[71] UK Central Point of Expertise on Timber, *Government procurement of timber in Belgium*, http://www.cpet.org.uk/uk-government-timber-procurementpolicy/international-context/international-policies-1/belgium

[72] Germany Government Procurement Policy, *Wood and paper based products*, http://www.sustainableforestprods.org/tools/german_government_procurement_policy

[73] UK Central Point of Expertise on Timber (2008) *Review of forestry certification schemes results*

[74] Timber Procurement Assessment Committee, Netherlands, http://www.tpac.smk.nl/

[75] UK Central Point of Expertise on Timber (2008)*A comparative study of the national criteria for 'legal and 'sustainable' timber and assessment of certification schemes in Denmark, UK, Netherlands and Belgium* http://www.cpet.org.uk/uk-government-timber-procurement-policy/international-context/international-policies-1/comparativestudy-of-danish-uk-dutch-and-belgium-national-criteria

labelled if they comply with minimum content requirements for virgin wood from sustainably managed forests and/or wood from recycled sources.

Sustainable virgin	100%	70-100%	0%	0-100%	0-30%
Post-consumer recycled	0%		85-100%	0-85%	70-100%
Pre-consumer recycled		0-30%	0-15%		
Controlled			0%	0-30%	0-30%

Figure 8. Illustration of the 5 current labels from FSC and PEFC.

In order for the label to appear on the final product, all actors in the supply chain that have handled to product, semi-finished product or any wood raw materials must be covered by valid chain of custody certificates. These certificates can be checked on public databases.

It should be added that for any remaining wood content, the following minimum requirements apply to both schemes: it must be legally sourced, not originate from genetically modified organisms and should not come from forests that are being converted into plantations.

8.1.2 Stakeholder discussion

Some questioned whether the availability of certified wood was sufficient to satisfy demand. This could be a valid point in some EU Member States. For example, from FSC's own data, in some Member States well over 50% of all forests are FSC certified whereas in others less than 10% are certified.

There was strong support for the inclusion of such a criterion on sustainably sourced wood given that wood can be the predominant material in many types of furniture products.

The simple requirement for wood to be legally sourced only was queried because this should already be covered by the requirements of the EU Timber Regulation. However, it was countered that the EUTR currently does not apply to certain product categories such as seating and bamboo products, which encompass certain furniture items.

8.1.3 What relevant ecolabel criteria and other green initiatives say

The FEMB sustainability basic level requirements for office and non-domestic furniture for indoor use (Draft 2, July 2012) describes a basic pre-requisite that all wood specified in the product, with the exception of recovered or reused wood, is CITES compliant and/or compliant with the EU Timber Regulation. Advanced level requirements are split into two different ambition levels. The lower level requires that at least 70% (volume or mass) of solid wood or 50% of wood chips/fibres used in wood-based panels is certified as coming from sustainably managed forests according to FSC, PEFC or equivalent

schemes. The more ambitious requirement sets a minimum of 95% /volume or mass) of sustainable certified wood or wood-based products.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) requires that at least 70% (volume or weight) of all solid wood or 50% of all wood-based materials are certified as coming from sustainably managed forests according to FSC, PEFC or equivalent schemes. Furthermore, the standard specifically states that the percentage can be calculated using a sliding average of supplies over a maximum period pf 12 months.

The Blue Angel RAL UZ 38 for low emission furniture and slatted frames made of wood and wood-based materials (Jan. 2013) states that at least 50% of the solid wood or primary raw materials used in wood-based materials shall be sourced from sustainably managed forests. A hierarchical approach to verification is used where the simplest option is for the furniture manufacturer to be CoC certified by FSC or PEFC.

The Nordic Ecolabel for furniture and fitments (version 4.9, Mar. 2011) states that at least 70% by weight of any wood from pine, spruce, birch and tropical timber or 50% by weight of any other type of wood must be derived from sustainable certified forests if the total amount of solid wood in the furniture product exceeds 10% by weight. For wood-based panels, the minimum quantity of sustainable certified wood is 50% by weight and again only applies if wood-based panels account for at least 10% by weight of the furniture product.

The EU Ecolabel criteria for furniture require that at least 70% by weight of wood or wood-based materials shall be virgin material sourced from sustainably managed forests and/or recycled material.

8.1.4 Why not recommended in EU GPP criteria

Several Member States are using their own GPP/SPP criteria to define sustainable management of forests and have different processes in place to determine whether certification schemes provide sufficient assurance. In this situation, it was not possible, within the framework of this criteria development process, to provide a harmonised definition of sustainable managed forestry.

The current consensus of the leading Member States is that, in general, FSC and PEFC provide sufficient levels of assurance for compliance with their national criteria. Although 100% certified sustainable wood is desirable, it could be difficult to achieve due to possible fluctuations in market demand, particularly for SMEs that are accustomed to working with a limited number of suppliers. Instead, a minimum of 70% sustainable wood should be achievable and fits well with the current requirements of the FSC and PEFC labelling schemes. Nonetheless, public authorities are recommended to seek feedback from the market prior to publishing the Invitation To Tender (ITT).

8.2 Recycled plastic content

8.2.1 Why relevant to GPP?

Plastics are almost exclusively made from chemical feedstocks obtained from finite resources of crude oil. From cradle to gate, the embodied energy in plastic high (of the order of 30-100 MJ/kg depending on the polymer and production process).

Despite the significant energy savings that can be obtained from recycling plastics, the current market situation is that it is cheaper to produce virgin plastics than to specifically collect, transport and sort plastic waste before blending it with virgin material and additives before remelting and extrusion or injection moulding.

Unlike paper and metal, the recycling rates for plastic can still improve a lot. Part of the problem is a lack of market signals for products with recycled plastic content.

The high calorific value of plastic and the vast number of different types of plastic products used on the market, each with their own unique combinations of additives and potential contaminants after use, has led to the situation where often incineration in waste-to-energy plants is considered as a more suitable alternative than recycling.

8.2.2 Stakeholder discussion

While stakeholders acknowledged the environmental benefits of plastic recycling and the need for improved recycling rates, discussion mainly focussed on potential problems rather than opportunities. First of all, practical limits to any minimum recycled plastic content were expressed where experience with the Nordic Ecolabel revealed that applicants found their requirement for a minimum 50% recycled plastic content too high to meet.

Part of the justification for this was that any requirements for minimum recycled contents in Ecolabel criteria are subject to possible market fluctuations in the availability of plastic recyclates and the quality of recyclates available. While minimum recycled contents tend to be required in Ecolabel criteria due to their pass/fail nature, a more flexible approach could be possible in GPP criteria when used as an award criterion where points are simply awarded in proportion to the recycled content.

It was mentioned that high recycled contents in plastics would create problems with discolouring of white and lightly coloured components. However, in terms of extruded plastic parts, it was added that it is possible to use co-extrusion technology where an inner core of high recycled plastic content is covered with a thin covering layer of virgin plastic of the desired colour and other aesthetic properties.

Other concerns raised were the lack of control about the introduction of hazardous substances into the product via recycled waste streams. The particular case of lead and cadmium in recycled PVC was mentioned. It was responded that cadmium has already been considered and is covered by Regulation 494/2011 and that it is foreseeable that a similar approach may be applied for lead.

However, since the level of recycled content in the final product cannot be easily checked by the procurer, a solid system to certify the content would be necessary.

It was suggested that the use of batch delivery information following EN 15343 "*Recycled Plastics – Plastics recycling traceability and assessment and conformity of recycled content*", as a basis for communicating the presence or non-presence of restricted hazardous substances.

The risk of hazardous substances in recycled plastics is highest in those plastics which have a long lifetime, such as PVC piping, guttering, window frames and door frames.

Most plastics, especially the types that are collected in post-consumer kerbside schemes, have a much shorter lifetime and so a less likely to contain hazardous substances of concern.

8.2.3 What relevant ecolabel criteria and other green initiatives say

The French NF 217 Ecolabel for furniture (version 10, Jan. 2104) does specifically require the use of any minimum quantity of recycled plastic but encourages its use indirectly via a criterion about the total embodied energy of the furniture product.

As mentioned above, the Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) requires that any furniture containing more than 10% by weight plastic shall have a plastic recycled content of at least 50% and that recycled PP, PE and PET must be from post-consumer materials and that no halogenated flame retardants must be present as impurities in quantities above 0.01% by weight.

In Belgium, the Belgian Quality Association (BQA) has a specific certification scheme for products containing recycled polymers. Certification can be obtained at three different levels:

- Level 1: controlling the flows and physical characteristics of recycled materials in the production process.
- Level 2: requirements of Level 1 plus guarantees of end product specifications in line with a defined sampling program.
- Level 3: requirements of Level 2 plus quality control actions to ensure the absence of substances of very high concern listed by REACH and RoHS.

The EU Ecolabel criteria for Furniture require that any furniture product consisting of at least 20% by weight plastic (excluding packaging) shall have a minimum recycled plastic content of 30% (again excluding packaging).

8.2.4 Why not recommended in EU GPP criteria

Although third party Environmental Product Declarations (EPDs) in accordance with ISO 14025 are increasingly used by producers and would be a possible option to consider for demonstrating proof that recycled plastics have been incorporated into the product, it was felt that more detail was needed about the level of information provided to third party auditers and how it can be ensured that recycled plastics are actually used in a certain product instead of another one in a factory which may produce multiple different products.

This topic was earmarked as an area for future research for later GPP criteria revisions.

8.3 Flame retardants in furniture

8.3.1 Why relevant to GPP?

Flame retardants are examples of substances that are applied to furniture upholstery in order to reduce its potential to contribute to the development and spread of fire. Potential benefits of flame retardants are reduced rate of heat release, reduced total heat release, reduced degree of flame spread, reduced rate of flame spread and possibly reduced smoke production. In the event of a fire, this can help provide extra time to occupants to evacuate the building and/or get the fire under control before it spreads further.

Considering the context of this report, there are two broad approaches that can be taken to reducing the risk of fatalities from fire events in a building.

(i) furniture-specific approaches: The choice of less ignitable and slower burning materials over more ignitable and faster burning ones (see Figure 9). Another possibility is the placement of an interliner of appropriately non-flammable material, which can effectively avoid the need for the use of flame retardants in padding foams if it is placed between the padding foam and the upholstery covering material. This approach is expected to play an increasingly important role in upholstered furniture design[76].

Fibre	Flammability
Cotton Flax Silk	Ignite easily Burn heavily with white smoke formation Do not melt away from the flame
Cellulosic fibres Rayon	Burn rapidly like cotton May melt away from the flame (with or without burning)
Acetates	Burn heavily May melt away from the flame without burning Form burning drops
Acrylics	Burn rapidly Form burning drops Form dense black smoke
Polyamide Polyolefins Polyesters Other synthetic fibres	Burn slower while releasing a high amount of heat May melt away from the flame without burning Form burning drops May continue glowing after flame extinction
Modified acrylics ("Modacrylics")	Burn very slowly Tend to melt away from the flame without burning May self-extinguish under certain conditions
Aramid	Does not burn, strong char formation

Figure 9. Inherent flammability of various fibres

(ii) more holistic approaches: For example the careful management of any combustible chemicals onsite, indoor smoking bans, the minimisation of other ignitable materials (e.g. curtains, carpets, upholstery) in the interior design of buildings, smoke detectors linked to automatic sprinkler systems and designing rooms so as to have multiple exits and minimum bottlenecks in the event of an evacuation.

[76] Nazaré and Davis: A review of fire blocking technologies for soft furnishings. Fire Science Reviews 2012 1:1.

However, in public buildings in most EU Member States, part of the overall approach to fire safety includes specific measures for furniture upholstery materials and mattresses to display a minimum resistance to defined ignition sources.

Some examples of public institutions where significant quantities of upholstery furniture may be used are offices, hospitals, nursing homes, psychiatric wards and prisons. The presence of high numbers (and densities) of mattresses in these buildings further increases the risk of any particular fire event spreading out of control. The limited freedom of movement in prisons and psychiatric wards further exacerbates the potential risk and the limited mobility of patients in nursing homes and hospitals has the same effect. It should be noted that due to the absence of specific GPP criteria for mattresses in other documents, the scope for GPP furniture criteria has been extended to potentially include mattresses.

The main environmental issues related to flame retardants are:

- that a number of widely used flame retardants have been classified as hazardous substances
- that flame retardants remain in the final product in order to impart the reduced flammability function,
- that there is an exposure risk to users due to gradual migration of flame retardants from upholstery materials
- there is an exposure risk to the wider environment at the End-of-Life of the furniture product and if flame retardants are halogenated, their incineration will result in increased acid vapour formation and, if incinerated under poorly controlled conditions, an increased risk of potential dioxin or furan formation.

8.3.2 Stakeholder discussion

The opinions of stakeholders during the revision of EU Ecolabel criteria for furniture can be broadly split into two groups: (i) those who wanted hazardous and halogenated flame retardants to be banned in EU Ecolabel furniture and (ii) those who felt that it was essential to continue to permit flame retardants to be used in EU Ecolabel furniture to account for possible requirements to comply with different fire safety standards. In the end, a harmonised approach was taken between the criteria for EU Ecolabel textiles (Decision 2014/350/EU) and EU Ecolabel furniture (Decision (EU) 2016/1332). This did ban the use of flame retardants per se and allowed the use of certain hazardous flame retardants in certain materials only when certain conditions were applicable (i.e. ATO as a synergist in textile or coated fabrics when compliance with EN, ISO or Member State fire safety standards needs to be demonstrated and workplace exposure is controlled within certain limits or, other flame retardants with H317, H373, H411, H412 and/or H413 classes only when necessary to meet EN, ISO or Member State fire safety standards). It was decided that such an approach with GPP criteria for furniture would be too complicated and so the only restrictions relating to flame retardants are introduced via the horizontal requirements relating to reporting of any SVHC's present in component parts/materials above 0.1% (w/w) (core level TS3 in approach B) or to avoid the use of any SVHCs (including flame retardants) in concentrations above 0.1% (w/w) in component parts/materials (comprehensive level TS5 in approach B). Much later in the revision process, there was a push for "flame retardant free" furniture in GPP criteria.

Arguments against the use of halogenated flame retardants made reference to a number of these chemicals which have severe toxicological hazards such as acute toxicity, toxic for reproduction and persistent, bioaccumulative and toxic (PBT). Specific examples of flame retardant substances that had been listed as Substances of Very High Concern (SVHCs) were cited, such as HBCDD (CAS No. 3194-55-6), TCEP (CAS No. 115-96-8), SCCPs (CAS No. 85535-84-8) and DecaBDE (CAS No. 1163-19-5). The logic of the argument was that if many halogenated flame retardants are classified with severe

hazard classes, then it would be best to take a precautionary approach and ban all halogenated flame retardants, which is the approach that has been taken in the Nordic ecolabel criteria for furniture and fitments and the Blue Angel criteria for low-emission upholstered furniture. The Blue Angel criteria go further, banning the addition of any flame retardants based on the argument that their presence complicates future recycling and disposal. However, the Blue Angel criteria then defines a white list for flame retardants that extends to inorganic phosphates, boron compounds and dehydrating agents like aluminium trihydrate.

Stakeholders against any generic ban on all halogenated flame retardants referred to the principles by which the REACH and CLP Regulations work, where a substance is classified based on its own toxicological properties. They added that it was not in the general approach of the Commission to ban entire groups of substances when, in theory, it is possible that a number of substances in that group will not have hazard classifications that are restricted by EU Ecolabel criteria. In the particular case of flame retardants, stakeholders representing the chemical industry argued that compliance with fire safety regulations was of paramount importance and blanket bans on groups of substances should not be prioritised over compliance with safety legislation.

Counter-arguments against those in favour of a REACH and CLP based approach argued that there are many substances registered under REACH and which only have self-classifications, which sometimes contradict each other. Furthermore, it would be highly unlikely that procurers would have the technical skills and experience to understand the information in any supplied safety data sheets and cross-check this with ECHA databases for registered substances.

Later in the revision process, the European Furniture Industries Confederation expressed its support for the promotion of flame-retardant free furniture. They argued that the use of significant quantities of potentially hazardous flame retardants was being promoted by particularly stringent fire safety standards that use an open flame as the ignition source and that many Member States followed this stringent standard as part of a precautionary approach to the procurement of public and contract furniture. Uncertainty was expressed about whether the use of materials complying with stricter fire safety standards actually correlates to reduced occurrences of and fatalities from fires.

Besides the adverse impacts of increased manufacture, exposure and release of hazardous substances, further arguments against the use of flame retardants were the increased production costs, potential difficulties when recycling or incinerating materials at End-of-Life and perceived barriers to free trade in the internal market due to the different requirements for fire safety compliance in different Member States.

There is a significant difference between the fire safety requirements for domestic furniture (which are largely non-existent) and in public furniture (which are addressed in one way or another by all Member States, e.g. EN 1021-1 or the stricter EN 1021-2). The UK and Ireland stand out as having the strictest approaches to domestic furniture in the EU.

Reference has been made to the regulatory situation in California and in particular the 2013 revision made to Technical Bulletin 117. Following pressure from organisations such as the American Home Furnishings Alliance and the Green Science Policy Institute, the new revision (TB 117:2013) has moved away from open flame testing and now applies methods based on the smoulder resistance of cover fabrics, barrier materials and resilient filling materials used in upholstered furniture. The new standard also obliges producers to categorically state whether flame retardant chemicals have been used in the furniture product or not.

8.3.3 What relevant ecolabel criteria and other green initiatives say

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) prohibit the use of any halogenated flame retardants and also restrict halogenated flame retardants as impurities that may appear in recycled plastic streams to concentrations of 100ppm.

The Blue Angel RAL UZ 117 (Sept. 2009) criteria for low emission upholstered furniture effectively ban the use of flame retardants in due to criteria regarding the ease of recycling and disposal at the end-of-life of the product. However, an exception is made for inorganic ammonium phsophates, boron compounds or other dehydrating materials, such as alumina trihydrate, $Al(OH)_3$.

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) only restrict the use of flame retardant treatments that contain more than 0.1% by weight SVHCs. However, when flame retardants are used, it must be reported to the assessor, together with safety data sheets as a means of demonstrating compliance.

EU Ecolabel criteria for furniture adopted in Decision (EU) 2016/1332 effectively prevent the use of any flame retardants that are listed in the SVHC candidate list and/or are classified as toxic, hazardous to the environment, carcinogenic, mutagenic or toxic to reproduction if the substance is considered to remain in concentrations exceeding 0.1% by weight of the treated component part of material. A list of specific hazard classes is provided, against which any flame retardants used should be checked. A specific derogation (H351) from this requirement is made for the use of Antimony Trioxide as a synergist flame retardant. Other general derogations that are granted for flame retardants are for those classified as category 2 specific target organ toxicity (H373) and category 2, 3 or 4 aquatic toxicity (H411, H412 and H413).

The French NF 217 Ecolabel for furniture (version 10, Jan. 2104) prohibits the use of any flame retardants that are listed as SVHCs or that were added to Annex XVII to the REACH Regulation via the substance lists provided Regulations (EC) No 55/2009 and (EC) No 276/2010. The French ecolabel also makes a direct link to the OEKOTEX 100 standards for Class IV textiles, which effectively ban the use of any flame retardant unless the specific flame retardant treated fabric has been approved by OEKO-TEX. As of January 2017, some 24 different fabrics were approved as well as over 100 approved flame retardant precursors and auxiliaries. Due to the fact that only commercial names of approved chemicals are provided, it is not immediately clear what hazards classifications may apply to these substances and whether or not they are halogenated.

8.3.4 Why not recommended in EU GPP criteria

The main reason for not promoting the concept of "flame-retardant free" furniture directly in EU GPP criteria across Europe is that there is currently no ecolabel or green initiative that is going so far as to completely ban the use of flame retardants in upholstered furniture. Instead, restrictions are always placed on certain hazardous flame retardants.

While the need for flame retardants can potentially be avoided altogether by careful choice of materials and product design, such upholstered furniture can be considered to only represent a niche market at this stage and, unlike California, current fire safety standards in Europe for public furniture are currently not well set up to embrace this approach. Furthermore, there is a lack of a harmonised approach to fire safety standards at the European level. Each Member State has its own regulations, which can vary substantially in strictness. Consequently, any potential restrictions on flame retardants recommended in EU GPP criteria may conflict with specific Member State legislation.

Arguments to promote less hazardous flame retardants in certain Type I ecolabels have targeted the banning of halogenated compounds and or only allowing the use flame retardants that are less hazardous or have no hazard classification at all under REACH.

In general, EU GPP criteria have tended to avoid any topics that would require procurers to possess a reasonable degree of understanding of the REACH and CLP Regulations. The general requirements for SVHCs in TS5 of Approach B (procurement of new furniture) basically place the onus on tenderers to provide written declarations about the presence/absence of SVHCs. The comprehensive level specification effectively results in the banning of the use of a number of hazardous flame retardants already, such as HBCDD, TCEP, SCCPs and DecaBDE.

Where there is national legislation or mandatory standards, which requires that furniture meets a specific level of flame retardancy, the public authority has to take this into account when writing the tender documents. If no binding rules or standards exist, the public authority is not bound to adhere to any specific voluntary standard. In the case of the standards listed above, EN 1021-2 requires a higher level of flame retardancy than EN 1021-1. This can lead to cost increases and is likely to require the use of different materials/substances, some of which might have hazardous properties. The use of these substances may have an influence on the cost for recycling as well as on reuse opportunities. The public authority should therefore consider, according to the intended use and location of the furniture items, what levels of flame retardancy it wants to require.

If procurers do decide to specifically restrict the use of flame retardants in upholstered furniture and mattresses, it is recommended that they take an approach that focuses on the hazard class of the flame retardant instead of simply whether the compound is halogenated or not. It is possible that there are highly toxic flame retardants which are non-halogenated and, conversely, that there are non-toxic halogenated flame retardants. Each possible flame retardant should be considered on the merits of its individual REACH registration and CLP classification where this is available.

8.4 Minimum durability requirements

8.4.1 Why relevant to GPP?

The findings of the Preliminary Report for the revision of the EU Ecolabel and EU GPP criteria for furniture showed that the bulk of the environmental impact of furniture products is associated with the production of raw materials and the manufacturing stages. Impacts due to packaging, the use phase were considered as minor.

All of the environmental impacts that are embodied in the furniture product can be spread out over a longer period, and impacts associated with the need to manufacture new furniture, or to dispose of old furniture, can be reduced by procuring durable furniture products.

8.4.2 Stakeholder discussion

Due to the extremely wide range of furniture items that can potentially fit into the product group scope, it was not considered possible to set a sufficient range of requirements that could be applied to furniture in general.

Reference was made in Technical Specification 5 (core) and Technical Specification 8 (comprehensive) to a number a number of fitness for use standards that could be used as a basis for testing of relevant furniture products. These standards are listed in Appendix IV.

The choice of standards listed in Appendix IV was agreed following consultation with industry stakeholders. However, no reference was made to specific minimum requirements from these standard tests because different types of furniture for different intended uses and in different service requirements should have different minimum requirements.

However, later in the revision process, particular input from a stakeholder with experience of setting public procurement criteria for large calls for tenders for office furniture and workstations revealed that they found it helpful to set minimum durability requirements and that tenderers were able to respond to those criteria. The requirements were set as either mandatory or award criteria and referred to the durability of certain parts or materials used in the furniture products. The following key points were considered:

For decorative surfaces:

- Mandatory: The abrasion resistance should be "*N ≥ 350 tr*" according to part 10 of EN 438-2.
- Mandatory: The scratch resistance should be "*Index ≥ 2*" according to part 25 of EN 438-2.
- Optional, added value: The resistance to impact should be "*no fracture or cracking on 80% of shocks*" according to part 21 of EN 438-2.
- Optional, added value: The resistance to light should be "*Blue scale No. 6 or Gray scale I ≥ 3*" according to EN ISO 105-B02 or EN 15187 and as per the provisions of EN 20105-A02.
- Optional, added value: The resistance to dry heat should be "*no visible deterioration after 16 hours at 70°C*" according to EN 12722 or EN 438-2.
- Optional, added value: The gloss should be "at least 45 gloss units" according to EN 13722.

- Optional, added value: The resistance to cold liquids should be "≥ 4" according to EN 12720.

For cabinets and rolling containers:

- Mandatory: Strength and stability of the structure must be tested according to EN 14073-3.
- Mandatory: Impact resistance must be tested by EN 6272-1 with a large surface penetrator.

For high partitions:

- Mandatory: Mechanical safety to be tested according to EN 1023-3.
- Mandatory: Euroclass D as a minimum for reaction to fire test data according to EN 13501-1.

Seating furniture:

- Mandatory: Test for stability, strength and durability of office chairs according to EN 1335-3.
- Mandatory: Loss of thickness and hardness must be less than 5% and 25% respectively for flexible cellular polymeric materials (e.g. PU foam) used in seating that are subject to a constant load of 75 daN according to EN ISO 3385. For the same type of materials used in backrests, the loss of thickness and hardness must be less than 5% and 25% respectively after being subjected to a constant load of 30 daN, also according to EN 3385.
- Mandatory: according to EN ISO 2439, a hardness requirement of ≥ 12 daN to achieve 40% indentation (and an indentation factor ≥2.5) must be met for flexible cellular polymeric materials in seating and a hardness of ≥ 5 daN for 40% indentation (also with an indentation a factor ≥2.5) for the same type of materials used in backrests.

8.4.3 What relevant ecolabel criteria and other green initiatives say

The Nordic Ecolabel criteria for furniture and fitments (version 4.9, Dec. 2011) make reference to a series of national and international standards, indicating the nature of the test and setting different requirement levels on a scale of 1-6. Requirements include durability aspects such as resistance to water, to grease, to grease and scratches, to scratches, to alcohol, to coffee, to heat (dry and humid) and to acid/alkaline sweat. The criteria then make reference to specific types of furniture, specifying what minimum levels of requirements that should be met for that particular product.

The Blue Angel RAL UZ 117 (Sept. 2009) criteria for low emission upholstered furniture make a general reference to a "serviceability" that covers quality standards for abrasion resistance, tensile strength, light fastness, rub fastness and deformation by compression but does not mention any specific standards by name or specific test result requirements.

The FEMB sustainability requirements for office and non-domestic furniture for indoor use (Draft 2, Jul. 2012) make reference to all relevant EN or ISO standards related to safety, strength, durability and fitness for use. A list of relevant standards is then to be provided in an Annex although this had not yet been completed in the draft document.

EU Ecolabel criteria for furniture adopted in Decision (EU) 2016/1332 have conditional quality requirements for resistance of decorative surfaces to water, grease, alcohol, coffee, heat (dry and wet) and scratching. The condition is that if coatings with a VOC content higher than 5% are used, or the effective quantity of VOCs applied is of the range 30-60g/m^2 coated surface area, then the decorative surface will need to be demonstrated to meet these durability requirements in order to merit the use of the

higher quantities/concentrations of VOCs. Specific minimum physical durability requirements are set for upholstery covering materials (specifically textile fabrics, leather and coated fabrics). The EU Ecolabel criteria also have a specific criterion for fitness for use, which refers to a series of EN standards which should be complied with where relevant. However, the criterion does not set any specific requirements for results.

The French NF 217 Ecolabel for furniture (version 10, Jan. 2014) only makes a general reference to "fitness for purpose" requirements that will be defined by the certification body.

8.4.4 Why not recommended in EU GPP criteria?

With the exception of decorative surfaces (referred to in the Nordic ecolabel and EU Ecolabel) and upholstery coverings (referred to in the EU Ecolabel criteria), there is a general lack of clear guidance over what can be considered as representing a durable furniture product that can be expected to have an extended life.

The issue is more complicated for ecolabel criteria since the scope for these ecolabels extends to both domestic and public furniture, which have very different use environments and thus very different minimum acceptable durability requirements.

With GPP criteria, the scope is limited to public furniture, and for this reason we have added this section to the Technical report to act as a guide for procurers who may wish to request mandatory or optional compliance with certain durability standards. If they were to take this approach forward, it would be simplest to expand upon the existing Technical Specification 5 (core) or 8 (comprehensive) for fitness for use when procuring new furniture under Approach B.

However, the main reason for not inserting some of these durability requirements directly in the EU GPP criteria is a lack of information about the market coverage of products that would meet certain minimum durability requirements and the fact that some aspects, such as the hardness of PU foam in cushioning, will directly impact on user comfort and preferences, which are highly subjective qualities.

9. Conclusions

The EU GPP criteria for furniture procurement have been presented, together with a summary of background technical discussion, rationale and reference to relevant criteria in other ecolabels and green initiatives.

Unlike most EU GPP criteria, three different approaches have been presented:

- Approach A: Procurement of furniture refurbishment services
- Approach B: Procurement of new furniture
- Approach C: Procurement of End-of-Life services.

The optimum approach will depend in the specific situation of the procurer's situation but it is possible that a combination of approaches is also relevant.

The overall aim of the criteria is to support as much as possible the incorporation of requirements that will enhance the useable lifetime of furniture or to encourage second and third lifetimes via refurbishment and/or direct reuse by other users – thus supporting efforts to encourage a shift towards a Circular Economy approach. This is reflected well not only by the incorporation of approaches A and C but also by requirements for more durable upholstery coverings, to design for disassembly and repair, to guarantee the availability of spare parts and to encourage longer warranties.

The other broad focus of the EU GPP criteria is to limit the potential exposure of users to residual hazardous substances in furniture by placing maximum limits on the quantities of such residues and by specifying low formaldehyde emission wood-based panels, low VOC emission upholstery coverings, padding and potentially entire furniture products that are low emission.

There is a strong degree of overlap with the recently published EU Ecolabel criteria for furniture (Commission Decision (EU) 2016/1332), especially with regards to award criteria for new furniture procurement, in the hope that both the EU GPP and EU Ecolabel criteria will help reinforce each other and increase awareness amongst both procurers and furniture manufacturers.

List of figures

List of tables

Appendices

Appendix I. Durable upholstery covering materials

Requirements for good physical quality upholstery materials in furniture are defined in Tables 7, 8 and 9 below.

Table 7. Physical requirements of leather used in Ecolabel furniture (taken from Tables 1 and 2 in EN 13336)

Fundamental characteristics	**Test method**		**Recommended values**		
			Nubuck, Suede and Aniline*	**Semi-aniline***	**Coated, pigmented and other***
pH and ΔpH	EN ISO 4045		≥ 3.5 (if the pH is ≤4.0, ΔpH shall be ≤ 0.7		
Tear load, average value	EN ISO 3377-1		> 20 N		
Colour fastness to to-and-fro rubbing	EN ISO 11640. Total mass of finger 1000g. Perspiration alkaline solution as defined in EN ISO 11641.	Aspects to be evaluated	Change of leather colour and felt staining	Change of leather colour and felt staining No destruction of finish	
		using dry felt	50 cycles, ≥ 3 grey scale	500 cycles, ≥ 4 grey scale	
		using wet felt	20 cycles, ≥ 3 grey scale	80 cycles, ≥ 3/4 grey scale	250 cycles, ≥ 3/4 grey scale
		using felt wetted with artificial perspiration	20 cycles, ≥ 3 grey scale	50 cycles, ≥ 3/4 grey scale	80 cycles, ≥ 3/4 grey scale
Colour fastness to artificial light	EN ISO 105-B02 (method 3)		≥ 3 blue scale	≥ 4 blue scale	≥ 5 blue scale
Dry finish adhesion	EN ISO 11644		--	≥ 2N / 10mm	
Dry flex resistance	EN ISO 5402-1		For aniline leather with non-pigmented finish only, 20 000 cycles (no finish damage cracks)	50 000 cycles (no finish damage cracks)	50 000 cycles (no finish damage cracks)
Colour fastness to water spotting	EN ISO 15700		≥ 3 grey scale (no permanent swelling)		
Cold crack resistance of finish	EN ISO 17233		--	-15°C (no finish crack)	
Fire resistance	EN 1021 or relevant national standards		Pass		

*Definitions of these leather types are according to EN 15987.

Table 8. Physical requirements for textile fabric covering materials in furniture upholstery.

Test factor	Method	Removable and washable coverings	Non-removable and washable coverings
Dimensional changes during washing and drying	Domestic washing: ISO 6330 + EN ISO 5077 (three washes at temperatures as indicated in the product with tumble drying after each washing cycle) Commercial washing: ISO 15797 + EN ISO 5077 (at minimum of 75 °C)	+/- 3.0% for woven fabrics +/- 6.0% for non-woven fabrics	N/A
Colour fastness to washing	Domestic washing: ISO 105-C06 Commercial washing: ISO 15797 + ISO 105-C06 (at minimum of 75 °C)	≥ level 3-4 for colour change ≥ level 3-4 for staining	N/A
Colour fastness to wet rubbing*	ISO 105 X12	≥ level 2-3	≥ level 2-3
Colour fastness to dry rubbing*	ISO 105 X12	≥ level 4	≥ level 4
Colour fastness to light	ISO 105 B02	≥ level 5**	≥ level 5**
Fabric resistance to pilling and abrasion	Knitted and non-woven products: ISO 12945-1 Woven fabrics: ISO 12945-2	ISO 12945-1 result >3 ISO 12945-2 result >3	ISO 12945-1 result >3 ISO 12945-2 result >3

* does not apply to white products or products that are neither dyed nor printed

** A level of 4 is nevertheless allowed when furniture covering fabrics are both light coloured (standard depth ≤ 1/12) and made of more than 20 % wool or other keratin fibres, or more than 20 % linen or other bast fibres.

Table 9. Physical requirements for coated fabric covering materials in furniture upholstery

Property	Method	Requirement
Tensile strength	ISO 1421	CH ≥ 35daN and TR ≥ 20daN
Tear resistance of plastic film and sheeting by the trouser tear method	ISO 13937/2	CH ≥ 2,5daN and TR ≥2daN
Colour fastness to artificial weathering – Xenon arc fading lamp test	EN ISO 105-B02	Indoor use ≥ 6; Outdoor use ≥ 7
Textiles – abrasion resistance by the Martindale method	ISO 5470/2	≥ 75,000
Determination of coating adhesion	EN 2411	CH ≥ 1,5daN and TR ≥ 1,5daN

Where: daN = deca Newtons, CH = Warp and TR = Weft

Appendix II: Testing requirements and restrictions for dyes in textiles, coated fabrics and leather

Included here are the substances listed in Entry 43 (Appendix 8) of Annex XVII to Regulation (EC) No 1907/2006 that shall be tested for in any dyed leather (using the EN ISO 17234 standard) or textiles (using the EN ISO 14362-1 and 14362-3 standards).

Table 10. Carcinogenic arylamines to be tested in textiles or leather.

Aryl amine	CAS Number	Aryl amine	CAS Number
4-aminodiphenyl	92-67-1	3,3'-dimethyl-4,4'-diaminodiphenylmethane	838-88-0
Benzidine	92-87-5	4,4'-oxydianiline	101-80-4
4-chloro-o-toluidine	95-69-2	4,4'-thiodianiline	139-65-1
2-naphtylamine	91-59-8	o-toluidine	95-53-4
o-amino-azotoluene	97-56-3	2,4-diaminotoluene	95-80-7
2-amino-4-nitrotoluene	99-55-8	2,4,5-trimethylaniline	137-17-7
4-chloroaniline	106-47-8	4-aminoazobenzene	60-09-3
2,4-diaminoanisol	615-05-4	o-anisidine	90-04-0
4,4'-diaminodiphenylmethane	101-77-9	p-cresidine	120-71-8
3,3'-dichlorobenzidine	91-94-1	3,3'-dimethylbenzidine	119-93-7
3,3'-dimethoxybenzidine	119-90-4	4,4'-methylene-bis-(2-chloro-aniline)	101-14-4

A number of dye compounds, although not directly restricted by Entry 43 of Annex XVII to Regulation (EC) No 1907/2006, are known to cleave during processing to form some of the prohibited substances listed in Table 10 above. In order to greatly reduce uncertainty about compliance with the established limit of 30 mg/kg for the substances listed in Table 10, manufacturers are recommended, but not obliged, to avoid the use of the dyes listed in Table 11.

Table 11. Indicative list of dyes that may cleave to form carcinogenic arylamines

Disperse dyes		**Basic dyes**	
Disperse Orange 60	Disperse Yellow 7	Basic Brown 4	Basic Red 114
Disperse Orange 149	Disperse Yellow 23	Basic Red 42	Basic Yellow 82
Disperse Red 151	Disperse Yellow 56	Basic Red 76	Basic Yellow 103
Disperse Red 221	Disperse Yellow 218	Basic Red 111	
Acid dyes			
CI Acid Black 29	CI Acid Red 4	CI Acid Red 85	CI Acid Red 148
CI Acid Black 94	CI Acid Red 5	CI Acid Red 104	CI Acid Red 150
CI Acid Black 131	CI Acid Red 8	CI Acid Red 114	CI Acid Red 158
CI Acid Black 132	CI Acid Red 24	CI Acid Red 115	CI Acid Red 167
CI Acid Black 209	CI Acid Red 26	CI Acid Red 116	CI Acid Red 170
CI Acid Black 232	CI Acid Red 26:1	CI Acid Red 119:1	CI Acid Red 264
CI Acid Brown 415	CI Acid Red 26:2	CI Acid Red 128	CI Acid Red 265
CI Acid Orange 17	CI Acid Red 35	CI Acid Red 115	CI Acid Red 420
CI Acid Orange 24	CI Acid Red 48	CI Acid Red 128	CI Acid Violet 12
CI Acid Orange 45	CI Acid Red 73	CI Acid Red 135	
Direct dyes			
Direct Black 4	Direct Blue 192	Direct Brown 223	Direct Red 28
Direct Black 29	Direct Blue 201	Direct Green 1	Direct Red 37
Direct Black 38	Direct Blue 215	Direct Green 6	Direct Red 39
Direct Black 154	Direct Blue 295	Direct Green 8	Direct Red 44
Direct Blue 1	Direct Blue 306	Direct Green 8.1	Direct Red 46

Direct Blue 2	Direct Brown 1	Direct Green 85	Direct Red 62
Direct Blue 3	Direct Brown 1:2	Direct Orange 1	Direct Red 67
Direct Blue 6	Direct Brown 2	Direct Orange 6	Direct Red 72
Direct Blue 8	Basic Brown 4	Direct Orange 7	Direct Red 126
Direct Blue 9	Direct Brown 6	Direct Orange 8	Direct Red 168
Direct Blue 10	Direct Brown 25	Direct Orange 10	Direct Red 216
Direct Blue 14	Direct Brown 27	Direct Orange 108	Direct Red 264
Direct Blue 15	Direct Brown 31	Direct Red 1	Direct Violet 1
Direct Blue 21	Direct Brown 33	Direct Red 2	Direct Violet 4
Direct Blue 22	Direct Brown 51	Direct Red 7	Direct Violet 12
Direct Blue 25	Direct Brown 59	Direct Red 10	Direct Violet 13
Direct Blue 35	Direct Brown 74	Direct Red 13	Direct Violet 14
Direct Blue 76	Direct Brown 79	Direct Red 17	Direct Violet 21
Direct Blue 116	Direct Brown 95	Direct Red 21	Direct Violet 22
Direct Blue 151	Direct Brown 101	Direct Red 24	Direct Yellow 1
Direct Blue 160	Direct Brown 154	Direct Red 26	Direct Yellow 24
Direct Blue 173	Direct Brown 222	Direct Red 22	Direct Yellow 48

Appendix III: Requirements for low chemical residue latex and PU foams

The concentrations in the latex foam of the substances listed below shall not exceed the limit values shown in Table 12.

Table 12. Restricted substances in latex foams used in furniture upholstery padding materials

Group of substances	Substance	Limit value (ppm)	Assessment and verification conditions
Chlorophenols	mono- and di-chlorinated phenols (salts and esters)	1	A
	Other chlorophenols	0.1	A
Heavy metal	As (Arsenic)	0.5	B
	Cd (Cadmium)	0.1	B
	Co (Cobalt)	0.5	B
	Cr (Chromium), total	1	B
	Cu (Copper)	2	B
	Hg (Mercury)	0.02	B
	Ni (Nickel)	1	B
	Pb (Lead)	0.5	B
	Sb (Antimony)	0.5	B
Pesticides*	Aldrin	0.04	C
	o,p-DDE	0.04	C
	p,p-DDE	0.04	C
	o,p-DDD	0.04	C
	p,p-DDD	0.04	C
	o,p-DDT	0.04	C
	p,p-DDT	0.04	C
	Diazinone	0.04	C
	Dichlorfenthion	0.04	C
	Dichlorvos	0.04	C
	Dieldrin	0.04	C
	Endrin	0.04	C
	Heptachlor	0.04	C
	Heptachlorepoxide	0.04	C
	Hexachlorobenzene	0.04	C
	Hexachlorocyclohexane	0.04	C
	α-Hexachlorocyclohexane	0.04	C
	β-Hexachlorcyclohexane	0.04	C
	γ-Hexachlorocyclohexane (Lindane)	0.04	C
	δ-Hexachlorocyclohexane	0.04	C
	Malathion	0.04	C
	Methoxichlor	0.04	C
	Mirex	0.04	C
	Parathion-ethyl	0.04	C
	Parathion-methyl	0.04	C
Other specific substances that are restricted	Butadiene	1	D
* Only for foams composed of natural latex for at least 20 % by weight.			

The concentrations in the PUR foam of the substances listed below shall not exceed the limit values shown in Table 13.

Table 13. List of restricted substances in PUR

Substance group	Substance (acronym, CAS number, element symbol)	Limit value	Method
Heavy Metals	As (Arsenic)	0.2 ppm	B
	Cd (Cadmium)	0.1 ppm	B
	Co (Cobalt)	0.5 ppm	B
	Cr (Chromium), total	1.0 ppm	B
	Cr VI (Chromium VI)	0.01 ppm	B
	Cu (Copper)	2.0 ppm	B
	Hg (Mercury)	0.02 ppm	B
	Ni (Nickel)	1.0 ppm	B
	Pb (Lead)	0.2 ppm	B
	Sb (Antimony)	0.5 ppm	B
	Se (Selenium)	0.5 ppm	B
Plasticizers	Dibutylphthalate (DBP, 84-74-2)*	0.01% w/w (sum of all 6 phthalates in furniture for children less than 3 years old) *0.01% w/w (sum of 4 phthalates in all other furniture products)	C
	Di-n-octylphthalate (DNOP, 117-84-0)*		
	Di (2-ethylhexyl)-phthalate (DEHP, 117-81-7)*		
	Butylbenzylphthalate (BBP, 85-68-7)*		
	Di-iso-decylphthalate (DIDP, 26761-40-0)		
	Di-iso-nonylphthalate (DINP, 28553-12-0)		
	ECHA Candidate List** phthalates	Not added intentionally	A
TDA and MDA	2,4 Toluenediamine (2,4-TDA, 95-80-7)	5.0 ppm	D
	4,4'-Diaminodiphenylmethane (4,4'-MDA, 101-77-9)	5.0 ppm	D
Tinorganic substances	Tributyltin (TBT)	50 ppb	E
	Dibutyltin (DBT)	100 ppb	E
	Monobutyltin (MBT)	100 ppb	E
	Tetrabutyltin (TeBT)	-	-
	Monooctyltin (MOT)	-	-
	Dioctyltin (DOT)	-	-
	Tricyclohexyltin (TcyT)	-	-
	Triphenyltin (TPhT)	-	-
	Sum	500 ppb	E
Other specific substances that are restricted	Chlorinated or brominated dioxins or furans	Not added intentionally	A
	Chlorinated hydrocarbons: (1,1,2,2-Tetrachloroethane, Pentachloroethane, 1,1,2-Trichloroethane, 1,1-Dichloroethylene)	Not added intentionally	A
	Chlorinated phenols (PCP, TeCP, 87-86-5)	Not added intentionally	A
	Hexachlorocyclohexane (58-89-9)	Not added intentionally	A
	Monomethyldibromo–Diphenylmethane (99688-47-8)	Not added intentionally	A
	Monomethyldichloro-Diphenylmethane (81161-70-8)	Not added intentionally	A
	Nitrites	Not added intentionally	A
	Polybrominated Biphenyls (PBB, 59536-65-1)	Not added intentionally	A
	Pentabromodiphenyl Ether (PeBDE, 32534-81-9)	Not added intentionally	A
	Octabromodiphenyl Ether (OBDE, 32536-52-0)	Not added intentionally	A
	Polychlorinated Biphenyls (PCB, 1336-36-3)	Not added intentionally	A
	Polychlorinated Terphenyls (PCT, 61788-33-8)	Not added intentionally	A
	Tris(2,3-dibromopropyl) phosphate (TRIS, 126-72-7)	Not added intentionally	A
	Trimethylphosphate (512-56-1)	Not added intentionally	A
	Tris-(aziridinyl)-phosphinoxide (TEPA, 545-55-1)	Not added intentionally	A
	Tris(2-chloroethyl)-phosphate (TCEP, 115-96-8)	Not added intentionally	A
	Dimethyl methylphosphonate (DMMP, 756-79-6)	Not added intentionally	A

*with reference to the latest version of the ECHA Candidate List at the time of application

Appendix IV: List of relevant EN fitness for use standards

Upholstered furniture

- EN 1021-1 Furniture - Assessment of the ignitability of upholstered furniture - Part 1: Ignition source smouldering cigarette
- EN 1021-2 Furniture - Assessment of the ignitability of upholstered furniture - Part 2: Ignition source match flame equivalent

Note: In case there is national legislation or mandatory standards, which requires that furniture meets a specific level of flammability, the public authority has to take this into account when writing the tender documents. If no binding rules/standards exist, the public authority is not bound to adhere to any specific voluntary standard. In the case of the standards listed above, EN 1021-2 requires a lower level of flammability than EN 1021-1. This can lead to the use of flame retardant chemicals which may have negative effects for the environment, health, durability and quality of products, and may lead to cost increases. The public authority should therefore consider, according to the intended use and location of the furniture items, what levels of flammability it needs to require.

Office furniture

- EN 527-1 Office furniture - Work tables and desks - Part 1: Dimensions
- EN 527-2 Office furniture - Work tables and desks - Part 2: Mechanical safety requirements
- EN 1023-2. Office furniture - Screens - Part 2: Mechanical safety requirements
- EN 1335-1 Office furniture - Office work chair - Part 1: Dimensions - Determination of dimensions
- EN 1335-2 Office furniture - Office work chair - Part 2: Safety requirements
- EN 14073-2 Office furniture - Storage furniture - Part 2: Safety requirements
- EN 14074 Office furniture - Tables and desks and storage furniture - Test methods for the determination of strength and durability of moving parts

Outdoor furniture

- EN 581-1 Outdoor furniture - Seating and tables for camping, domestic and contract use - Part 1: General safety requirements
- EN 581-2 Outdoor furniture - Seating and tables for camping, domestic and contract use - Part 2: Mechanical safety requirements and test methods for seating
- EN 581-3 Outdoor furniture - Seating and tables for camping, domestic and contract use - Part 3: Mechanical safety requirements and test methods for tables

Seating furniture

- EN 1022 Domestic furniture - Seating - Determination of stability
- EN 12520 Furniture - Strength, durability and safety - Requirements for domestic seating
- EN 12727 Furniture - Ranked seating - Test methods and requirements for strength and durability
- EN 13759 Furniture - Operating mechanisms for seating and sofa-beds - Test methods
- EN 14703 Furniture - Links for non-domestic seating linked together in a row - Strength requirements and test methods

- EN 16139 Furniture - Strength, durability and safety - Requirements for non-domestic seating

Tables

- EN 12521 Furniture - Strength, durability and safety - Requirements for domestic tables
- EN 15372 Furniture - Strength, durability and safety - Requirements for non-domestic tables

Kitchen furniture

- EN 1116 Kitchen furniture - Co-ordinating sizes for kitchen furniture and kitchen appliances
- EN 14749 Domestic and kitchen storage units and worktops - Safety requirements and test methods

Beds

- EN 597-1 Furniture - Assessment of the ignitability of mattresses and upholstered bed bases - Part 1: Ignition source: Smouldering cigarette
- EN 597-2 Furniture - Assessment of the ignitability of mattresses and upholstered bed bases - Part 2: Ignition source: Match flame equivalent
- EN 716-1 Furniture - Children's cots and folding cots for domestic use - Part 1: Safety requirements
- EN 747-1 Furniture - Bunk beds and high beds - Part 1: Safety, strength and durability requirements
- EN 1725 Domestic furniture - Beds and mattresses - Safety requirements and test methods
- EN 1957 Furniture - Beds and mattresses - Test methods for the determination of functional characteristics and assessment criteria
- EN 12227 Playpens for domestic use - Safety requirements and test methods

Storage Furniture

- EN 16121 Non-domestic storage furniture - Requirements for safety, strength, durability and stability

Other types of furniture

- EN 1729-1 Furniture - Chairs and tables for educational institutions - Part 1: Functional dimensions
- EN 1729-2 Furniture - Chairs and tables for educational institutions - Part 2: Safety requirements and test methods
- EN 13150 Workbenches for laboratories - Dimensions, safety requirements and test methods
- EN 14434 Writing boards for educational institutions - Ergonomic, technical and safety requirements and their test methods

Appendix V: List of abbreviations used in the ISO 1043 plastic marking scheme

Table 14: ISO 1043-1 symbols for homopolymeric polymers

Symbol	Material	Symbol	Material	Symbol	Material
CMC	Carboxymethylcellulose	POM	Poly(oxymethylene);Polyformadehyde	PEEKK	Polyehtheretherketoneketone
CA	Celluloseacetate	PPE	Poly(phenyleneEther)	PEEST	Polyesterester
CAB	Celluloseacetatebutyrate	PPS	Poly(phenylenesulfide)	PEEK	Polyetheretherketone
CAP	Celluloseacetatepropionat	PPSU	Poly(phenylenesulfone)	PEI	Polyetherimide
CN	Cellulosenitrate	PVAC	Poly(vinylacetate)	PEK	Polyetherketone
CP	Cellulosepropionate	PVAL	Poly(vinylalcohol)	PEKEKK	Polyetherketoneetherketoneketone
CTA	Cellulosetriacetate	PVB	Poly(vinylbutyral)	PEKK	Polyetherketoneketone
CF	Cresol-formaldehyde	PVK	Poly(vinylcarbazole)	PES	Polyethersulfone
EP	Epoxide;Epoxy	PVC	Poly(vinylchloride)	PEUR	Polyetherurathane
EC	Ethylcellulose	PVF	Poly(vinylfluoride)	PE	Polyethylene
FF	Furan-formaldehyde	PVFM	Poly(vinylformal)	PI	Polyimide
PS-HI	Highimpactmodifiedpolystyrene	PVDF	Poly(vinylidenefluoride)	PIB	Polyisobutylene
MF	Melamine-formaldehyde	PVP	Poly(vinylpyrrolidone)	PIR	Polyisocyanurate
MC	Methylcellulose	PVDC	Poly(viynlidenechloride)	PMI	Polymethacylimide
PFA	Perfluoroalkoxlalkanepolymer	PMS	Poly-(α-methylstyrene)	PP	Polypropylene
PF	Phenol-formaldehyde	PAN	Polyacrylonitrile	PS	Polystyrene
PBAK	Poly(butylacylate)	PAEK	Polyacyetherketone	PSU	Polysulfone
PBT	Poly(butyleneterephthalate)	PA	Polyamide	PTFE	Polytetrafluorouethylene
PDAP	Poly(diallylphthalate)	PAI	Polyamidimide	PUR	Polyurethane
PEOX	Poly(ethyleneoxide)	PB	Polybutene	SI	Silicone
PET	Poly(ethyleneterephthalate)	PC	Polycarbonate	UP	Unsaturatedpolyester
PMMA	Poly(methylmethacrylate)	PCTFE	Polychlorotrifluoroethylene	UF	Urea-formaldehyde

Table 15: ISO 1043-1 symbols for co-polymeric materials

Symbol	Material	Symbol	Material
ABAK	Acrylonitrile-butadiene-acrylate	PEBA	Poly(etherblockamide)
ABS	Acrylonitrile-butadiene-styrene	PESTUR	Polyesterurethane
ACS	Acrylonitrile-chlorinatedpolyethylene-styrene	PFEP	Perfluoro(ethylene-propylene)
AEPDS*	Acrylonitrile/ethylene-propylene-diene/styrene	PMMI	Poly(N-methylmethylacylimide)
AMMA	Acrylonitrile-methylmethacrylate	PMP	Poly(4-methylpent-1-ene)
ASA	Acrylonitrile-styrene-acrylate	SAN	Styrene-acrylonitrile
CFS	Casein-formaldehyde	SB	Styrene-butadiene
E/P	Ethylene-propylene	SMAH	Styrene-maleicanhydride
EEAK	Ethylene-ethylacrylate	SMS	Styrene-α-methylstyrene
EMA	Ethylene-methacrylicacid	VCE	Vinylchloride-ethylene
ETFE	Ethylene-tetrafluoroethylene	VCEMAK	Vinylchloride-ethylene-methylacrylate
EVAC	Ethylene-vinylacetate	VCEVAC	Vinylchloride-ethylene-vinylacetate
EVOH	Ethylene-vinylalcohol	VCMAK	Vinylchloride-methylacrylate
LCP	Liquid-crystalpolymer	VCMMA	Vinylchloride-methylmethacrylate
MBS	Methacrylate-butadiene-styrene	VCOAK	Vinylchloride-octylacrylate
MMABS	Methylmethacrylate-acrylonitrile-butadiene-styrene	VCVAC	Vinylchloride-vinylacetate
MPF	Melamine-phenol-formadehyde	VCVDC	Vinylchloride-vinylidenechlodire
PAR	Polyarylate		

*AEPDS was known as EDPM

Table 16: **ISO 1043-2 symbols for fillers and reinforcing materials in plastics**

Symbol	Material [1]		Symbol	Form/Structure
B	Boron		B	Beads, spheres, balls
C	Carbon		C	Chips, cuttings
D	Alumina trihydrate		D	Fines, powders
E	Clay		F	Fiber, fibre
G	Glass		G	Ground
K	Calcium carbonate		H	Whisker
L	Cellulose		K	Knitted fabric
M	Mineral: metal [2]		L	Layer
N	Natural organic (cotton, sisal: hemp: flax: and so forth.)		M	Mat (thick)
P	Mica		N	Non-woven (fabric, thin)
Q	Silica		P	Paper
R	Aramid		R	Roving
S	Synthetic organic (finely divided PTFE: polyimides or thermoset resins)		T	Talcum
S	Flake		W	Wood
T	Twisted or braided fabric, cord		X	Not specified
V	Veneer		Z	Others (not included on this list)
W	Woven fabric		X	Not specified
Y	Yarn		Z	Others, not included on this list
[1] Materials may be further defined; for example by their chemical symbols or by additional symbols defined in the relevant International Standard.				
[2] In the case of metals (M), the type of metal must be indicated by its chemical symbol.				

Table 17: ISO 1043-3 abbreviations used for plasticizers

Abbreviation	Common name	IUPAC* equivalent	CAS-RN**
ASE	Alkysulfonic acid ester	Alkysulfonates or Alkyl alkanesulfonates	not known
BAR	butylo-acetylricinoleate	Butyl ®-12-acetoxyoleate	140-04-5
BBP	Benzyl butyl phthalate	same	85-68-7
BCHP	Butyl cyclohexl phthalate	same	84-64-0
BNP	Butyl nonyl phthalate	same	not known
BOA	Benzyl octyladipate	benzyl2-ethyhexyl adipate	3089-55-2
BOP	Butyl octyl phthalate	butyl2-ethylhexyl phthalate	85-69-8
BST	Butyl stearate	same	123-95-5
DBA	Dibutyl adipate	same	105-99-7
BEP	di-(2-butoxyethyl) phthalate	bis(2-butoxyethyl) phthalate	117-83-9
DBF	dibutyl fumarate	same	105-75-9
DBM	dibutyl maleate	same	105-76-0
DBP	dibutyl phthalate	same	84-74-2
DBS	dibutyl sebacate	same	109-43-3
DBZ	dibutyl azelate	same	2917-73-9
DCHP	dicyclohexyl phthalate	same	84-61-7
DCP	dicapryl phthalate	bis(1-methylheptyl) phthalate	131-15-7
DDP	didecyl phthalate	same	84-77-5
DEGDB	diethylene glycol dibenzoate	oxydiethylene dibenzoate	120-55-8
DEP	diethyl phthalate	same	84-66-2
DHP	diheptyl phthalate	same	3648-21-3
DHXP	dihexyl phthalate	same	84-75-3
DIBA	diisobutyl adipate	same	141-04-8
DIBM	diisobutyl maleate	same	14234-82-3
DIBP	diisobutyl phthalate	same	84-69-5
DIDA	diisobutyl adipate	***	27178-16-1
DIDP	diisodecyl phthalate	***	26761-40-0
DIHP	diisoheptyl phthalate	as above	41451-28-9
DIHXP	diisohexyl phthalate	same	71850-09-4
DINA	diisononyl adipate	***	33703-08-1
DINP	diisononyl phthalate	***	28553-12-0
DIOA	diisooctyl adipate	***	1330-86-5
DIOM	diisooctyl maleate	***	1330-76-3
DIOP	diisooctyl phthalate	***	27554-26-3

Abbreviation	Common name	IUPAC* equivalent	CAS-RN**
DIOS	diisooctyl sebacate	***	27214-90-0
DIOZ	diisooctyl azelate	***	26544-17-2
DIPP	diisooctyl phthalate	same	605-50-5
DMEP	di-(2-methyloxyethyl)	bis(2-methoxyethyl)	117-82-8
DMP	dimethyl phthalate	same	131-11-3
DMS	dimethyl sebacate	same	106-79-6
DNF	dinonyl fumarate	same	2787-63-5
DMN	dinonyl maleate	same	2787-64-6
DNOP	di-n-octyl phthalate	dioctyl phthalate	117-84-0
DNP	dinonyl phthalate	same	14103-61-8
DNS	dinonyl sebacate	same	4121-16-8
DOA	dioctyl3) adipate	bis(2-ethylhexyl)3) adipate	103-23-1
DOIP	dioctyl isophthalate	bis(2-ethylhexyl) isophthalate	137-89-3
DOP	dioctyl phthalate	bis(2-ethylhexyl) phthalate	117-81-7
DOS	dioctyl sebacate	bis(2-ethylhexyl) sebacate	122-62-3
DOTP	dioctyl terephthalate	bis(2-ethylhexyl) terephthalate	6422-86-2
DOZ	dioctyl azelate	bis(2-ethylhexyl) azelate	2064-80-4
DPCF	diphenyl cresyl phosphate	diphenyl x-tolyl orthophosphate where x demotes o, m, p or mixture	26444-49-5
DPGDB	di-x--propylene glycol dibenzoate	not possible	not known
DPOF	diphenyl octyl phosphate	2-ethylhexyl diphenyl orthophosphate or octyl diphenyl orthophosphate	1241-94-7
DPP	diphenyl phthalate	same	84-62-8
DTDP	diisotridecyl phthalate (see note X)	***	27253-26-5
DUP	diundecyl phthalate	same	3648-20-2
ELO	epoxidized linseed oil	not possible	8016-11-3
ESO	epoxidized soya bean oil	not possible	8013-07-8
GTA	glycerol triacetate	same	102-76-1
HNUA	heptyl nonyl undecyl adipate (=711A)	not possible	Not known
HNUP	heptyl nonyl undecyl phthalate (=711P)	not possible	68515-42-4
HXODA	heptyl octyl decyl adipate (=610A)	not possible	not known
HXODP	heptyl octyl decyl phthalate (=610P)	not possible	68515-51-5
NUA	nonyl undecyl adipate (=911A)	not possible	not known
NUP	nonyl undecyl phthalate (=911P)	not possible	not known
ODA	octyl decyl adipate	decyl octyl adipate	110-29-2
ODP	octyl decyl phthalate	decyl octyl phthalate	68515-52-6
ODTM	n-octyl decyl trimellitate	decyl octyl hydrogen Benzene1,2,4-tricarboxylate	not known
PO	paraffin oil	not possible	8012-95-1
PPA	poly(propylene adipate)	same	not known
PPS	poly(propylene sebacate)	not possible	not known
SOA	sucrose octa-acetate	sucrose octaacetate	126-14-7
TBAC	tributyl o-acetylcitrate	same	77-90-7
TBEP	tri-(2-butoxyethyl) phosphate	tris(2-butoxyethyl) orthophosphate	78-51-3
TBP	tributyl phosphate	tributyl orthophosphate	126-73-8
TCEF	trichloroethyl phosphate	tris(2-chloroethyl) orthophosphate	6145-73-9
TCF	tricresyl phosphate	tri-x-tolyl orthophosphate where x denotes o, m, p or mixture	1330-78-5
TDBPP	tri-(2,3-dibromopropyl) phosphate	tris(2,3-dibromopropyl) orthophosphate	126-72-7
TDCPP	tri-(2,3-dichloropropyl) phosphate	tris(2,3-dichloropropyl) orthophosphate	78-43-3
TEAC	triethyl o-acetylcitrate	same	77-89-4
THFO	tetrahydrofurfuryl oleate	same	5420-17-7
THTM	triheptyl trimellitate	triheptyl benzene-1,2,4-tricarboxylate	1528-48-9
TIOTM	triisooctyl trimellitate	tris(6-methylheptyl) Benzene-1,2,4-tricarboxylate	27251-75-8
TOF	trioctyl phosphate	tris(2-ethylhexyl) orthophosphate	78-42-2
TOPM	tetraoctyl pyromellitate	tetrakis(2-ethylhexyl) benzene-1,2,45-tetracarboxylate	3126-80-5
TOTM	trioctyl trimelliate	tris(2-ethylhexyl) benzene-1,2,45-tetracarboxylate	89-04-3
TPP	triphenyl phosphate	triphenyl orthophosphate	115-86-6
TXF	trixylyl phosphate	tri-x,y-xylyl orthophosphate, where x and y denotes o, m, por mixture	25155-23-1

* IUPAC = International Union of Pure and Applied Chemicals

** CAS-RN = Chemical Abstracts Service – Registry Number

*** Several plasticizers having "iso" names indicating brached groups may consist of several isomers. For this reason, no single IUPAC name can describe the detailed chemical composition of each of these plasticizers.

Table 18. List of code numbers from ISO 1043-4 for flame retardant types used in plastics

HALOGONATED COMPOUNDS	
10	aliphatic/alicyclic chlorinated compounds
11	aliphatic/alicyclic chlorinated compounds in combination with antimony compounds
12	aromatic chlorinated compounds
13	aromatic chlorinated compounds in combination with antimony compounds
14	aliphatic/alicyclic brominated compounds
15	aliphatic/alicyclic brominated compounds in combination with antimony compounds
16	aromatic brominated compounds (excluding brominated diphenyl ether and biphenyls)
17	aromatic brominated compounds (excluding brominated diphenyl ether and biphenyls) in combination with antimony compounds
18	polybrominated diphenyl ether
19	polybrominated diphenyl ether in combination with antimony compounds
20	polybrominated biphenyls
21	polybrominated biphenyls in combination with antimony compounds
22	aliphatic/alicyclic chlorinated and brominated compounds
23, 24	not allocated
25	aliphatic fluorinated compounds
26-29	not allocated
NITROGEN COMPOUNDS	
30	nitrogen compounds (confined to melamine, melamine cyanurate, urea)
31-39	not allocated
ORGANIC PHOSPHORUS COMPOUNDS	
40	Halogen-free organic phosphorus compounds
41	Chlorinated organic phosphorus compounds
42	Brominated organic phosphorus compounds
43-49	not allocated
INORGANIC PHOSPHORUS COMPOUNDS	
50	ammonium orthophosphates
51	ammonium polyphosphates
52	red phosphorus
53-59	not allocated
METAL OXIDES, METAL HYDROXIDES, METAL SALTS	
60	aluminium hydroxide
61	magnesium hydroxide
62	antimony (III) oxide
63	alkali-metal antimonate
64	magnesium/calcium carbonate hydrate
65-69	not allocated
BORON AND ZINC COMPOUNDS	
70	inorganic boron compounds
71	organic boron compounds
72	zinc borate
73	organic zinc borate
74	not allocated
SILICA COMPOUNDS	
75	inorganic silica compounds
76	organic silica compounds
77-79	not allocated
OTHERS	
80	graphite
81-89	not allocated
90-99	not allocated

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