



Green Public Procurement

Wall Panels Technical Background Report

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1 Introduction

1. Background

Following on from previous work in developing GPP criteria for ten product groups¹, a further ten products and sub-products have been identified for the development of GPP purchasing criteria to add to the European Commission's GPP training Toolkit Module 3, which presents recommended GPP criteria for products and services. GPP is a voluntary instrument.

Wall panels have been identified as a product group for criteria development. This report provides background information on the environmental impact of wall coverings and outlines the key relevant European legislation affecting this product group. It then goes on to describe existing standards and ecolabels that cover this product group. Finally it outlines the rationale for the core and comprehensive environmental purchasing criteria that are being proposed.

This report accompanies the associated **Product Sheet** that contains the proposed purchasing criteria and ancillary information for green tender specifications and as such they should be read alongside one another.

The format for the purchasing recommendations comes in the form of two sets of criteria:

- The core criteria are those suitable for use by any contracting authority across the Member States and address the key environmental impacts. These are designed to be used with minimum additional verification effort or cost increases.
- The comprehensive criteria are for those who wish to purchase the best environmental products available on the market. These may require additional verification effort or a slight increase in cost compared to other products with the same functionality.

Within the core and comprehensive criteria, the guidance follows the various stages of a public procurement procedure and explains how best to integrate environmental criteria at each stage:

- Subject matter. It means the title of the tender, i.e. a short description of the product, works or service to be procured.
- Technical Specifications. Provide a clear, accurate and full description of the requirement and standard to which goods, works or services should conform. Description of the minimal technical specifications which all bids need to comply with. Set specific environmental criteria, including hurdles and levels that need to be met for specific products.
- Selection Criteria. It is based in the capacity / ability of the bidders to perform the contract. Assist in the identification of appropriate suppliers, for example to ensure adequately trained personnel or relevant environmental policies and procedures are in place.
- Award Criteria. The award criteria on the basis of which the contracting authority will compare the offers and base its award. Award criteria are not pass/fail criteria, meaning that offers of products that don't comply with the criteria may still be considered for the final decision, depending on their score on the other award criteria.
- Contract Performance Clause - Specify the conditions that must be met in the execution of the contract, for example as to how the goods or services are to be supplied, including information or instructions on the products to be provided by the supplier.

It should be noted that the contractor is bound by the existing legal framework.

Where the verification for the criteria states that other appropriate means of proof can be used, this could include a technical dossier from the manufacturer, a test report from a recognised body, or other relevant evidence. The contracting authority will have to satisfy itself on a case by case basis, from a technical/legal perspective, whether the submitted proof can be considered appropriate.

¹ <http://www.ec.europa.eu/environment/gpp>

2 Abbreviations

CEN	European Committee for Standardisation
CLP	Classification, Labelling and Packaging, for CLP Regulation
COD	Chemical Oxygen Demand
CPD	Construction Products Directive
CSA	Canadian Standards Association
EPBD	Energy Performance of Buildings Directive
EPD	Environmental Products Declaration
ETS	EU Emissions Trading Scheme
EU	European Union
EURIMA	European Insulation Manufacturers Association
FGD	Flue-gas desulfurisation
FSC	Forestry Stewardship Council
GHG	Greenhouse Gas (emissions)
GPP	Green Public Procurement
IARC	International Agency for Research on Cancer
MDF	Medium Density Fibreboard
MDI	Methylene Diphenyl Diisocyanate
MS	Member States
MWEI	Management of Waste from Extractive Industries Directive
OECD	Organisation for Economic Cooperation and Development
OSB	Oriented Strand Board
PACIA	Plastics and Chemical Industry Association
PEFC	Pan European Forest Certification Council
PMDI	Polymeric Methylene Diphenyl Diisocyanate
REACH	Registration, Evaluation, Authorisation and Restriction of Chemical Substances Directive
TOC	Total Organic Content
VOC	Volatile Organic Compound
WRAP	Waste and Resource Action Programme

The following terms are used in this report and as such are explained below.

COD - Chemical Oxygen Demand: the equivalent mass of oxygen required to oxidise dissolved and suspended organic matter under defined conditions.

Building envelope: The barrier between conditioned and unconditioned space, including all walls, floors, roofs, doors and windows.

Post-Consumer: Material generated by households, or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose.

Pre-Consumer: Material diverted from the waste stream during a manufacturing process.

Gypsum: Calcium sulfate dihydrate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

3 Definition, Scope and Background

3.1 Product Description

Wall panels are large, rigid sheets used to create (with a framing system) or finish the walls of a building. The primary function of a wall panel is to divide up space within a building into rooms and/or areas. In addition the transfer of heated or cooled air between areas should be minimised, as should noise transfer. Wall panels replace the more traditional building method of single width brick walls for internal division, usually coated with render, then plaster.

For the purpose of these green public procurement criteria it is proposed to focus on internal wall panel materials in buildings. Such a definition encompasses two different ranges of products:

- Gypsum based board in all its forms for internal walls, usually referred to as plasterboard
- Wood based boards such as plywood, fibre-board or chipboard for use in walls.

The use of such boards in furniture is outside the scope of this product group's GPP criteria.² The same applies to any such boards where they are used in floors and roofs, as these will have different characteristics due to the different functions, demands and stresses put on them during use.

Wall panels will therefore be taken as the two above categories of material used in vertical or angled placement (for example in loft conversions) in a building, where the panel itself is not load bearing and its surface is not the final surface seen in the finished building, i.e. it will be plastered, skimmed, painted, papered etc.

For the purposes of ease of understanding the market in this report the internal wall panel market has been divided into two categories:

- Internal gypsum based plasterboard
- Internal wood based wall panels

This is a slightly artificial product category. Many of the manufacturers and trade organisations for this area are divided into those that work with gypsum products and those that work with wood based products. In addition wall panels cannot be used in isolation, but require fixings to be mounted to and sealants or fillers to finish the surface. Many of the regulations and safety standards concerning wall panels concern their operation *in-situ*, i.e. consider the system of the wall rather than the individual components.

However a product based approach is also necessary for those who wish to specify that the most environmentally sustainable materials be used within the sustainably designed building, or for whom refurbishment is the focus and where other measures, such as the Energy Performance of Buildings Directive for example, would not apply.

Most wall panel products are covered by the Construction Products Directive (CPD, see Section 6.2). Construction products covered by the CPD have to be CE marked. CE marking is accompanied by specific technical information about specific performance of these products.

² GPP criteria are available for furniture at http://ec.europa.eu/environment/gpp/toolkit_en.htm

3.2 Technologies

This section explains some of the detail behind the two main wall panel materials; gypsum plasterboard and wood based panels.

3.2.1 Gypsum Plasterboard Panels

Gypsum is a mineral that has been extensively used for many applications over a long period of time. Traditionally this material has been excavated from natural deposits, which are extensive throughout many regions of the world. EU production of mined gypsum has increased in recent years, totalling around 30 million tonnes in 2007; with world gypsum production at 147Mt.³ Spain is the most significant producer in Europe, followed by France, Italy and Germany. Together these countries produce over 20 million tonnes a year.^{4,5} The Eastern European plasterboard market is developing rapidly and with it their mining activities.

Alternatively synthetic gypsum can be used, derived from coal power stations and flue-gas desulfurisation (FGD). Desulfogypsum (DSG) or FGD gypsum is a by product of the flue gas cleaning process.

The calcium sulphate semi-hydrate form of gypsum is formed into sheets between two layers of heavy paper or fibreglass mats and dried. This material is then used to cover original walls, or attached to stud work to create internal walls in all construction types (residential, commercial, new or refurbished). Studwork is the supporting framework of an internal wall or partition, often built from timber, but metal components can also be used. Depending on the type of plasterboard used it can be skimmed with a surface layer of plaster, or simply have the joins and nail indentations filled with a sealer.

Gypsum plasterboard as a material provides good levels of acoustic insulation and thermal insulation, as well as generating cavities behind the main face where further insulation can be used. In addition gypsum products offer a high level of fire protection, due to the water present in the material and gypsum's non-combustible nature. When gypsum is exposed to heat the water vaporises, which slows heat transfer to adjacent rooms, thus slowing the progress of the fire for up to four hours.⁶

Incorporating recycled gypsum into new gypsum plasterboard can have significant implications for fire resistance and fire ratings. Where scrap boards are incorporated into new boards, they are shredded, including the paper, and then incorporated. Thus new boards with a recycled content contain a higher quantity of paper in the core material. This has the potential to reduce the fire resistant properties of the board, and so amounts of recycled content must be carefully controlled and are currently kept to low levels to ensure fire safety properties are not compromised.⁷ It is possible to remove some paper from recycled boards through sieving which would improve the purity of the recycled gypsum. However the inclusion of paper in the core can have positive influence on the strength of the board.

3.2.2 Wood-Based Panels

Wood-based board is the name given to a group of products which include solid wood panels, laminated veneer lumber (LVL), plywood, oriented strand board (OSB), particleboards, flaxboard, cement bonded particleboard and fibreboard. Each of these sub groups of wood-based panel is subdivided further, for example particleboard is available in a number of grades suitable for different end uses.

Wood based panels can be made from both virgin and recovered wood. Whether or not recovered wood is used is largely dependent on the type of panel product being produced. Particleboard can utilise both virgin and recovered wood and typically uses between 25% and 95% recovered wood in

³Analysis of the competitiveness of the non-energy extractive industry in the EU, Brussels, 04.06.2007, SEC(2007) 771

⁴The Economics of Gypsum and Anhydrite, Ninth edition 2004, Roskill Report.

⁵WORLD-MINING-DATA, Minerals Production, Vol. 24, Vienna 2009, <http://www.wmc.org.pl/sites/default/files/WMD2009.pdf>

⁶Living with Gypsum, Eurogypsum booklet.

⁷Eurogypsum Waste Policy: Building Value For Society

production. OSB utilises virgin wood as does fibreboard, although there is research looking into producing panels made from recovered wood for fibreboards.

Each of the different types of wood based panel was developed for a different reason. For example, plywood was created to provide panels with stability strength in all three dimensions, and thus requires straight, well-grown timber. Wood particleboard (chipboard) and fibreboards utilise small particle sized wood-fibres or saw mill co-products and were developed to give sheet materials with uniform properties. OSB was developed in the mid 1970s as a way to use timber that is too small for plywood production. The boards are made of strands arranged usually in three layers, and this gives greater mechanical properties than the previously used wafer-boards or flake-boards.⁸

Wood-based panels utilised as wall panelling can have two functions, namely structural and non-structural. A wood based panel used in a structural application normally as part of a timber frame building will provide racking resistance to a structure. They can also be utilised in non-structural situations for decorative purposes and can provide a degree of impact resistance and a substrate for fixing to. In this product group internal wall applications are the focus.

When used as part of an acoustic or thermal insulating system, wood based panels can contribute to the overall performance as they are often used in construction in such a way as to create cavities that can be filled with insulation.

Many product ranges for both wood based and gypsum based panels exist which build on their thermal and acoustic properties, however these will not be explored here as such features are outside the scope of this report. For more information regarding Green Public Procurement (GPP) of thermal insulation materials see The Technical Specifications for GPP, Thermal Insulation Background Report and Product Sheet.

3.2.3 Renewable Material Wall Panels

The use of renewable and organic materials in addition to wood in wall panels, although very small, is growing.⁹ The products use the fibrous and thermal properties of straw, flax and hemp within specially designed panels (usually held within a wood or wood panel outer frame), and are often finished with lime based plasters. These products offer an alternative panelling system to the modern materials such as wood fibre and gypsum plaster boards.

Such panels are likely to have different requirements to standard wall panels, for example storage, or drying times, so their use would need to be factored in at an early stage of the building process.

The use of renewable material in wall panels should meet the performance requirements (i.e. sound insulation, mould growth (which happens with organic materials), resistance to fire, etc) of the national building regulations and of the Construction Products Directive.

3.3 The Wall Panel Market in Europe

The wall panel market, with its various products, is a well-established and growing market. Use of plasterboard in Europe has tripled in the past 25 years, from 25% to 76% of all gypsum-based building products, and is projected to grow at 5% each year until 2012.¹⁰ The proportion of wood based panels used for walls is difficult to establish, as such panels have many end uses.

3.3.1 Gypsum based panels

The use of plasterboard can be split into three traditional sectors, with the following percentage breakdown of their market share:

⁸ Wood Panel Industries Federation, Wood Panel Guide Introduction.

⁹ Accelerating the Development of the Market for Bio-based Products in Europe, A Lead Market Initiative for Europe, 2007, http://209.85.229.132/search?q=cache:AjicNAxUS_QJ:ec.europa.eu/enterprise/policies/innovation/files/lead-market-initiative/bio_based_products_taksforce_report_en.pdf+JRC,+biobased+building+materials&cd=1&hl=en&ct=clnk

¹⁰ Comment by GPDA, Gypsum Products Development Agency, UK and Republic of Ireland Gypsum Trade Association.

- House building: 30%
- Commercial Industrial: 30%
- Repair, Maintenance, Improvement: 40%

The growth in the use of plasterboard is due to a range of factors, as use of plasterboard has grown faster than the construction industry for many years. One aspect is likely the speed and ease with which internal walls can be finished, while another is likely the increasing popularity of timber-framed constructions. The increasing prevalence of timber framed houses is likely to further grow the amount of plasterboard used in Europe. Estimations for the UK, for example, show a 3.3% increase in the use of timber framing in 2007, despite the declining rate of house building in the economic downturn.^{11,12} The market share of timber framed construction is now 22%.¹³

Buildings utilising timber construction are popular due to the reduced cost to build and reduced time required for building. In addition timber framing is gaining favour as a more environmentally friendly method of construction when compared to brick and cement constructions, with supporters arguing it has the lowest CO₂ impact of any commercially available building material.¹⁴ As building regulations and sustainability codes tighten, many in the timber building industry argue that the material's ability to comply with, and often exceed, the current and future national requirements is one of its greatest advantages.

Utilising timber frames, stud-work and wall panels allows very simple methods of construction to be used. These techniques are one component of 'Modern Methods of Construction', or MMC, and are increasingly regarded as a means of improving quality while keeping costs down, reducing time spent on site, improving on-site safety and overcoming skills shortages, i.e. the low availability of skilled construction workers, in the construction of housing. Such methods are also in line with European-wide policies of building affordable housing.

Table 1 provides some data on gypsum wall panels: the standard sizes they are available in as well as their thermal properties.¹⁵

Table 1: Standard plasterboard sizes and thermal properties

Board thickness (mm)	Width (mm)	Length (mm)	Thermal Resistance (m ² K/W)
9.5	900 to 1250	1800 to 2700	0.05
12.5	900 to 1250	1800 to 3600	0.07
15	900 to 1250	1800 to 3000	0.08

The European gypsum plasterboard market is dominated by three companies: Lafarge Gypsum, Saint-Gobain Gyproc and Knauf. As the transport costs of plasterboard overseas are relatively high, production for the European market is carried out in Europe.

Each of the key European companies offer a standard range of board thickness and size, different finishes, various edge type and advanced ranges with properties such as improved thermal properties or improved noise reduction properties. Previously the 9.5mm thickness board dominated, but as building regulations become increasingly rigorous the 12.5mm thickness board is coming to dominate the market.

Plasterboard is selected according to the type, size, thickness and edge profile required for the project. In addition, availability and cost will be critical factors.

¹¹ UK Timber Frame Association, <http://www.timber-frame.org/index.php?page=43>

¹² Article, 'Timber Frame House Building on the Up', http://www.edie.net/news/news_story.asp?id=14721.

¹³ Timber Frame Association Interim Market Report, May 2008.

¹⁴ UK Timber Frame Association, <http://www.timber-frame.org/html/old-members-area/pr-and-marketing/environment/?PHPSESSID=36cae5e0d2776920a6c6a>, A1M Timber Frames, <http://www.a1mtd.com/timber-5.html>

¹⁵ Lafarge, British Gypsum and Knauf product ranges.

3.3.2 Wood based panels

While the wall panel market as a whole, with its various products, is a well-established and growing market, the proportion of wood based panels used for walls is difficult to establish, as such panels have many end uses. Only 9% of the wood-based board produced is used in construction. The most common other uses include furniture, internal doors, and packaging, which account for 72% of uses.^{16,17}

European consumption of boards (2003) is greatest for particleboard at 32.1 million m³, followed by MDF at 10.5 million m³ and OSB 2.1 million m³. Demand for wood panels is greatest in Germany, followed by Italy and then France.¹⁸

In new buildings, both residential and commercial, wall panels can be used in standard sizes if this has been taken into account during the design phase. In older buildings where refurbishment is carried out wall panels may be used to cover uneven surfaces, and will almost certainly have to be cut to size. One of the disadvantages of wall panels is that standard products do not offer the strength of brick and plaster walls. This can be a hindrance to users of the space, as they may wish to use the wall to support structures – heavy pictures or shelves for example.

The different physical properties of various wall materials must be weighed up against one another, along with other procurement decisions of cost, environmental impact and product quality.

¹⁶ Feropa Statistics from 2005.

¹⁷ Cei-Bois, Statistics Report, <http://www.cei-bois.org/frameset.html>

¹⁸ European Panel Federation Presentation at the UNECE Timber Committee, 61st Session, 7-10th October 2003, <http://www.unece.org/timber/docs/tc-sessions/tc-61/presentations/14-janssens.pdf>

4 Key Environmental Impacts

For wall panels the key impacts arise from energy consumed during manufacture, natural resources consumption due to manufacture, and disposal impacts when products reach the end of their use phase as well as waste arising during installation.¹⁹

4.1 Materials and Manufacture

Both production of gypsum based wall panels and wood based panels are energy intensive industries according to the definition of production value given in the Council Directive 2003/96 of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity. Here "Production value" means turnover and this includes subsidies directly linked to the price of the product, plus or minus the changes in stocks of finished products, work in progress and goods and services purchased for resale, minus the purchases of goods and services for resale.

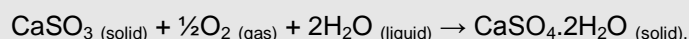
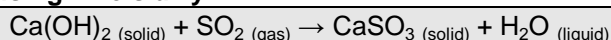
4.1.1 Gypsum Plasterboard Panels

As explained in section 3.2.1, gypsum is a common naturally occurring mineral, deposits of which are found throughout the world. It is comprised of calcium sulfate, with two water molecules, giving calcium sulfate dihydrate: $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Extraction of naturally occurring gypsum requires mining – usually open pit mines, then processing and transport. Although there is no shortage of this material mining can cause an impact in terms of land take, energy use and potential loss in biodiversity. Within Europe the gypsum industry has begun to rehabilitate some former quarries in recent decades, working to reintroduce the naturally occurring flora and fauna.²⁰ Production of natural gypsum closely follows demand as it is mined as needed by the cement and plasterboard companies who are the main consumers.

Alternatively synthetic gypsum can be used. The increasing use of synthetic gypsum has been the main feature of global gypsum supply in the last decade.⁴ The synthetic gypsum used in plasterboard is usually derived from power stations that use coal, a fossil fuel which often contains significant amounts of sulfur. Burning leads to considerable amounts of sulfur dioxide, SO_2 , which would be emitted into the atmosphere, were it not for the use of desulfurisation systems (scrubbers) that remove the SO_2 from the exhaust gases of the combustion process for energy generation. Removal of SO_2 from these waste gases is desirable because when in the atmosphere it can lead to acid rain and act as a respiratory tract irritant to humans.

To prevent this, flue-gas desulfurisation (FGD) systems are used. These use scrubbers or sorbing systems to remove sulfur dioxide through reacting it with an alkaline material such as limestone or lime, as sulfur dioxide itself is acidic gas. Limestone-based scrubbing processes have proved to be the most popular to date. An example of a desulfurisation process is described below in Box 1 where lime, calcium hydroxide $\text{Ca}(\text{OH})_2$ is the compound used to remove the SO_2 . As can be seen, the first step produces calcium sulfite, CaSO_3 and water. If this is then oxidised it goes on to form calcium sulfate CaSO_4 . When water is absorbed by this material (water of crystallisation) it becomes gypsum, called desulfogypsum (DSG) or FGD gypsum.

Box 1 Wet scrubbing, using lime slurry:²¹



FGD gypsum is sold by the energy sector to the plaster and ceramics industry as a product, rather than being disposed as waste.²² Production is throughout Western Europe, but output is currently

¹⁹ Defra, Sustainable Consumption and Production Roadmap for Plasterboard, <http://www.defra.gov.uk/environment/consumerprod/products/plasterboard.htm>

²⁰ Biodiversity Stewardship in Gypsum Quarrying: our best practices, Eurogypsum, <http://www.eurogypsum.org/documents/bio-en.pdf>

²¹ Eurogypsum Factsheet on What Is Gypsum? Environment and Raw Material Committee.

concentrated in Germany. Traditionally plasterboard production facilities were located close to natural gypsum deposits but the increasing use of synthetic gypsum has resulted in production facilities being established across Europe in close proximity of large power stations. Estimates for its use reveal that it provided approximately 44% of the gypsum used by the plaster industry in 2007 across Europe. However this is an average figure, in some European countries such as France, Spain and Italy, its use is scarce while in others like the Benelux and Scandinavian countries, usage is greater.²³ A weakness in using FGD gypsum is the potential risk associated with dependency on a separate industry. Any change in energy policy that reduced the production of FGD gypsum, such as an increased use of low-sulfur coal, or of gas, has the potential to affect future supplies of this material.

FGD gypsum has a higher purity, usually 96%, where as natural gypsum is usually around 80%. Thus lower quality gypsum can be blended with the high purity FGD gypsum, which permits material that would not have been mined in the past to become an exploitable reserve. A comparison of FGD gypsum and naturally occurring gypsum, commissioned by VGB and the German Gypsum Association, identified that the differences in chemical composition and trace elements between the materials were insignificant. Therefore, on health grounds, no distinction between materials needs to be made.²⁴ In addition the Gypsum Industry does not distinguish between the materials with respect to the environmental implications, although considerable discussion is made of the inclusion of FGD gypsum.

Once the gypsum has been sourced to make plasterboards it must be dehydrated into a hemi-hydrated form $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ at temperatures of 150-165°C and ground to a powder – both of which require inputs of energy, usually natural gas.²⁵ The hemi-hydrate gypsum powder is mixed with water to form a slurry, and to this a range of additives may be included, depending on the final specific use of the plasterboard and the surface required. Much of the manufacturing waste generated during production is re-incorporated into new plasterboard, termed ‘feedstock recycling’, which helps to minimise material use and materials costs. Possible additives include plasticisers, foaming agents, and accelerators.²⁶ The slurry is sandwiched between two layers of mat and dried in a drying chamber to specific moisture content as the gypsum reforms. The most common material used to sandwich and support the gypsum is paper. This is often heavy duty, 100% recycled post consumer paper fibre. Fibreglass can also be used, and offers enhanced fire resistance properties and increased flexibility. Fibreglass is composed of thin fibres of glass and thus the environmental implications of this material are similar to those of conventional glass.²⁷ Although both paper and fibreglass manufacture have environmental implications, they are small in comparison to the implications of gypsum due to the relatively small amounts used. The standard quantity in the finished paper utilising product is 94% gypsum and 6% paper. The product is then cut to size and ‘finished’ to give plasterboard.²⁸

Another potential source of gypsum is that formed as a by-product of processing phosphate into fertiliser using sulfuric acid. Such gypsum is known as Phosphogypsum, and is actually produced in greater quantity than FGD gypsum. However this gypsum can be radioactive due to the presence of naturally occurring uranium and radium in the ore used, and therefore much of this by-product goes unutilised. Titanogypsum is yet another source of artificial gypsum, and is a by-product of the manufacture of titanium dioxide, a common whitening agent, while fluorogypsum is a by-product from the manufacture of hydrofluoric acid.²⁹

4.1.2 Wood-based Panels

The wood based panels sector accounts for approximately 9% of the wood industry in Europe. The raw material for wood based panels is usually small forest round-wood that would be too small to be used within the timber trade, sawmill products such as sawdust and chips and post-consumer and

²² Eurogypsum, Stakeholder Contribution to the Sectoral Case Studies for the Communication on By-Products and Waste, <http://www.eurogypsum.org/documents/BY-PRODUCTCONSULTATION--EUROGYPSUMREPLY-FINAL28September2006.pdf>.

²³ Information supplied by Gypsum Products Development Association during Consultation process.

²⁴ VGB technical Scientific reports: Comparison of Natural Gypsum and FGD Gypsum: studies for a comparative assessment of the health impact of natural gypsum from coal-fired power plants with a view to their use in the manufacture of building materials- 1191-VGB instruction sheet-analysis of FGD gypsum-analytical method – first edition 1991 and reprint 1998.

²⁵ Caractéristiques Environnementales et Sanitaires, suivant la norme XP P01-010, January 2003, Syndicat National des Industries du Plâtre.

²⁶ Plasticiser: An additive used to make a material more soft and supple. Foaming agent: A surfactant present in small quantities that encourages a foam to form or improves that stability of a liquid/slurry by preventing the formation of bubbles. Accelerator: A chemical that speeds up a reaction of process.

²⁷ Glass – What’s the Environmental Impact, http://www.treehugger.com/files/2004/11/ecotip_glass_a.php

²⁸ Eurogypsum Publication, ‘Gypsum and the Commission Proposal on ETS: Background Information and Analysis’, 27th Feb. 2008.

²⁹ WRAP Plasterboard Programme, About Plasterboard, <http://www.wrap.org.uk/construction/plasterboard/about.html>

post-industrial reclaimed wood.³⁰ The industry is a large re-processor of reclaimed wood, in the UK for example it re-uses up to 80% of the available material.

The wood panel industry faces a challenge with the growing bio-energy market, as the raw material needs of these two industries overlap. The European Wood Panel Federation recommends ‘functional cascade’ to address this overlap, i.e. that the wood be used in a primary product, followed by reusing or recycling and once these options have been exhausted the wood should be used as an energy source.

Plywood and OSB are the two most common types of wood based panel used in the construction sector.³¹ There are many possible products within this category that may be used as part of internal walls, including plywood (some forms are called block-board), fibreboard (some forms are called MDF), particle-board (chipboard) and oriented strand board (OSB).

Most wood based panels are manufactured from wood fibres, particles or veneers and an adhesive with the application of heat and pressure. Plywood is a wood-based panel consisting of an assembly of layers glued together with the direction of the grain in adjacent layers usually at right angles. Plywood can be made in a number of different ways such as with layers in the same direction or with a core of solid wood. Fibreboards are made from separated wood fibres bound together by natural felting or with synthetic resin, then pressed with heat. An exception to this is the bond in hardboard which derived from the felting of fibres, in the absence of heat, and their inherent adhesive properties when formed under pressure.^{32,33} Particleboards generally use wood which has been pounded to reduce the fibres to particle size fragments, which are then bound together, using the application of heat and pressure in combination with resin to form sheets. OSB is made from strands or flakes that are laid in layers that oriented so that they are adjacent to each other with a resin and is pressed with heat to form sheets.

The resins used to bind wood based panels are generally synthetic phenol-formaldehyde resin (urea or melamine urea) and polyurethane resins. Other binding agents can be used, such as those based on MDI – methylene diphenyl diisocyanate, which is polymerised to pMDI. Boards may contain water-repellent admixtures (waxes), and a variety of other substances to improve their performance and the ease with which they can be worked. The raw materials for these products, in 2003 in Europe, used 14% recycled wood, 62% sawmill co-products and 24% virgin wood.

The production of wood based panels is an energy intensive industry. Although much of the energy requirement is met through the burning of biomass, estimated to be 75% and much of this will be process waste as the manufacturers are self sufficient to some degree, this is still a significant energy requirement.³⁴

Each of these products is an engineered wood product forming a composite material with characteristics different to that of wood. The benefits offered by such boards include:

- Improved characteristics with regard to splitting, cracking and shrinkage compared to wood.
- The wooden raw material can be made from wood chips, sawmill shavings or even sawdust. Over recent years wood based board manufacturers have started to incorporate recycled wood into the boards, reducing the raw material requirements of the manufacturing process.³⁵
- Large panels may be manufactured from fibres from small trees that would otherwise be useless.
- Small pieces of wood, and wood that has defects, can be used in many engineered wood products, especially particle and fibre-based boards.

However a disadvantage for engineered wood products is that the required glues may be harmful.³⁶ A concern with some resins is the release of formaldehyde in the finished product, often seen with urea-formaldehyde bonded products. Formaldehyde can be classified as toxic, allergenic or carcinogenic depending on how it is used and the concentrations in which it is present. The chemical formaldehyde has been formerly classified as “1: carcinogenic to humans” by the International Agency for Research

³⁰ All Party Parliamentary Group for the Wood Panel Industry, UK, <http://www.appgwoodpanelindustry.co.uk/>

³¹ European Wood Factsheet, 2. The Wood Working Industry, Cei-Bois, <http://www.cei-bois.eu/prowood/pdf/Eurofact2-Wood%20Industry3.pdf>

³² Wood Panel Industries Federation, http://www.wpif.org.uk/pg/03_section1%20v2.pdf

³³ Feropa, <http://www.feropa.org/fibreboardferopa.htm>

³⁴ Figures provided by the WIPF.

³⁵ Panel Guide Recycled Wood, Wood Panel Industries Federation, http://www.wpif.org.uk/pg/30_section5_4v2.pdf_p.1

³⁶ Engineered Wood, <http://www.nationmaster.com/encyclopedia/Engineered-wood>

on Cancer (IARC), due to possible effects from large doses of the substance on workers in the chemicals manufacturing industry. In the EU formaldehyde is classified according to the Dangerous Substances Directive as a category 3 (C3) carcinogen leading to a risk phrase R 40 (Limited evidence of a carcinogenic effect).

4.1.3 Packaging

Definitions for packaging and specific types of packaging, including primary, secondary and tertiary are included in Article 3 of Directive 94/62/EC on packaging and packaging waste and can be summarised as:

- 'Packaging' shall mean all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer. 'Non-returnable' items used for the same purposes shall also be considered to constitute packaging.

As outlined in below, the Packaging Directive aims to ensure packaging waste is dealt with effectively and sets targets for Member States with regard to the recovery and recycling of packaging materials. These targets were revised by Directive 2004/12/EC and are summarised below, with full details available in Article 6 of the Directive.

- no later than 31 December 2008 60 % as a minimum by weight of packaging waste will be recovered or incinerated at waste incineration plants with energy recovery;
- no later than 31 December 2008 between 55 % as a minimum and 80 % as a maximum by weight of packaging waste will be recycled;
- no later than 31 December 2008 the following minimum recycling targets for materials contained in packaging waste will be attained:
 - (i) 60 % by weight for glass;
 - (ii) 60 % by weight for paper and board;
 - (iii) 50 % by weight for metals;
 - (iv) 22.5 % by weight for plastics, counting exclusively material that is recycled back into plastics;
 - (v) 15 % by weight for wood.

The relevance of packaging as a key environmental impact depends on factors such as product life time and the types of materials used.

In the course of this study, consultation feedback suggests that using the same packaging criterion across different product groups is not an appropriate approach. In addition, for the majority of products in this study packaging is not a key issue, given their long life times, energy consumption during manufacturing and that some use energy in the use phase.

Commentators suggest that other factors also make this approach inappropriate, these are outlined below:

- The lack of a definitive evidence base to use when setting and justifying specific criteria.
- Focussing on a single parameter e.g. recycled content, may lead to sub-optimal environmental results. For example packaging with an increased recycled content may be less robust so more may be required to protect the goods whilst in transit.
- A fixed parameter value does not allow a flexible approach to the issue and may mean few suppliers can satisfy the requirement(s).

Consequently a packaging criterion is not included in the GPP specification. However, an explanatory note highlighting relevant issues that contracting authorities may wish to consider are included. Contracting authorities can determine for themselves the importance they wish to place on packaging and the particular issues that are relevant to them depending on their existing policies and practices.

4.2 Use Phase

The installation of panels into a building has implications for the internal air quality of the building. Any treatments that have been used on the panels that are volatile will be released into the building over the use period of the panels. One chemical of concern is formaldehyde, commonly used in wood based wall panels.

Aside from internal air quality, use phase environmental considerations are small. Wall panels can form part of an insulation system, but this is outside the scope of this product group and report.

4.2.1 Gypsum based panels

Formaldehyde and other binding agents are not used in the manufacture of gypsum wall panels, but may be present in some joint compounds used in a gypsum wall panel system.³⁷ In addition gypsum may absorb formaldehyde, if present, from its surroundings, and then release it when the surrounding level falls. Thus gypsum plasterboard wall panels are not appropriate as a barrier placed between wood based panels and the interior of a building to avoid emissions of volatile chemicals into indoor air.³⁸

A European research project has developed new types of building boards based on calcium sulfate dehydrate and clinophilolite, that can significantly reduce the concentration of substances such as ammonia, formaldehyde, benzene and tobacco smoke in indoor air.³⁹

4.2.2 Wood based panels

The release of free formaldehyde from a wood based panel into the surrounding air can be affected by temperature, the type of glue resin used, humidity and panel thickness. Many manufacturers have worked to reduce formaldehyde emissions from pressed wood products by 80-90% from the levels of the early 1980s.³⁷ Evidence shows that formaldehyde release decreases over time, i.e. release is predominantly in the time immediately after manufacture. The release of formaldehyde has been linked to 'sick house syndrome', potentially having a significant effect on the health of people using the rooms.⁴⁰ The levels that may be encountered indoors can be well below guideline limits.⁴¹ The World Health Organisation's (WHO) guideline limit for indoor exposure to formaldehyde, from all sources, is 0.08ppm, or 0.1mg/m³ of air. The WHO reports that 'The lowest concentration that has been associated with nose and throat irritation in humans after short-term exposure is 0.1 mg/m³ (0.08 ppm), although some individuals can sense the presence of formaldehyde at lower concentrations'.⁴² Tests on indoor air quality have shown that formaldehyde levels are generally less than 25% of the WHO guideline limit, of which it is estimated that the amount coming from wood panels equates to less than one eighth of the WHO guidelines.⁴¹

The wood panel industry has standards and guidance on the permitted levels of formaldehyde that can be emitted by wood based panels. The European standard EN13986 sets formaldehyde emissions in which Class E1 boards are limited to emissions of 0.13 mg / m³ of air (or 0.1ppm, as measured according to the "emission chamber test", EN 717-1). The E1 class of boards includes particleboards, OSB, and MDF. All European manufacturers can meet this standard and some are developing products with emissions that are 50% of the E1 level i.e. 0.05ppm.⁴³ A further standard is currently under development, the EPF-S Class, which would limit formaldehyde levels to 4 mg/100g in panel board, and 5mg/100g in MDF.⁴⁴

³⁷ Consumer Product Safety Commission, An Update On Formaldehyde: 1997 Revision CPSC Document #725, <http://www.cpsc.gov/CPSC/PUBS/PUBS/725.html>

³⁸ Advice from German Environment Agency during consultation phase.

³⁹ Information supplied by Gypsum Products Development Association during Consultation process.

⁴⁰ Japanese Ecolabel, Eco Mark Product Category No. 111, Board Made of Wood or the Like 2.1.

⁴¹ Wood Panel Industries Federation, Panel Guide, http://www.wpif.org.uk/pg/36_section6_4v2.pdf

⁴² WHO, 2000. Air Quality Guidelines for Europe, World Health Organization, Regional Office for Europe, Copenhagen, WHO Regional Publications, European Series, No. 91, Second Edition, Chapter 5.8 Formaldehyde, pp. 87–90, 2000.

⁴³ Advice from Wood Panel Industries Federation, during consultation phase and the German Environment Agency.

⁴⁴ Comment from European Panel Federation during Consultation Phase.

Similarly, the other main kind of binding agents for wood-based panels are pMDI-containing compounds, which could potentially also off-gas any uncombined monomeric MDI once installed, although evidence also exists that this does not occur in practice after several hours.^{45,46} MDI has been shown to be an irritant and sensitiser (from the polyurethane industry).⁴⁷ MDI based panels are automatically classified to E1 standard (following EN 13986) without testing, and can also be classified E0 under the Japanese classification (F****), the most stringent classification worldwide.⁴⁸

It should be noted that the new Global Harmonised System (GHS) for Classification and Labelling of chemicals will soon be implemented in the EU Member States. See UN Economic Commission for Europe, GHS: Status of Implementation for more information.⁴⁹

4.3 Waste: Installation and End of Life

With both types of indoor wall panels there are two significant phases of waste generation once the product is in its final form:

- Installation: off-cuts and trimming losses, waste resulting from wasteful design, damaged boards, and over-ordering.⁵⁰
- End of life removal due to strip out activities, refurbishment and demolition.

The first category can be addressed through better design and ordering initially – so standard boards can be used without the need to cut each one down to the correct size. Better construction site management also has the potential to significantly reduce wastage. Gypsum based and wood based panels are considered to be high bulk, low value, and therefore are not necessarily well taken care of when on a construction site. Consequently materials are lost through weather damage, lack of care, etc.⁵¹ It is estimated by the Gypsum Industry that waste at installation phase could potentially be reduced to 5% through better site-management practices, such as covered storage and careful transport and stacking.

The second category will generate significantly more waste than the first, as it is still cheaper to demolish an entire site rapidly and dispose of all materials together, than to spend time stripping out the various elements to enable recycling of the individual materials.⁵² The ease of deconstruction of buildings at end of life can vary by country due to varying regulatory requirements and due to building type.

Taken together these waste phases contribute significantly to C&D waste disposal in various countries, although it is difficult to identify specifically the proportion of wall panel materials disposed of in landfill as few studies have investigated this, and those that do are based on estimated data.

4.3.1 Gypsum Plasterboard Panels

Buildings reaching the end of their life currently are still predominantly constructed with brick and plaster (not plasterboard) walls, but this situation is rapidly changing. Use of plasterboard began in the 1960s and 1970s and such buildings are beginning to reach the end of their useful life today.

A few studies have considered gypsum waste. For example in New Zealand where the plasterboard market is mature approximately 20% by weight of resources disposed of in landfills is construction and demolition waste and of this approximately 12% is gypsum plasterboard.⁵³ In North America plasterboard wastes represent up to 15% of construction and demolition waste, again in a mature

⁴⁵ Advice from Wood Panel Industries, during consultation phase. Quote research from Fraunhofer Institut WKI, Braunschweig.

⁴⁶ Testing Shows MDI Emissions Insignificant From Commercial Boards and Polyurethane-Bonded Substrates, Premal P. Parekh, William J. Karoly, Huntsman Polyurethanes, 2002.

⁴⁷ WHO, Formaldehyde, http://www.euro.who.int/document/aig/5_8formaldehyde.pdf

⁴⁸ Comment from ISOPA - European Diisocyanate and Polyol Producers Association during Consultation Phase.

⁴⁹ UN Economic Commission for Europe, GHS: Status of Implementation,

http://www.unece.org/trans/danger/publi/ghs/implementation_e.html#European%20Union%20and%20European%20Economic%20Area

⁵⁰ Estimate originally generated by the Federation of Plastering and Drywall Contractors in 2006 relating to the UK Market, reported in Diverting plasterboard waste from landfill in the UK, Oakdene Hollins, 2006.

⁵¹ Comment from BRE Plasterboard specialist.

⁵² Life Cycle Assessment of Plasterboard, WRAP Technical Report.

⁵³ New Zealand Ecolabelling Trust, Gypsum Plasterboard Specifications, EC-19-07.

market.⁵⁴ Western Europe is a consolidating market, and Eastern Europe is a developing market and as such only the amount of gypsum waste has been estimated at approximately 3 million tonnes landfilled annually.⁵⁵

A study from the UK in 2006 identified the main sources of waste to be trimming waste, stairwells, over ordering and weather damage, together potentially amounting to 10-20% according to WRAP, Lafarge and FDPC. The study highlights the lack of plasterboard contractor accountability as a major contributor to the high levels of waste generated. They report of one major house builder who identified through an internal study, “losses of 19% for apartment developments and 15% for house developments”.

Gypsum plaster board has a sulfate content of 53-58%. When it is disposed of in a landfill site and allowed to decay with organic matter and in the presence of water and the absence of air, it can generate hydrogen sulfide gas as a breakdown product, which is a toxic substance. Plasterboard is rarely incinerated as the sulfate content may be converted back to sulfur dioxide gas. It is for this reason that in 2002 as part of the process of establishing criteria and procedures for the acceptance of waste at landfills, the EU reclassified gypsum products as high sulfate, non-hazardous non-inert waste. The implication of this is that gypsum products cannot be disposed of as standard waste, but must be disposed of in the absence of organic matter. Different solutions have been adopted by countries, with some, such as Germany, going as far as to ban high sulfate waste from common landfill sites altogether.

The effect of the revised regulations is to increase the cost of disposing of plasterboard, both labour and landfill costs, at a time when landfill costs were rising already. It is now necessary to segregate gypsum waste from general construction waste on building and demolition sites.

As plasterboard waste has to be segregated from other C&D waste streams, this encourages recycling options. While recycling unused construction plasterboards is possible, and the incorporation of process waste into new boards performed as standard, recycling post consumer gypsum plasterboard waste is more challenging as it may be contaminated. However, this potential recycling pathway offers an opportunity to reduce the amount of plasterboard entering the waste stream. It will also help reduce demand for virgin resources, in turn reducing impacts of mining and related processing. Indeed gypsum is one of the very few construction products where, theoretically at least, closed loop recycling is possible, i.e. where the same material is used again and again.

The largest market for recycled gypsum is incorporation into new plasterboard achievable due to the recyclability of gypsum itself. Recycled gypsum, as with virgin gypsum, can also be used for cement manufacture, road construction, as a soil improver and stabiliser or use as a replacement for clay block manufacture.^{56, 57}

While recycling plasterboard into alternative products, or into new plasterboard helps to divert waste from landfill, a recent life cycle analysis study (LCA) by WRAP, a UK government body which funds and carries out waste mitigation research, indicated that little environmental benefit is achieved through incorporating recycled gypsum into new plasterboard versus using 100% virgin gypsum material. The investigation compared three classes of plasterboard:⁵⁸

1. Baseline: a Type A sheet: 12.5 mm thick; 1200 x 2400 mm; square edge profile – the most commonly used type in the UK, based on 2007 production.
2. 15% recycle: an equivalent board that incorporates 15% post-consumer recycled gypsum
3. 25% recycle: another equivalent board that incorporates 25% post consumer recycled gypsum.

⁵⁴ Gypsum Wallboard, Canada's Environmental Choice Programme (EcoLogo), CCD-020, <http://www.ecologo.org/common/assets/criterias/CCD-020.pdf>

⁵⁵ Gypsum Recycling, <http://www.gypsumrecycling.biz/?Side=2055&Udvid=1>

⁵⁶ WRAP <http://www.wrap.org.uk/>

⁵⁷ Eurogypsum <http://www.eurogypsum.org/>

⁵⁸ Life Cycle Assessment of Plasterboard: Quantifying the environmental impacts throughout the product life cycle, building the evidence base in sustainable construction, WRAP http://www.wrap.org.uk/downloads/Life_Cycle_Assessment_of_Plasterboard.7c47e12c.5313.pdf

Table 2 shows the key results from the WRAP study for three main life cycle parameters:

- Global warming potential (GWP) which indicates the effect on climate change, expressed in CO₂ equivalents
- Human Toxicity, the effect on individuals in the population, expressed in equivalents of the toxic chemical compound 1,4-dichlorobenzene
- Eutrophication, which describes the effect on rivers and lakes in terms of excessive growth of algae, expressed in phosphate equivalents.

Table 2 Sample impact assessment results comparison

Impact Category	Unit	Baseline	15% recycled content	25% recycled content
Global Warming (GWP100)	kg CO ₂ eq	11.90	11.68	11.45
Human Toxicity	kg 1,4-DB eq	2.43	2.40	2.33
Eutrophication	kg PO ₄ ³⁻ eq	0.0043	0.0043	0.0041

All figures assume low transport, 50 km or less between point of collection and point of use.

Overall the impact profiles generated from these three scenarios suggest that while environmental benefits can be achieved through incorporating post-consumer recycled gypsum into plasterboard, the benefits are relatively small in comparison with the overall system impacts.

For example the scale of savings is demonstrated below in Table 3 and it can be seen that the benefits are all less than 10% between the current product system and the product with 25% recycled content. If a scenario with high transport is used, the plasterboard is transported over 450km between point of collection and point of use, then the savings reduce again compared to the baseline system.

Table 3 Relative savings between baseline board and 25% recycled-content board

Impact Category	Unit	Savings per sheet of type A plasterboard	Savings as a % of total impacts for the baseline system
Global Warming (GWP100)	kg CO ₂ eq	0.769	6%
Human Toxicity	kg 1,4-DB eq	0.09	4%
Eutrophication	kg PO ₄ ³⁻ eq	0.00020	5%

On this matter a publication by Eurogypsum (European federation of national associations of gypsum products manufacturers) states that:

“There is also an environmental penalty to pay as recycling gypsum waste is more energy intensive than using raw gypsum, because of the need to collect and transport the material, sort and purify it and remove the moisture content, which is the most energy intensive part of the manufacturing process.”

However, increased recycling rates do reduce the amount of materials going to landfill, and close the loop on materials and resource consumption, and as such is an important consideration in itself. Therefore having environmental criteria concerned with recycled content of panels would be a logical conclusion.

Effective recycling of post consumer gypsum plasterboards, as with all other types of post consumer recycling, requires the co-operation of a number of businesses including the deconstruction contractor, collector, recycler, plasterboard producer and authorities.

Tackling the problem of plasterboard disposal and recycling from demolition or refurbishment sites is considerably more challenging than recycling process waste or installation waste as such material is contaminated with a far higher level of paper, nails, screws, wood, etc. Recycling of post-consumer gypsum waste could be encouraged through the use of deconstruction rather than demolition at sites that are being redeveloped. Deconstruction techniques would allow sorting and recycling of non-load bearing elements such as plasterboard. Currently however most buildings in Europe are demolished not deconstructed and consequently attention is now largely focused on the first phase of waste production, construction, rather than this second, end-of-life phase.

4.3.2 Wood-based Panels

Identifying the disposal patterns for wood based panels is difficult as data on the amount of demolition waste arising from wood based panels was not identified. It is likely that much wood based panel waste is disposed of to landfill. However the updated Waste Directive places limits on the amount of TOC (total organic carbon) that is permissible, and this may have implications for the disposal of these materials.

Alternative disposal routes include incineration and associated energy from waste. Interest and activity in utilising waste wood from the building sector is developing rapidly across a number of Member States. Modern incinerators have flue gas controls in place to mitigate the escape of unwanted combustion products to the atmosphere. Combustion of contaminated wood products must be carried out in compliant facilities, with the appropriate emission controls. Composting, or using the shredded wood based panels as ground cover, is a further alternative disposal route, but hindered by the types of glues that may have been used and any surface treatments that have been applied.

Recycling of the wood based panels is not usually possible as the size of the wood chips, fibres and particles has often been reduced such that further processing would render them unsuitable.

4.4 Summary

This chapter has discussed the environmental impacts from the manufacture, installation, waste and end-of-life impacts of wall panels.

For both types of panel, gypsum and wood-based, there are shared types of environmental impact, such as the use of raw materials, the content of recycled materials and the ultimate disposal of waste from the production and installation stages of the life cycle, as well as the impacts common with many other products, such as transportation and packaging.

Wall panels, whether composed of gypsum or wood based, have significant material and energy requirements. Post consumer recycling schemes are almost non-existent, but the incorporation of process waste is widespread. Recent analysis demonstrates that post consumer recycling schemes for gypsum plasterboard offer a good way to reduce the amount of waste that goes to landfill, but do not significantly reduce the environmental impact of these building products. There is little information relating to post-consumer recycling for wood panels.

The most effective way in the short term to reduce the environmental impact of such materials is to prevent waste and wastage. In the long term an approach that encompasses initial processing, transport, waste and recycling is needed to reduce the impact of these products.

5 Cost Considerations

Internal walls are a standard component of most buildings, certainly those used as homes or work places. Wall panels were traditionally considered to be high bulk, low value products where the low value ascribed to the materials resulted in considerable damage and wastage, and consequently over-ordering was performed deliberately.

The raw materials required for both types of boards are generally low cost but product prices will be affected by rising energy costs and competition for raw material in the case of wood.

The availability of the cheaper FGD gypsum, a by-product from the energy sector that needs to be disposed ensures the cost of gypsum remains stable at these low prices. The three main producers of plasterboard in Europe all use FGD gypsum in their manufacturing process,⁵⁹ but levels of consumption are undisclosed due to competition rules.

As discussed in section 4.1.1, FGD gypsum is incorporated into gypsum products as standard practice. No distinction between gypsum sources is made, and correspondingly no distinction between the environmental credentials of specific products is made, although there is much reference to including recycled gypsum which often means FDG gypsum. It is therefore not currently possible to differentiate plasterboard products by price with a potentially improved environmental profile due to their recycled content. As discussed above FGD gypsum has a high purity, so can be combined with lower purity natural gypsum that otherwise could not be used.

The primary sources of raw material for wood based panels are small forest round-wood (that is wood too small for use as timber), sawmill products and post-consumer and post-industrial reclaimed wood.⁶⁰ Raw material costs are affected by fluctuations in European and world market demand for timber, often affected by demand for timber for construction and severe weather events. The increasing popularity of using virgin wood to generate energy concerns the panel sector, as it represents a potential threat to wood supplies and costs.⁶¹

Where buildings are not able to use the industry standard board sizes it is possible to purchase speciality sizes of boards as part of a bespoke service. As is to be expected this will cost more than the standard service, and will have a minimum order quantity which may be considerable.

Over the lifetime of the boards they will undergo wear and tear through the rooms being used and may need resurfacing from time-to time. It is likely that this can be achieved by a skim coat of plaster or heavy duty paper on either type of board when a building is refurbished, rather than a replacement internal wall or replacement wall panels.

At disposal stage, either during installation or end of life, increasing landfill costs and restrictions throughout the European Union will result in increased disposal costs. These increased costs are most likely to be passed onto the end purchasers of the buildings through the overall contractual construction costs, rather than being totally borne by the construction companies themselves.

⁵⁹ Characterisation of Mineral Wastes, Resources and Processing technologies – Integrated waste management for the production of construction material, WRT 177 / WR0115, Case Study: Flue gas desulphurisation (FGD) gypsum in plasterboard manufacture, Dr Andrew M Dunster BRE, http://www.smartwaste.co.uk/filelibrary/Plasterboard_FGD_gypsum.pdf

⁶⁰ All Party Parliamentary Group for the Wood Panel Industry, UK, <http://www.appgwoodpanelindustry.co.uk/>

⁶¹ United Kingdom Forest Products Association, UK Panel Products Sector Report, 10th Jan 2008, <http://www.ukfpa.co.uk/site/woodnews.html>

6 Relevant European Legislation and Policy

This section details the EU legislation that is relevant to wall panels, which is important for setting the framework in which standards and labels have been developed. Contracting authorities should also be aware of any additional local, regional or national legislation pertinent to their situation with respect to a particular product or service.

6.1 Construction Products Directive (CPD) 89/106/EEC

The Construction Products Directive (CPD) is aimed at creating a single market for construction products, through the use of CE Marking. It defines the Essential Requirements of construction works (buildings, civil engineering works) which indirectly determines the requirements for construction products (in function of the works design and the climatic and geological conditions in the place where the construction works are situated).

Construction products must declare their performance for mechanical strength and stability, fire safety, health and environment effects, safety of use, sound nuisance and energy economy if EU or national regulatory requirements exist. Under the Directive, the Commission may give a mandate to standardisation organisations such as CEN to develop standards in consultation with industry. A list of the adopted standards can be found on the European Commission's website.⁶² Where harmonised standards are not available, existing national standards apply. For more information please see Appendix 2.

There are a number of standards that relate to gypsum plasterboard. The key one is EN 13915:2007 which sets the definitions, requirements and test methods for prefabricated gypsum plasterboard panels with a cellular paperboard core, i.e. the standard plasterboard product. In addition, EN 14190:2005 sets the definitions, standards and test methods for gypsum plasterboard products from reprocessing; it is therefore a key standard concerning the recycling of gypsum.⁶³

The Harmonised European Standard for wood-based panels, EN 13986, provides the mechanism by which specific products can be shown to satisfy the requirements of the CPD. There are further aspects that relate to wood-based board, most are specific to the type of board under consideration.

One significant area in the CPD for wall panels is that concerned with the harmonisation of fire test standards, as part of the European Classification System (Euroclass). This includes a classification of building products based on their reaction to fire performance, and it defines the test methods to be used.

In addition this Directive introduced a key change to the way thermal conductivity of a building is measured and declared. This change makes each component of a building's envelope important in achieving an energy efficient building, and so has relevance for wall panels.⁶⁴

It should be noted also that Directive 93/68/EEC⁶⁵ amended the CPD 89/106/EEC on the approximation of laws, regulations and administrative provisions of the Member States relating to Construction Products.

The Commission has adopted a proposal to replace Council Directive 89/106/EEC by a Regulation (CPR) with the aim to better define the objectives of Community legislation and make its implementation easier.⁶⁶ It now includes a specific extra essential requirement related to the sustainable use of natural resources, stating that:

⁶² <http://ec.europa.eu/enterprise/newapproach/standardization/harmstds/reflist/construc.html>

⁶³ Cited in OJ C 319 (2005-12-14), CPD 89/106/EEC.

⁶⁴ TIMSA Brief: New European Legislation and lambda 90/90.

⁶⁵ OJ L 220, 30.8.1993, p. 1–22 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31993L0068:EN:HTML>

⁶⁶ http://ec.europa.eu/enterprise/construction/index_en.htm

"The construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and ensure the following:

- (a) Recyclability of the construction works, their materials and parts after demolition.
- (b) Durability of the construction works.
- (c) Use of environmentally compatible raw and secondary materials in the construction works."

6.1.1 CEN TC 350

Based on mandate 350 European technical standards are currently under development in CEN and will provide a methodology for the voluntary delivery of environmental information for construction products, in a similar way to an environmental product declaration (EPD). It will provide information to allow purchasers to compare the technical and environmental performance of products.

The European standardisation approach is based on a lifecycle assessment methodology covering production (mandatory), construction, use (including maintenance) and end of life stages (all optional). The standardisation work will also consider social and economic aspects of sustainability.

The following diagram demonstrates the various stages considered.

Product			Construction		Use					End of life			
Raw materials supply	Transport	Manufacturing	Transport	Construction/ installation	Use	Maintenance	Repair	Replacement	Refurbishment	Deconstruction/ demolition	Transport	Reuse/recycling	Disposal

Within these stages the following environmental indicators are being developed:

1. Life Cycle Impact Assessment (LCIA) emission indicators (output):
 - Climate change
 - Destruction of the stratospheric ozone layer
 - Acidification of land and water resources
 - Eutrophication
 - Formation of ground level ozone
2. Resource use indicators (input):
 - Use of non-renewable materials
 - Use of renewable materials
 - Use of secondary materials
 - Use of non-renewable primary energy
 - Use of renewable primary energy
 - Use of freshwater resources
3. Waste indicators
 - Construction and demolition waste to recycling
 - Construction and demolition waste to energy recovery
 - Non-hazardous waste to disposal
 - Hazardous waste to disposal
 - Radioactive waste to disposal

CEN TC 350 is working on a standardised voluntary approach across Europe for the delivery of environmental information on construction products, and to assess the environmental performance of building products and new and existing buildings. It will specify what information should be declared

on the labels of construction products, however, the declarations will not specify benchmarks or standards that products should aspire to, which will be done by other instruments like GPP. Until the CEN TC 350 work is complete the EU GPP criteria have been developed using the current evidence base available that is provided by the existing ecolabels.

The following timetable for CEN 350 has been provided by EURIMA:

WI	Standard	Title of standard	Comment
	prEN 15643-2	Sustainability of construction works- Framework for Environmental Performance	Enquiry September 2008
WI 350002	EN	Sustainability of construction works – Assessment of environmental performance of buildings – Calculation methods	Enquiry Nov 08
WI 350003	EN	Sustainability of construction works - Assessment of environmental performance of buildings - Use of the EPD	Enquiry June 09
WI 350004	prEN 15804	Sustainability of construction works - Assessment of environmental performance of buildings- Product category rules	Enquiry September 2008
WI 350005	EN	Sustainability of construction works – Environmental product declarations Communications format	Enquiry January 2009
WI 350006	TR	Sustainability of construction works – Environmental product declarations – Methodology and data for generic data	Vote January 2009

ISO standards exist for determining life cycle impacts. The interested reader is guided towards EN ISO 14040: 2006, EN ISO 14044: 2006, EN ISO 14025: 2005 and EN ISO 21930:2007 for further details.

6.1.2 CEN TC 351

Mandate 351 was established in 2005 under the framework of the Construction Products Directive (89/106/EEC - CPD with the title "Construction products: Assessment of release of dangerous substances". It deals with the emission of dangerous substances from construction products that may have harmful impacts on human health and the environment (Essential Requirements 3 (ER3) of the CPD). Horizontal standardised assessment methods for harmonised approaches relating to dangerous substances are developed under the CPD and relates to emissions to indoor air and release to soil, surface water and ground water. These horizontal assessment methods will be used in product specific harmonised European standards under the framework of the CPD. Technical reports for CEN 351 were due in April 2009.⁶⁷ By January 2010, despite a number of documents having been reviewed, no TC 351 documents were approved for enquiry/ formal vote.⁶⁸

6.2 The Energy Performance of Buildings Directive (EPBD) 2010/31/EU

This Directive⁶⁹ is a recast of Directive 2002/91/EC and is concerned with promoting energy efficiency in buildings across Europe using cost effective measures, whilst at the same time harmonising standards across Europe to those of the more ambitious Member States. The original Directive has been recast for the purposes of clarity in light of previous amendments and further substantive amendments to be made.

⁶⁷ <http://www2.nen.nl/cmsprod/groups/public/documents/bestand/249543.pdf>

⁶⁸ <http://www.normapme.com/docs/expertsmeeting/presentations/experts/>

⁶⁹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF>

It is widely recognised as important to tackle the construction sector as energy use in buildings, for space heating, cooling and lighting accounts for around 40 % of total energy use in Europe.

This Directive centres around four key strands:

- Providing a methodology framework for calculating the energy performance of buildings, taking into account local climatic conditions;
- Applying energy performance requirements to both new buildings and existing building stock;
- Providing a certification scheme for all buildings together with;
- Regular assessments of any heating and cooling equipment installed.

The recast Directive ensures that all new buildings must comply with high energy-performance standards as well as generating a significant proportion of their own energy through renewables after 2020. The intention is that the public sector will lead the way through using buildings with "nearly zero" energy standards two years earlier, from January 2019. However the definition of "nearly zero" was left vague, and this will allow member states to define their own standards.

Buildings with a useful floor area over 500m² that are occupied by public authorities and frequently visited by the public will be required to display the energy performance certificate in a prominent place, where one has been issued. The 500m² threshold will be lowered to 250m² on 9 July 2015.

The provision for existing buildings states that where major renovations are carried out these must increase energy-savings if doing so is "technically, functionally and economically feasible". In addition Member States will have to develop national plans that encourage owners to install smart meters, heat pumps and heating and cooling systems using renewables energy sources, as well as listing incentives from technical assistance and subsidies to low-interest loans by mid-2011 for the transition to near zero-energy buildings.

6.3 REACH Regulation EC 1907/2006

The REACH Regulation⁷⁰ came into force on 1 June 2007 and deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances. It provides an improved and streamlined legislative framework for chemicals in the EU, with the aim of improving protection of human health and the environment and enhancing competitiveness of the chemicals industry in Europe.

REACH places the responsibility for assessing and managing the risks posed by chemicals and providing safety information on to users in industry instead of public authorities, promotes competition across the internal market and encourages innovation.

Manufacturers are required to register the details of the properties of their chemical substances on a central database, which is run by the European Chemicals Agency in Helsinki. The Regulation also requires the most dangerous chemicals to be progressively replaced as suitable alternatives develop.

For substances in products, like plasterboards or wood panels, article 7 of the regulation applies.

6.4 The Classification, Packaging and Labelling of Dangerous Substances Directive 67/548/EEC

This Directive⁷¹ is concerned with chemical safety. It categorises substances that are considered to be dangerous under the following headings: explosives (E), oxidizing agents (O), flammable (F or F+), toxic (T or T+), harmful (Xn), corrosive (C), irritants (Xi), sensitisers, carcinogens (Carc.), mutagens (Mut.), dangerous to the environment (N), and toxic for reproduction (Repr.). Some of the binding agents used in wood panel will come under one or more of these headings.

⁷⁰ OJ L 396, 30.12.2006, p. 1–849 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:396:0001:0849:EN:PDF>

⁷¹ OJ 196, 16.08.1967 p.1 – 98 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31967L0548:EN:HTML>

A major update of the Directive in September 2008 added several hundred chemical compounds to the list of substances.

The requirements under this Directive will ultimately be replaced by the CLP Regulation (No.1272/2008).

6.5 The CLP Regulation (EC) No 1272/2008

The Regulation of 16 December 2008⁷² on classification, labelling and packaging of substances and mixtures entered into force on 20 January 2009 and will ultimately replace the current rules on classification, labelling and packaging of substances (Directive 67/548/EEC) and preparations (Directive 1999/45/EC). Substance classification and labelling must all be consistent with the new rules by 1 December 2010 and for mixtures 1 June 2015.

The Regulation aims to ensure a high level of protection of human health and the environment, as well as the free movement of chemical substances, mixtures and certain specific articles, whilst enhancing competitiveness and innovation. This should be achieved by ensuring that the same hazards will be described and labelled in the same way all around the world.

6.6 Management of Waste from Extractive Industries (MWEI) 2006/21/EC

Producers of natural gypsum must comply with the MWEI Directive, as they are engaged in mining and quarrying activities. This Directive was adopted in 2006, and Member States had to transpose the regulations into national law by 1 May 2008. The Directive provides for measures, procedures and guidance to prevent or reduce as far as possible any adverse effects on the environment, in particular water, air, soil, fauna and flora and landscape, and any resultant risks to human health, brought about as a result of the management of waste from the extractive industries.

Specific aspects of this Directive include managing calcium sulfate leachate and ensuring it is neither toxic nor eco-toxic, and that there is no formation of hydrogen sulfate gas in the mining waste.⁷³

6.7 Waste Framework Directive 2008/98/EC

The revised Waste Framework Directive⁷⁴ was signed on behalf of the European Parliament and the Council on 19 November 2008. The revised Directive replaces the existing Waste Framework Directive (2006/12/EC), the Hazardous Waste Directive and the Waste Oil Directive. These Directives will all be repealed in December 2010, once the requirements of the revised Waste Framework Directive have been transposed by Member States into national legislation.

The revised Waste Framework Directive sets the basic concepts and definitions related to waste management and lays down waste management principles such as the "polluter pays principle" and the "waste hierarchy". In relation to construction waste recycling targets of 70% are to be achieved by 2020:

"b) by 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material ... shall be increased to a minimum of 70% by weight"

It also provides clarification regarding the definition of waste and other concepts such as recycling and recovery.

⁷² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF>

⁷³ OJ L 102, 11.4.2006, p. 15–34 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:102:0015:0033:EN:PDF>

⁷⁴ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0003:EN:PDF>

6.8 Landfill Directive 1999/31/EC

This Directive aims to encourage waste minimisation and increased levels of recycling and recovery of waste and thus reduce the negative effects of landfilling on the environment.⁷⁵

In 2002, as part of the process to establish criteria and procedures for the acceptance of waste at landfills, the EU reclassified gypsum products as high sulfate, non-hazardous non-inert waste. Member States had to implement this by 2005. Gypsum products cannot be disposed of as standard waste, and must be disposed of thus:

“Non-hazardous Gypsum-based materials should be disposed of only in landfills for non-hazardous waste in cells where no biodegradable waste is accepted. The limit values for total organic carbon and dissolved organic carbon given in sections 2.3.1 and 2.3.2 shall apply to waste land-filled together with Gypsum-based materials.”

6.9 Directive on Packaging and Packaging Waste 94/62/EC and the Directive amending Directive 94/62/EC on packaging and packaging waste 2004/12/EC

The EC Packaging Directive⁷⁶ seeks to reduce the impact of packaging and packaging waste on the environment by introducing recovery and recycling targets for packaging waste, and by encouraging minimisation and reuse of packaging⁷⁷. A scheme of symbols, currently voluntary, has been prepared through Commission Decision 97/129/EC.⁷⁸ These can be used by manufacturers on their packaging so that different materials can be identified to assist end-of-life recycling.

The Packaging Directive (94/62/EC) was amended in 2004 by Directive 2004/12/EC⁷⁹. This amendment included a number of key revisions. These included further clarification regarding the definition of packaging, amendments to the provisions relating to prevention and revised targets for the recovery and recycling of packaging materials.

6.10 Emissions Trading Scheme (EU ETS) 2003/87/EC

The EU ETS is a scheme for greenhouse gas emission allowance trading within the Community (and including Norway, Lichtenstein and Iceland), in order to reduce of greenhouse gas emissions in a cost-effective and economically efficient manner. This Directive⁸⁰ was introduced in 2003 and the trading scheme commenced operation in 2005. The EU ETS applies to the Gypsum industry as specifically cited in Annex I, and to the wood based panel producers with facilities of 20MW or greater.

Current classification of the Gypsum Industry varies across Europe as it is not specifically named in the original Directive. For example, in the UK Gypsum Manufacturers are liable for the EU-ETS scheme as they operate combustion installations with a thermal input greater than 20MW, while Denmark decided to include the Gypsum industry from phase 1 of ETS, and Spain only included sites over 50MW. Other European countries may have chosen to interpret the Directive in a different way and the thermal installations may be exempt.⁸¹

The EU ETS is currently in its second period of trading which runs from January 2008 until December 2012.⁸² A revision of the EU ETS legislation has been agreed by Council and the European Parliament and will come into force from January 2013. Under this revision drying or calcination of gypsum and

⁷⁵ OJ L 182 , 16.07.1999 P.1–19 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:HTML>

⁷⁶ OJ L 365, 31.12.1994, p. 10–23 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:HTML>

⁷⁷ <http://www.defra.gov.uk/environment/waste/topics/packaging/index.htm>

⁷⁸ OJ L 050, 20.02.1997 P. 28 – 31, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31997D0129:EN:HTML>

⁷⁹ OJ L 47, 18.2.2004, p. 26–32, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:047:0026:0031:EN:PDF>

⁸⁰ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:en:PDF>

⁸¹ Comment from EU-ETS expert.

⁸² EU Emissions Trading Scheme, http://ec.europa.eu/environment/climat/emission/index_en.htm

production of plaster boards and other gypsum products across the EU will be included in the EU ETS from January 2013.

6.11 Directive on the indication by labelling and standard product information of the consumption of energy and other resources by energy related products 2010/30/EU

This Directive⁸³ is a recast of the original Energy Labelling Directive (92/75/EEC). The recast has been undertaken to clarify the Directive in light of the number of changes, and further changes that have been made to the original directive.

Directive 92/75/EEC was only applicable to household appliances. The recast Directive (2010/30/EU) aims to improve the overall environmental performance of products and to help consumers buy more eco-friendly products, through its application to ‘energy related products’, including construction products, that have a significant direct or indirect impact on the consumption of energy.

This extension of the scope to energy related products could reinforce potential synergies between existing legislation, and in particular Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy related products.

The recast Directive for the labelling of energy related products forms part of the broader legal framework to bring about energy savings and environmental gains.

6.12 Future Legislation

In 2008 a proposal for a Regulation of the European Parliament and of the Council laying down the obligations of operators who place timber products on the market (COM2008/0644 final-COD2008/0198)⁸⁴ was put forward. This has become known as the proposed EU Due Diligence Regulation.

To minimise the risks of placing illegally harvested timber and timber products on the market, the proposal outlined requirements for the due diligence system, which included the following:

- Measures to track timber and timber products
- Ensure information regarding compliance with applicable legislation is available
- Require operators to show prudence, judgement and positive action when considering the legality of timber entering their supply chains.

The Regulation is still in the process of being finalised and progress can be followed through the European Parliament website.⁸⁵

Once the EU “due diligence” regulation is in operation, wood placed on the EU market and which has thus been subject to a due diligence system will also be deemed to be legal, unless a specific challenge arises under which its bona fides are unproven. In the future this will be useful for the verification of green public procurement criteria relating to timber.

⁸³ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0001:0012:EN:PDF>

⁸⁴ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0644:FIN:EN:PDF>

⁸⁵ <http://www.europarl.europa.eu/oeil/file.jsp?id=5704232>

7 Existing Ecolabels and Standards for Wall Panels

7.1 Ecolabels

There are several voluntary Ecolabels in existence for wall panels, including the German Blue Angel, the Nordic Swan, and the Environmental Choice ecolabels in New Zealand, Canada and Australia as well as the Japanese EcoMark. The eco-label schemes developed outside Europe are based on legislative instruments which are not necessarily implemented in the European Union. The criteria developed also reflect different levels of market maturity than the European one. However where ecolabels developed in Europe are limited in terms of scope and criteria for a product group, the international ecolabels are useful to develop additional meaningful GPP requirements.

The different ecolabels have varying scope, some covering gypsum plasterboard specifically; others are more general and consider a range of wall panel materials. In all cases the ecolabel requirements are comprised of a list of simple requirements, each of which must be achieved before award of the eco-label can be given. The following sections summarise the key attributes of each label and its criteria. More detail is given in Appendix 1.

The key environmental impacts highlighted in these Type 1 Ecolabels, and the environmental limits for materials, have been used to generate the criteria detailed in the Wall Panel Product Sheet. The technical performance of the product has not been considered as it has been assumed that the product will perform to the relevant quality standards.

7.1.1 German Blue Angel Ecolabel

The German Blue Angel ecolabel (updated edition released in April 2008⁸⁶) is specifically for low-emission composite wood-based panels intended for indoor use. It covers chipboard, wood core plywood, fibreboards, MDF, veneer plywood boards and solid wood boards.⁸⁷ The products must meet the usual quality standards of serviceability, i.e. the corresponding DIN (German) or CEN (European) Standards.

The material criteria for this ecolabel include the specification that wood used shall not come from cold boreal forests and warm tropical rainforests, but will come from existing and lastingly cultivated forests. In terms of wood treatments, formaldehyde-containing glues should not exceed a concentration of 0.05 ppm of formaldehyde, composite wood panels containing PMDI-based binding agents must not emit any detectable monomer MDI and composite wood panels using phenol-containing glues must not exceed a phenol concentration of 14µg/m³. Neither wood preservatives (fungicides, insecticides, fire protection agents) nor halogenated organic compounds may be added to composite wood panels and their coatings.

Compliance is demonstrated through the applicant presenting the formulation for the production of the wood-based material and of the coating, naming the woods used and giving their origin. In addition applicants must present test certificates which demonstrate compliance with the chemical content specifications (e.g. formaldehyde content, PMDI content, phenol content).

7.1.2 Nordic Swan Ecolabel

The Nordic Swan Ecolabel for Wall Panels (valid from 19.03.2003 – 31.03.2010) encompasses all panels that are used in the building decorating and furniture industry. This includes both wood-based panels and gypsum-based panels, as well as panels designed to absorb sound.

⁸⁶ Low-emission wood products and wood based products, April 2008, Der Blaue Engel.

⁸⁷ Basic criteria for Award of the Environmental Label, Low-Emission Composite Wood Panels, RAL-UZ 76.

The material requirements specified in this ecolabel state that wood should not be sourced from forests that require protection, and that *either* at least 30% should be from certified forests *or* 50% of the fibre material to come from waste fibre e.g. saw dust, recycled fibres. At least 30% of the board's non-renewable material should be recycled or re-used material, e.g. FGD gypsum.

The chemical requirements are that fibres are not bleached with chlorine-containing bleach, that any surfactants used must be biodegradable⁸⁸ and that products classified as carcinogenic, mutagenic, toxic for reproduction, toxic or allergens must not be used. Furthermore, the formaldehyde content must not exceed 0.3% w/w. In addition to these requirements there are a number of other chemical products which may not be used at all, such as halogenated flame retardants and alkyl phenols, as well as other chemical treatments that are limited in the final products, for example aromatic solvents must not exceed 1% w/w and formaldehyde additives must not exceed 8mg / 100g of dry product.

During the production of the panel emission limits are set such that total discharge of oxygen demanding chemicals, COD, to waterways shall be less than 10g COD per kg of cardboard, and 20kg per kg of product. Emissions of carbon dioxide (CO₂) and sulphur dioxide (SO₂) into the atmosphere are limited to 0.55kg and 0.45g per kg of product. Dust emission shall not exceed 25mg dust per m³ of air. This ecolabel also contains a limit on the embodied energy within a panel calculated by adjusting and summing the electricity and fuel used. Panels consuming less than a predefined level of energy in their production are accepted as complying.

With respect to waste requirements, production waste must be reincorporated into the end product and manufactures must accept returns of their product if it consists of mainly non-renewable resources and/or the binding agents are inorganic compounds, at end of life to ensure material is reincorporated into new product. Finally instructions for storage, assembly and use must be provided to the customer.

7.1.3 New Zealand Environmental Choice Ecolabel

The New Zealand Specification (last reviewed in 2007, and due for review in 2012) exclusively covers gypsum plasterboard products. The product must comply with the relevant legislation and laws. In addition the products must comply with a specified list of material requirements that includes using 100% recycled wood, or 30% recycled wood and the remaining wood from a certified forestry scheme for the paper used in the product. Meanwhile the gypsum content must be at least 5% recycled gypsum board or 5% of waste gypsum board must be diverted by the manufacturing company, used for composting, as a soil amendment, or used in cement manufacture. Phosphogypsum (radioactive by-product from converting phosphate ore into fertilizer) may not be used.

A number of chemical treatments are not permitted, including the use of organic tin, halogenated organic chemicals and phthalates. In addition effective measures must be in place to control emissions to air and water from the manufacturing process, an energy management policy must be in place, as must a waste minimisation policy. The gypsum used must not be treated with anything that will prevent its recycling or composting in the future. At the point of sale appropriate information must be given to the customer on how to handle the product.

Verification of each of the requirements must be provided through a combination of safety certificates, laboratory testing, and guarantees provided by the manufacturer. If all the above conditions are met then the manufacturer may use the New Zealand Environmental Choice logo on his products.

7.1.4 Australia Environmental Choice Ecolabel

The Australian Ecolabel (valid from 26.10.2007 until 26.10.2010) has a broader scope than the above one for New Zealand as it covers all types of indoor boards. The criteria do not cover exterior siding or cladding, or materials with a structural function. The criteria are long and extensive as a wide range of materials are included, so below is only a brief summarisation – please refer to the appendix for more information, or to the original document for full details.⁸⁹

⁸⁸ In accordance with OECD-guideline for testing of chemicals, test method no. 301 A-F or 302 A-C.

⁸⁹ The Australian Ecolabel Programme, Panel Boards, GECA 04-2007.

The wall panel must be fit for purpose. This is verified by meeting the appropriate Australian label or through demonstrating sufficient quality by providing test case studies. The material requirements include proof of origin for wood or paper, either through a certification programme or through documentation of the supply chain. Alternatively reclaimed timber may be used, but again the origin must be recorded and approved. Gypsum may not be formulated or manufactured with phosphogypsum.

A detailed list of chemical treatments and constituents that are not permitted forms a core part of this ecolabel. Such materials include formaldehyde-containing glues, chlorine-containing bleach, aniline-based pigments, to name but a few. In addition there are limits placed on further treatments: wood preservatives must not contain more than 5% organic solvent, substances that carry one or more of R50, R51, R52, R53, R56 and R58 risk labels may not exceed 0.1 %. Further material criteria exist for the use of plastics, fabrics, glass, rubber and metals.

Other aspects of this ecolabel include various material requirements for recycled content including 10% of gypsum content must be recycled, and 20% of stainless steel must be recycled. Also no treatments may be used in the manufacture of the products that will prevent recycling of any wall panel awarded this label in the future. The manufacturer must have a waste policy in place to minimise waste generated, and must accept return of their product / have arrangements with a local recycler for further recycling of the product. The manufacturer must also provide written information for the product detailing its correct use, storage, maintenance and recycling.

7.1.5 Canadian Environmental Choice Ecolabel

Canada has a set of eco-label criteria specifically for gypsum wall boards (valid from March 2007 until 2010), as one of its Environmental Choice products.⁹⁰ The gypsum wallboards must meet or exceed all applicable government and industrial safety and performance standards, and ensure that the product has been manufactured and transported in such a manner that all steps of the process, including the disposal of waste products, will meet the requirements of all applicable governmental acts, by-laws and regulations for facilities located in Canada.

The material requirements are that gypsum boards must contain 10% post-consumer recycled material in the core of the finished product, or 20% post-industrial recycled material and 5% post-consumer recycled material in the core, or 50% by weight of post-industrial recycled material in the core. 100% recycled backing paper must be used. If the product is a fibre-reinforced board, the fibres must be derived from paper, paperboard stock, or wood.

On the product label it must be declared the type and percentage of recycled material contained in the finished product (i.e. post-consumer, post-industrial, or a combination of both). In addition detailed instructions concerning proper storage, handling and installation procedures must be provided.

Verification of these criteria being met is achieved through access to and inspection of quality control and production records and the right of access to production facilities on an announced basis.

7.1.6 Japan EcoMark Products

Japan has two sets of criteria for wall panels if they are to be awarded the Eco Mark. One covers wooden wall panels exclusively. The criteria for wooden wall panels⁴⁰ (valid from 19.10.2006 until 30.06.2009) states that the products must conform to appropriate quality standards as well as meeting a range of material requirements. Specifications include that 100% reused wood fibre be used (includes managed forest thinning). Chemical treatments such as adhesives and additives shall be declared, while wood preservatives shall not be used at all, neither shall heavy metals. Formaldehyde containing treatments shall conform to the appropriate emissions controls.

During manufacture the relevant laws covering emissions to air, water as well as odour and noise shall be conformed to. Efforts will be made to save energy during the manufacturing process. When the products are ready for transport to the final point of use the packaging used must give consideration to

⁹⁰ See <http://www.astm.org/Standards/C1278.htm> for more details.

resource saving and ease of recycling. Written information should be provided with the product to the end user regarding installation, use and disposal.

The second set of criteria that apply to wall panels cover 'Building Products Using Recycled Materials', and the intention is to encourage the incorporation of waste materials into new products (valid from 15.03.2006 until 31.05.2009).⁹¹ This set of criteria is applied to recycled materials that are used as 20% of the entire product. As such this document has a very broad scope, encompassing materials for roofs and floors, mats, insulation and sound absorption. With regard to wall boards, cement bonded wood-wool and flake boards, pulp cement boards, wood-wool cement boards laminated with flexible cement boards, fibre reinforced cement boards, rock wool sheathing boards and gypsum boards are covered.

The criteria state that all types of board should be recyclable or easily deconstructed for recycling at end of life. Any chemical preservative or treatment must not contain chromium, arsenic or pyrethroids, and any coating materials used must not contain aromatic chemicals, not toxic materials as pigments (such as lead or chromium).

7.1.7 International Standards

Many countries have building standards and specifications that are becoming increasingly focused on building sustainability, and specify wall materials and thermal standards for the building envelope.

Meanwhile, the global standardisation body ISO has set a new sustainability standard for the building construction sector, ISO 15392:2008 which covers the general principles to be followed for sustainable construction using 'cradle to grave' concepts.⁹²

A number of ISO standards have existed for gypsum plasterboard, but they are no longer used.

For panel boards the key ISO standards are:

- ISO 12460 Parts 1 – 3 Wood-based panels, Determination of formaldehyde release – through various test methods.
- ISOs 16978, 16979, 16981, 16987 Wood-based panels, various physical properties such as modulus of elasticity, moisture content, moisture content under various test conditions, surface soundness, dimension changes with relative humidity.
- ISO 9427:2003 Wood-based panels, Determination of density.
- ISO 9426:2003 Wood-based panels, Determination of dimensions of panels.

7.2 Examples of Best Practice

There are several countries in Europe that do not have an Ecolabel specifically for wall panels, but have recognised the problem of wall panel waste and have started schemes to address this waste stream. Such schemes are explored below.

France

In France local public authorities have set up waste collection sites at amenity centres across the country for the use of the general public, SMEs and craftsmen who bring their waste to these sites. France has 150 centres already receiving gypsum plasterboard, and the Institut Français de l'Environnement (IFEN) has estimated that 55% of gypsum plasterboard collected for recycling is from these centres.

The Netherlands

The Dutch plasterboard recycling scheme, encouraged by stringent recycling legislation, provides for on-site separate storage of gypsum (and three other products, paper, plastic and PUR-foam) in a designated

⁹¹ Japanese Ecolabel, Eco Mark Product Category No. 123, Building Products Using Recycled Materials.

⁹² International Organisation for Standardisation, Ref 1131, <http://www.iso.org/iso/pressrelease.htm?refid=Ref1131>

container.⁶ Once full, the contents are collected and removed from site, to be stored at a central point until sufficient has been accumulated for transportation to a recycling facility.

Denmark and Scandinavia

The Danish plasterboard recycling programme started in Autumn 2001 and uses containers for plasterboard scraps at local amenity sites, in addition to collections direct from construction sites.⁹³ More than 500 collection points, covering over 90% of the country's amenity sites, are serviced. The plasterboard waste is recycled before being sent to the production facilities of plasterboard manufacturers.

A similar scheme to that in the Netherlands exists in other parts of Scandinavia. These schemes are economically viable within a radius of 200km of the recycling plant. Beyond this distance the transport costs result in the scheme being more expensive than landfill.

Ireland

A very similar programme to the one in Denmark exists in Ireland, initiated in the Spring of 2005.⁹⁴ Most customers are from the greater Dublin area due to the location of the recycling collection sites, but the coverage of the system is expanding to other areas.

UK

The government sponsored WRAP Plasterboard Campaign (Waste and Resource Action Programme) was started in 2005, focusing on resource efficiency within the industry and minimising waste through reducing barriers that block a reduction in waste, and that block the recycling of plasterboard.⁹⁵

The trials to date have been run to segregate plasterboard waste on construction sites, generating good quality plasterboard recycle. Some of the trials predate the Plasterboard Campaign, and were initiated by the industry itself. This programme culminated in March 2007 with the Ashdown Agreement being signed by all three major plasterboard suppliers to the UK agreeing to targets:

- To reduce the amount of waste being sent to landfill from manufacturing operations in Great Britain to 10,000 tonnes/year by 2010.
- To increase the take back and recycling of plasterboard waste, for use in plasterboard manufacture, up to 50% of new construction waste arisings by 2010.

Work is underway to extend the agreement to other parts of the plasterboard supply chain, for example contractors and developers, and potentially to architects as well. In addition a publicly available specification, PAS 109-2008: specifications for the production of recycled gypsum from waste plasterboard, has been created which sets out how to produce acceptable recycle raw material.⁹⁶

In January 2010 the Quality Protocol 'Recycled Gypsum from Waste Plasterboard' was been released by WRAP and the Environment Agency.⁹⁷ This is a voluntary Protocol, which enables its users to recycle gypsum into products such as soil conditioners, fertilisers or new plasterboard from waste plasterboard in such a way that the producers will have certainty that what is produced will be regarded as having ceased to be waste and can be used without the need for waste management controls.

For wood based panels, WRAP commissioned the British Standards Institute (BSI) to develop a Publicly Available Specification (PAS) for recycled wood chip as a feedstock for panel board manufacture. The PAS will provide suppliers with advice on minimum quality requirements and guidance on good practice.⁹⁸

⁹³ WRAP, Plasterboard Case Study: International Practice in Plasterboard Recycling: Denmark, http://www.wrap.org.uk/downloads/Case_study_-_Plasterboard_recycling_in_Denmark.6fd51ecf.2982.pdf

⁹⁴ Gypsum Recycling Ireland Ltd, <http://www.gypsumrecyclingireland.com/>

⁹⁵ WRAP Plasterboard Programme, <http://www.wrap.org.uk/construction/plasterboard/>

⁹⁶ Comment from BRE Plasterboard expert.

⁹⁷ Recycled Gypsum from Waste Plasterboard, WRAP and EA, http://www.environment-agency.gov.uk/static/documents/100119PM_W524GypsumFINAL.pdf

⁹⁸ WRAP, Stakeholder Update Wood, <http://www.wrap.org.uk/downloads/Wood0504i.3b7d9d1b.568.pdf>, http://www.wrap.org.uk/wrap_corporate/news/new_1.html

Germany

Gypsum plasterboard and fibreboard manufacturers in Germany have entered into an agreement with *die Gesellschaft für die Aufbereitung und Verwertung von Reststoffen mbH* (GFR – The Association for the Processing and Recovery of Waste Materials, Ltd) to run a pilot plant that recycles gypsum construction and demolition waste without any input of plasterboard production waste.⁷ The plant is a mobile unit operating from two collection centres, one in the north and the other in the west of Germany.

8 Conclusion & Summary

Wall panels are a key component of Modern Methods of Construction.⁹⁹ There are two distinct product groups within the internal wall panel market – gypsum plasterboard and wood-based panels. While these two product areas overlap in potential use application, each offer different properties, and as such the purchaser, depending on the intended situation of use, must make the choice between them.

The product group itself is an artificial one, even though the products have similar end uses. In most reference sources (trade associations, ecolabels, etc.) gypsum products are dealt with as one product group and wood-based boards are dealt with as a separate group. The disadvantage of this arrangement is that there is then no one system available to guide the purchasing of wall panel materials in general. This has therefore been addressed by developing criteria for both wall product types to cover the possibility of either being specified by a procurement official or indeed being offered by a potential contractor.

The main environmental impact from wall panels comes from their manufacture and disposal; this is the case whether they are gypsum or wood based. The only significant impact from the use phase is the potential release of the glues and binding compounds into the internal atmosphere of a building. Therefore the opportunities to reduce the environmental impact from these products rest with the following:

- Manufacturers in the design and subsequent production phases
- The purchasers, architects and construction companies during the construction and installation phase in specifying the right type and size of panel
- The demolition or retro-fitting companies at the product's end-of-life
- Legislators who can encourage and force change of behaviour and process.

It should be noted that the actual users of the buildings where the products are in place often have no influence over the product selection.

The wide range of ecolabels available and initiatives started reflect the scale of use of these products and the environmental impact associated with such scale. As the products are relatively standard throughout the world, it should be relatively straightforward to adapt European and international Ecolabels for GPP.

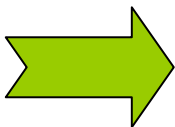
The core and comprehensive criteria proposed here (which are criteria that are proposed to be met by all products offered for purchase) therefore focus on the manufacturing stages and the waste generating phases as these are the areas where environmental gains can be made. Other criteria have been developed to take into account indoor air quality and the off-gassing of binding agents. The criteria have been based on the various approaches adopted by the Ecolabels described earlier as well as discussions with industry.

In addition, award criteria are proposed where appropriate. These are additional criteria on which the contracting authority will base its award decision. Award criteria are not pass/fail criteria, meaning that offers of products that don't comply with the criteria may still be withheld for the final decision, depending on their score on the other award criteria, including the price. To stimulate further market uptake of ever improved environmental products, award criteria should be considered depending on the specific circumstances of each case.

⁹⁹ Modern Methods of Construction (MMC) is a term used to describe a range of technologies and processes that are regarded as a means of improving quality while keeping costs down in the building industry. Here this term refers to the use of wall panels which allows very simple methods of construction to be used with timber frames, stud-work and the wall panels.

9 Proposal for Core and Comprehensive Criteria

It is proposed to set core and comprehensive criteria for Wall Panels. The proposed GPP criteria are designed to reflect the key environmental impacts. This approach is summarised in the following table:

Key Environmental Impacts	GPP Approach
<ul style="list-style-type: none"> • Impact of the materials used to create the wall panels – extraction, resource consumption, land take. • Impact of materials and substances used in production and subsequently released in use. • Impact of the energy used at the various stages of manufacturing the wall panels. • Impact of waste, as the wall panels and their waste off-cuts are disposed of at end of life waste. 	 <ul style="list-style-type: none"> • Promote good site management of materials (avoid damage to and waste of materials). • Encourage the purchase of gypsum wall panels using synthetic gypsum and recycled gypsum. • Reduce the use of certain chemical compounds. • Promote the use of environmentally sound materials. • Minimise the use of energy in manufacturing where possible. • Encourage the purchase of wood based boards that use sustainable wood materials. • Promote recycling schemes for construction and demolition waste.

Please note that the order of impacts does not necessarily translate to the order of their importance.

As outlined in Section 7, there is a range of Ecolabels created for wall panels, each of which cover a different range of products, and have varying criteria. This makes selection of a single, ideal one difficult.

It is proposed that, as the document clearly distinguishes between gypsum based wall panels and wood-based wall panels, the same distinction should apply for the core and comprehensive criteria.

The criteria for gypsum wall panels are based on the requirements of both the New Zealand and Nordic Swan Ecolabels. Certain aspects of good practice from the UK Ashdown Agreement have also been incorporated into the criteria. The criteria for wood based panels are based on the German Blue Angel and Nordic Swan Ecolabels.

Full details of the proposed purchasing criteria are provided in the associated Product Sheet for this product group.

10 Relevant EU Legislation and Information sources

10.1 EU Legislation

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products.
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31989L0106:EN:HTML>
- Council Directive 93/68/EEC amending many Directives including 89/106/EEC (construction products)
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31993L0068:EN:HTML>
- Council Landfill Directive 1999/31/EC encourages waste minimisation, recycling and recovery of waste.
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:HTML>
- Council Directive 2003/87/EC establishing the ETS for Green House gas emission allowance trading.
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:en:PDF>
http://ec.europa.eu/environment/climat/emission/pdf/ets_revision_proposal.pdf
- REACH Regulation 1907/2006 ensuring the Registration, Evaluation, Authorisation and Restriction of Chemical substances.
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:396:0001:0849:EN:PDF>
- Management of Waste from Extractive Industries (MWEI) 2006/21/EC
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:102:0015:0033:EN:PDF>
- The Classification, Packaging and Labelling of Dangerous Substances Directive 67/548/EEC
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31967L0548:EN:HTML>
- The CLP Regulation (EC) No 1272/2008. The Regulation of 16 December 2008 on classification, labelling and packaging of substances and mixtures
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF>
- Council Directive 94/62/EC to reduce packaging and packaging waste.
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994L0062:EN:HTML>
- Commission Decision (97/129/EC) of 28 January 1997 establishing the identification system for packaging materials pursuant to European Parliament and Council Directive 94/62/EC on packaging and waste packaging
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31997D0129:EN:HTML>
- Directive amending Directive 94/62/EC on packaging and packaging waste 2004/12/EC
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:047:0026:0031:EN:PDF>
- Waste Framework Directive 2008/98/EC
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF>
- Directive on the indication by labelling and standard product information of the consumption of energy and other resources by energy related products 2010/30/EU
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0001:0012:EN:PDF>
- Energy Performance of Buildings Directive (EPBD) 2010/31/EU

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF>

10.2 Ecolabels and Standards

- The New Zealand Ecolabelling Trust
<http://www.enviro-choice.org.nz/specifications/EC-19-07GypsumPlasterboardProducts.pdf>
- Good Environmental Choice Australia
<http://www.aela.org.au/ProductsRegister.htm>
- Japan Ecomark, Product Category No. 123 and 111.
www.ecomark.jp/english
- Environmental Choice Canada
Certification Criteria Document CCD-020, Gypsum Wallboard
- WRAP Plasterboard Programme
<http://www.wrap.org.uk/construction/plasterboard/index.html>
- German Blue Angel
http://www.blauer-engel.de/en/blauer_engel/index.php
- Nordic Swan
Panels for the building, decorating and furniture industry, Version 4.3, 19 March 2003 – 31 March 2010.
<http://www.svanen.nu/>
- International Organisation for Standardisation
Ref 1131 <http://www.iso.org/>
- European Committee for Standardisation
www.cen.eu/cenorm/homepage.htm

10.3 Studies and Other Sources of Information

- European Commission, Environment, Green Public Procurement
www.ec.europa.eu/environment/gpp
- DEFRA, British Government Department for Food and Rural Affairs
www.defra.gov.uk/environment/consumerprod/products/plasterboard.htm
- MTP Programme, BNPB1, 2 and 3
www.mtprog.com/
- Modern Built Environment KTN
www.bre.co.uk/page.jsp?id=873
- Waste Online
www.wasteonline.org.uk/resources/InformationSheets/Glass.htm
- Green Consumer Guide
www.greenconsumerguide.com/commercialll.php?CLASSIFICATION=25&PARENT=19
- EPF, European Panel Federation

www.europanel.org

- CEPMC, Council of European Producers of Materials for Construction
www.cepmc.org
- FEROPA, European Federation of Fibreboard Manufacturers
www.feropa.org
- Eurogypsum
www.eurogypsum.org
- Caractéristiques Environnementales et Sanitaires, suivant la norme XP P01-010, Cloison de distribution 98/48, January 2003, Syndicat National des Industries du Plâtre.
- GPDA, Gypsum Products Development Association
www.gdpa.com
- ENBRI, European Network for Building Research Institutes
www.enbri.org
- Cei-Bois, European Confederation of Wood-working Industries
www.cei-bois.org/
- Federation of Plastering and Drywall Contractors
www.fpdc.org
Diverting plasterboard waste from landfill in the UK, Oakdene Hollins, 2006
- Information on the use of renewable raw materials, e.g. bio-based products
http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/biobased-products/index_en.htm,
- http://www.nfcc.co.uk/metadot/index.pl?id=7866;isa=DBRow;op=show;dbview_id=2457
- http://www.nfcc.co.uk/metadot/index.pl?id=9162;isa=DBRow;op=show;dbview_id=2457
- http://www.nfcc.co.uk/metadot/index.pl?id=5970;isa=DBRow;op=show;dbview_id=2457
- http://www.nfcc.co.uk/metadot/index.pl?id=5971;isa=DBRow;op=show;dbview_id=2457
- Accelerating the Development of the Market for Bio-based Products in Europe, A Lead Market Initiative for Europe, 2007,
http://209.85.229.132/search?q=cache:AjjcNAXuS_QJ:ec.europa.eu/enterprise/policies/innovation/files/lead-market-initiative/bio_based_products_taksforce_report_en.pdf+JRC,+biobased+building+materials&cd=1&hl=en&ct=clnk

Appendices

Appendix 1 - Abridged and Summarised Ecolabel Details

Appendix 2 – Additional Technical Information

Appendix 1: Abridged and Summarised

Ecolabel Details

- A1.1 German Blue Angel Criteria
- A1.2 Nordic Swan Criteria
- A1.3 New Zealand Environmental Choice Ecolabel
- A1.4 Australia Environmental Choice Ecolabel
- A1.5 Canadian Environmental Choice Criteria
- A1.6 Japan EcoMark Criteria

A1.1 German Blue Angel Criteria

The criteria they must meet before the ecolabel can be used include:

1. Wood panels including formaldehyde-containing binding agents shall not exceed a compensation concentration of 0.05 ppm of formaldehyde in the test room. This includes coated boards, pre-coating.
2. Composite wood panels containing PMDI-based binding agents must not emit any detectable monomer MDI.
3. Composite wood panels including phenol-containing binding agents must not exceed a phenol concentration of 14µg/m³ in the test room.
4. Neither wood preservatives (fungicides, insecticides, fire protection agents) nor halogenated organic compounds may be added to composite wood panels and their coatings.
5. Wood used for the preparation of plywood and solid wood boards shall not come from cold boreal forests and warm tropical rainforests. It has to come from existing and lastingly cultivated forests.
6. Serviceability: The product shall meet the usual quality standards of serviceability. For this purpose, the corresponding DIN or CEN Standards shall be observed.
7. Advertising:
 - a. Advertising messages must not include any statements, such as “tested for biological living conditions”, or others belittling the risks in terms of Article 23, para. 4, Directive 67/548/EEC (such as, for example, “non-toxic” or “not detrimental to health”).
 - b. Product names including words like “bio”, “eco”, “nature” or the like shall not be admissible.
 - c. Chipboards must meet the indoor air requirements of RAL-UZ 38.

Compliance with the above criteria is demonstrated through the applicant presenting the recipe for the production of the wood-based material and of the coating, naming the woods used and giving their origin. Applicants shall also present test certificates which demonstrate compliance with the chemical content specifications (e.g. formaldehyde content, PMDI content, phenol content).

A1.2 Nordic Swan Criteria

Material Requirements

1. Wood should not be sourced from forest environments that need protection for biological and/or social reasons.
2. Wood must not be treated with type 1A or 1B pesticides when cut (WHO classification).
3. Wood content in the panel shall be:
 - a. At least 30% of constituent wood must be based on wood certified by a neutral third party on the basis of a valid forestry standard, or
 - b. At least 50% of the fibre material must be from sawdust/wood chips and/or waste wood from sawmills and/or recycled fibre.
4. The recycled (or reused) material content must be at least 30%.

5. Heavy metal content is limited to:
arsenic 20 mg/kg, lead 50mg/kg, cadmium 1mg/kg, mercury 1mg/kg, chromium 500mg/kg.
6. Fibre must not be bleached with any compounds containing chlorine.
7. Total discharge of COD shall be less than 10g COD/kg produced cardboard.
8. Surfactants used in de-inking reclaimed fibre or upgrading new fibrous pulp must be biodegradable.¹⁰⁰

Chemical Requirements

9. Chemical products classified as carcinogenic (R45, R49, R40), mutagenic (R46, R68), toxic for reproduction (R60, R61, R62, R63), toxic (R23-R28) or allergens when inhaled (R42)¹⁰¹ must not be used.
The content of free formaldehyde may be up to 0.3% w/w. The content of free formaldehyde in glues for plywood panels or laminated wood panels may be up to 0.5% w/w.
10. Halogenated organic binding agents, halogenated organic flame retardants, polychlorinated biphenyls, alkyl phenols, phthalates, aziridine or polyaziridines as well as pigments and additives based on lead, tin, cadmium, chromiumIV and mercury or their compounds must not be added to the chemical product.
11. The content of alkyl phenol etoxylates or other alkylphenol derivatives in the chemical product must not exceed 0.6% w/w.
12. The content of aromatic solvents must not exceed 1% w/w.
13. The total amount of compounds classified as environmentally harmful¹⁰² must be less than 0.5g/kg panel.
14. Solvents used for cleaning production equipment must not contain halogenated hydrocarbons, alkyl phenol etoxylates or less than 1% by weight of aromatic compounds.
15. Halogenated plastics must not be used in surface treatment.
16. Declare the substances in surface treatment
 - a. Chemical products for surface treatment must not be classified as environmentally harmful (R50, R50/R53, R51/53, R52, R52/R53 or R53) OR
 - b. Surface treatments or organic solvent must not exceed 12g per m², or 5g per m² of environmentally harmful substances.

Radioactive Materials

17. Where panels contain potentially radioactive material (e.g. from slag products, ash from coal fires) it must be demonstrated that the activity index (I1) is less than 1.

Manufacturing Requirements

18. The energy content of each panel produced must not exceed a set value, and this will encompass all electricity and fuel consumed during manufacture.

Emission Requirements

19. Emissions to air during manufacture and material processing (not extraction) shall not exceed 0.55 kg of CO₂ per kg of panel, or 0.45g of SO₂ per kg of panel.
20. Discharge to water in the case of wet processes, COD discharges shall not exceed 20 kg COD per kg of product (unfiltered sample).
21. Dust emission into the atmosphere shall not exceed 25 mg dust/m³ of air during production and refining of non-renewable materials.

Waste Requirements

22. Production waste (off cuts, trim waste, etc.) must be reutilised (reincorporated into the product, used for energy production, etc.)
23. Manufacturers must accept returns of their product, if it consists mainly of non-renewable resources and/or the binding agents are inorganic compounds, at end of life to reincorporate material into new product.

Packaging Requirements

24. Chlorine based plastics must not be used as packaging.

¹⁰⁰ In accordance with OECD-guideline for testing of chemicals, test method no. 301 A-F or 302 A-C.

¹⁰¹ In accordance with regulations of classification and labelling of hazardous chemicals in any Nordic country and/or EU's classification system 1999/45/EC (with amendments and corrections).

¹⁰² Classified by the chemical manufacturer/supplier in accordance with current regulations in Denmark, Finland, Iceland, Norway or Sweden or pursuant to the EU classification system (18th Amendment to Directive 67/548/EEC)

Information Requirements

Instructions for storage, assembly and use shall be provided to the customer.

A1.3 New Zealand Environmental Choice Ecolabel

Material Requirements:

1. Paper must be either from:

- a 100% recycled wood, or
- b a maximum of 30% by weight of the paper may be from plantations licensed under the Forest Stewardship Council or equivalent schemes and the licensee must ensure that raw materials do not come from forest environments that are protected for biological and/or social reasons. The remaining 70% must come from recycled wood.

Verification is confirmed through the provision of documentation covering the supplier, geographical source, proof of recycled input, proof of forestry management. Schemes including the FSC, PEFC, CSA certifications are taken as confirmation of these criteria.

2. The gypsum content must be

- a at least 5% (by weight) recycled gypsum board, or
- b 5% of waste gypsum board (based on annual average) must be diverted to a composting facility or be used in cement manufacture or equivalent approved diversion method.
- c The manufacturer must demonstrate plans to increase this percentage over time, as the specification requirement will be reviewed in the future and this percentage requirement is likely to increase.
- d Gypsum plasterboard shall not be formulated or manufactured with:
 - i) phosphogypsum
 - ii) any substances listed by the current International Agency for Research on Cancer (IARC) in Groups 1, 2A and 2B.
 - iii) formaldehyde or have the potential to release formaldehyde during use.

Verification is provided through quality control, independent laboratory testing, material safety data sheets and production documentation being supplied, along with relevant contracts and figures from composting or cement organizations if these disposal routes are pursued.

3. Agents and additives for surface treatment shall not be formulated or manufactured with organic tin compounds; halogenated organic binding agents; halogenated organic flame retardant; halogenated organic or aromatic solvents; or phthalates with alkyl groups such as methyl, ethyl, propyl, butyl or octyl; pigments or additives based on lead, cadmium, chromium, mercury and their compounds.

Verification is confirmed when relevant quality control and production documentation has been provided.

Manufacturing Requirements

4. Effective measures must exist to control emissions to air from the manufacturing process, especially dust and sulphur dioxide and to control water discharges including suspended solids and COD. CFC/halons must not be used in the production of the gypsum plasterboard or the raw materials and the solvents used to clean the production equipment must not contain halogenated hydrocarbons.

Relevant quality control and production documentation must be provided for verification.

Energy Management and GHG emissions

5. The producer of gypsum plasterboard must have effective energy management policies and procedures and/or an energy management programme and must demonstrate initiatives being developed to measure, report on and mitigate overall GHG emissions.

Conformance with this requirement shall be confirmed by relevant quality control and production documentation, based for example, on the 10 key principles as outlined in EECA's Energywise Companies Campaign Charter of Key Principles.

Waste Minimisation

6. The producer of gypsum plasterboard must have effective policies and procedures to minimise waste.

This will be confirmed through the relevant quality control and production documentation being provided and should include formal objectives, targets and a monitoring and reporting system.

Recyclability

7. Gypsum plasterboard must not be impregnated, labelled, coated or otherwise treated in a manner which would prevent recycling and / or composting in New Zealand or in the country where the product is used. In addition information on paint types that will not hinder the recycling or diversion of gypsum plasterboard must be available to purchasers.
Relevant test certificates and information sheets shall be supplied for review.

Product Information

8. Appropriate and acceptable information describing the handling, installation procedures, surface treatment applications, recycling and/or disposal methods shall be provided with the product or on the packaging or labels.
Conformance with these requirements shall be demonstrated by providing examples of labels, packaging and point of sale information.

For all the above criteria, in addition to the documentation specified above, the applicant company must confirm the requirements are met in writing and the Chief Executive Officer or authorised representative must sign the declaration.

A1.4 Australia Environmental Choice Ecolabel

Environmental Performance

1. The certified product should be fit for purpose, either meeting the appropriate Australian label, or demonstrating sufficient quality by providing testing reports/case studies.

Material Requirements

2. Fibre Sources
 - a The geographical origin of fibre material must be documented, allowing confirmation of origin throughout the supply chain as with FSC or AFS 2007 certified fibres.
 - b Sources that are not certified as sustainable shall not originate from illegal harvesting (in breach of national regulations), genetically modified organisms (see EU Directive 2001/18/EC), or from uncertified high conservation value habitat communities (communities containing significant concentrations of biodiversity values).
3. Salvaged and Reclaimed Timbers
Such fibres may be used, and include timbers legally sourced as pre-cut waste timber, deadwood from cityscape, urban and rural gardens, demolition sites, and waste wood from certified tree surgeons. This wood must be certified by the Good Environmental Choice Label or satisfy the requirements of GECA Standard No. 32 - Recycled and Reclaimed Timber.
4. Treatment of Timbers
 - a Materials used in boards must not be treated or impregnated with fungicides and insecticides that are classified by the IARC as type 1 or 2a.
 - b Wood preservatives must not contain more than 5% organic solvents by weight, and creosote must not be used.
 - c Panel boards that are intended to be used outdoors must not contain more than 0.1% by weight of any substance carrying R50, R51, R52, R53, R56 and R58 risk labels. It is acceptable that recycled fibre may have been treated with such substances during their previous lifecycles.
 - d Glues in plywood must be free of formaldehyde, and for other engineered wood products (particle board, MDF, decorative overlaid wood panels) must not exceed 1.0%w/w.
5. Paper Processing
Paper must not be bleached with any compounds containing or giving rise to elemental chlorine during the manufacturing process. Where surfactants are used these must be readily biodegradable in accordance with OECD guidelines.
6. Plastics
 - a Each plastic component weighing over 100g must be marked with an appropriate resin identification code from PACIA.

- b Additives: CFC, HCFC, HFC Methylene chloride or any other halogenated organic solvents shall not be used in the production of any plastic foam. It is accepted that recycled content may have been treated or produced with the above substances during their previous lifecycle.
 - c Aniline based amines, and pigments, catalysts or stabilisers containing mercury, lead, cadmium, tin or chromium must not be added to any plastic component.
 - d If 1,3 butadiene is used in latex, rubber or foams its concentration shall be less than 1 mg / kg.
 - e The total discharges to waste water (measured as COD or TOC) from the production of foam rubber shall be treated and decreased by 90% in on-site or external sewage treatment works prior to emissions into waterways.
7. Fabrics
All fabric must be certified by, or satisfy the requirements of, the Good Environmental Choice Label or carry another ISO 14 024 based ecolabel acceptable to GECA.
8. Glass
Lead glazing, crystal glass, mirror glass, wire reinforced glass or laminated glass must not be used in panel boards. Colouring agents or other additives containing lead, cadmium, mercury, chromium, arsenic or selenium must not be used.
9. Rubber
All rubber used in certified panel boards shall satisfy the materials requirements of GECA Standard 03 – Recycled Rubber Products.
10. Metals and Alloys
- a Coatings applied to metals or alloys must not contain cadmium, nickel, tin or chromium. In exceptional cases, surfaces may be treated with chromium or nickel where this is necessary on the grounds of heavy physical wear or in the case of parts that require particularly tight connections. This exemption will not be granted to parts that are intended to come into frequent contact with skin.
 - b Coatings applied to metals or alloys must not prevent recycling at the end of the normal life of the product (see Section 3.2.9) Metal fittings such as screws and bolts are exempt from this requirement where the coating serves to protect the product from staining due to corrosion. Coatings on any metal part must conform to the applicable Australian or international standard, if such a standard exists.
11. Gypsum
Gypsum plasterboard shall not be formulated or manufactured with phosphogypsum.
12. Adhesives
With the exception of the glues used for plywood and other engineered wood products, which have been discussed above, adhesives or other treatments used in the manufacture of certified products or packaging must be certified by, or satisfy the requirements of, the Good Environmental Choice Label or carry another ISO 14 024 based ecolabel acceptable to GECA.
13. Coatings and Treatments
- a No product or component may be impregnated, labelled, coated or otherwise treated in a manner which would prevent post consumer recycling. Exemptions may be made for products with a long product life where a coating or treatment would further extend the useful life of the product.
 - b Paints and waterproofing treatments used in or on certified panel boards must be certified by, or satisfy the requirements of, the Good Environmental Choice Label or carry another ISO 14 024 based ecolabel acceptable to GECA.
14. Hazardous Materials
No arsenic, cadmium, chromium, copper, lead, tin, mercury or antimony, elemental fluorine or chlorine, pentachlorophenol (PCP) or tar oils (benzo (α)pyrene) shall be used during manufacture. Mercury, arsenic, chromium or cadmium contaminant concentration shall be less than 1 mg/kg. Lead contaminant concentration shall be less than 10 mg/kg.
15. Prohibited Substances
No halogenated organic solvents or binding agents, fluoropolymer additives, aniline based amine, phthalates (DEHP, DBP, DAP, BBP, DMP, DMT, DEP, DMEP and DIBP, aziridine or polyaziridines, pigments and additives that contain lead, tin, arsenic, cadmium, mercury or their compounds, polybrominated diphenyl ethers, or short-chain (≤ 13 C) chlorinated organic flame retardants nor their functional derivatives or in-situ precursors shall be added to panel boards or be used at any stage of the manufacturing process.
16. Possible Radioactive Sources
Where panel boards are to be used indoors, and contain greater than 75% by mass of granites, pegmatites or gypsum, slag, clinker, or other waste from smelting, or ash from coal or peat

radioactive safety may be demonstrated either through direct physical measurement or chemical composition. The finished product must not contain more than U 8 mg / kg, Th 15 mg / kg and K 5% by mass.

17. Recycled Content Requirements

- a Aluminium: all aluminium products or parts shall contain at least 35% recycled content.
- b Stainless Steel: Stainless steel comprising greater than 5% of the total weight of the product shall contain at least 20% recycled content. Stainless steel panels must carry a minimum warranty of 40 years.
- c Plastics: Plastics comprising greater than 10% of the weight of the product shall contain at least 50% by weight recycled content, or at least 50% by weight polymers based on non-petrochemical derived polyols.
- d Gypsum and Other Minerals: gypsum or other mineral panels greater than 5% of the weight of the product must contain a minimum of 10% recycled content.

Waste Minimisation

18. The manufacturer must have effective policies and procedures to minimise waste, including measures to recycle waste materials from the production process.

19. Post Consumption Recycling and Labelling

The manufacturer shall accept the return of their product without additional cost (excluding transportation costs) for further recycling, or have arrangements with a local recycler to accept the product, or have an established product stewardship program that will divert the majority of recovered material from landfill.

20. Packaging Requirements

Chlorinated or halogenated plastics must not be used in product packaging.
Used packaging shall be able to be recycled by local recycling systems.

Product Information

21. The manufacturer must provide written information to the user clearly stating:

- a The intended use of the product.
- b Instructions for correct storage, installation and use so as to maximise the product lifetime.
- c Maintenance instructions, if required. Maintenance instructions must not specify nor require the use of any chemical or coating limited by any part of this standard.
- d Recycling instructions for the product end-of-life.

A1.5 Canadian Environmental Choice Criteria

Gypsum boards must:

Comply with the requirements of CAN/CSA-A82.27 *Gypsum Board Products*, and fibre-reinforced gypsum boards must comply with ASTM C1278 *Standard Specification for Fibre-Reinforced Gypsum Panels*,¹⁰³ verified by a signed statement of the Chief Executive Officer of the manufacturer.

1. Contain, when calculated on a three-month rolling average, meet one of the following:
 - a. a minimum of 10% by weight of post-consumer recycled material in the core of the finished product; or
 - b. a minimum of 20% by weight of post-industrial recycled material and 5% postconsumer recycled material by weight in the core; or
 - c. a minimum of 50% by weight of post-industrial recycled material in the core;
2. Declare, on the product label, the type and percentage of recycled material contained in the finished product (i.e. post-consumer, post-industrial, or a combination of both)
3. Provide detailed instructions concerning proper storage, handling and installation procedures;
4. Use 100% recycled paper for the backing material in the wallboard; and
5. If denominated as fiber-reinforced gypsum board, be manufactured using fibers that have been derived from paper, paperboard stock, wood and/or other organic material

Verification is achieved through access to and inspection of quality control and production records and the right of access to production facilities on an announced basis.

¹⁰³ See <http://www.astm.org/Standards/C1278.htm> for more details.

A1.6 Japan EcoMark Criteria

Board Made of Wood or the Like 2.1

Environmental Criteria

1. 100% reused/unused wood fibre shall be used (e.g. wood from thinning managed forests, waste wood from processing plants, waste packaging, wooden waste from the construction industry).
2. For products with a decorative surface, this shall be less than 5% by weight. It will not contain halogens or organic halogenides, and component ingredients shall be reported.
3. Name and amount of adhesives and additives shall be declared.
4. Wood preservatives, including termiticides, preservatives, pesticides and fungicides, shall not be used. This includes reused wood (if impregnated with the above chemical treatments for its previous role, such wood may not be incorporated into boards awarded this criteria).
5. Emissions of formaldehyde shall be of F**** grade. (See JIS A 5905 or JIS A 5908 for method and limits permitted.)
6. Toluene and xylene shall not be added.
7. Coatings used shall conform to criteria for heavy metals (See 4-1, Environmental Criteria of Eco Mark Product Category No. 126 Paints, Version 1.0.)
8. The production process shall conform to relevant environmental regulations and agreements on preventing air, water, noise, odour and emission pollution.
9. Energy saving efforts shall be made in the manufacturing process.
10. The packaging of the product shall give consideration to resource saving and ease of recycling. Plastics used for packaging shall not contain halogens or organic halogenides.

Quality Criteria

11. These products shall conform to the appropriate quality standards.
12. Manuals incorporating information covering installation, use and disposal shall be provided with the products.

Building Products Using Recycled Materials

1. It is specified that boards should be recyclable at end of life, or made such that they are deconstructable, allowing easy separation.
2. Termiticides, preservatives, mildewcides and insect repellents used within the products shall not contain chromium, arsenic or pyrethroids.
3. Coating materials shall not use aromatic compounds as solvents, nor use lead, cadmium, chromium or other toxic materials as pigments.

Appendix 2: Additional Technical Information

The CEN Technical Committee (TC) in charge of the draft of Gypsum products is CEN/TC 241. The scope of this TC is:

Prepare European standards for Gypsum plasters, Gypsum units, Gypsum based and ancillary products as well as for design and application of the products: definitions; performance; requirements; specifications; test methods.

Set up in 1995, TC 241 has already adopted and published the following standards:

EN 520 Gypsum plasterboards – Definitions, requirements and test methods
EN13279-1 Gypsum binders and gypsum plasters. Definitions and requirements
EN 13914-2 Design and principles of internal plastering
EN 13915 Prefabricated gypsum plasterboard panels with a cellular paperboard core – Definitions, requirements and test methods
EN 13950 Gypsum plasterboard composite panels
EN 13963 Jointing materials for Gypsum plasterboards – Definitions, requirements and test methods
EN 14195 Metal framing compatible for use with Gypsum boards – Definitions, requirements and test methods
EN 14209 Preformed plasterboard cornices – Definitions, requirements and test methods
EN 14190 Gypsum plasterboard products from reprocessing – Definitions, requirements and test methods
EN 14496 Gypsum based adhesives for composite and boards
EN 14566 Mechanical fasteners for Gypsum plasterboards systems - Definitions, requirements and test methods
EN15283-1 Gypsum boards with fibrous reinforcement. Definitions, requirements and test methods.
Gypsum boards with mat reinforcement

prEN 15303-1 Design and application of plasterboard system on frames – Part 1: general

One significant area in the CPD for wall panels is that concerned with the harmonisation of fire test standards, as part of the European Classification System (Euroclass). This includes a classification of building products based on their reaction to fire performance, and it defines the test methods to be used.

Technical standards for wood based panels are;

EN13986 Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking.