CI/SfB
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July 1997

# Healthier building

*with gypsum products*

## No. 2
## SUSTAINABLE DEVELOPMENT

*This publication looks at the issues involved in working towards sustainable development and the life cycle profile of gypsum products. It will give those working in the construction industry an overview of the regulatory and economic demands to which producers are working and provides an understanding of how the process of production and use of gypsum products currently satisfies these.*

GPDA
Gypsum Products Development Association

*This publication can form part of a structured programme of CPD (Continuing Professional Development)*

# Sustainable Development

The construction industry is one of the largest users of raw materials in the economy and thus has an important role to play in working towards sustainable development. Those involved in building - the material producers and the construction industry - are becoming increasingly aware of the importance of conserving resources and reducing the impact on the environment of their activities.

The body of knowledge about best practice in this area is increasing all the time. More and more information is being produced to help specifiers make judgements about the products and designs they are considering.

### The Healthier Building Campaign

The series *Healthier Building with Gypsum Products* addresses current concerns about the impact on health, the environment and efficiency of the way we build.

The series covers five topics:

1. Health and Safety - The CDM Regulations & Safety, Health and Welfare At Work (Construction) Regulations (July 1997)
2. Sustainable Development (July 1997)
3. The Building Regulations (July 1997)
4. Reduction of Waste (November 1997)
5. Efficient Building (November 1997)

The series is aimed at members of the design team and contractors. It is not intended to provide detailed design guidance, which is readily available in manufacturer's product literature, but rather to raise awareness of the issues involved.

The publications can form part of a structured programme of CPD (Continuing Professional Development).

The information in this publication gives the current position with regard to building products at the date of publication. A list of organisations who could be contacted for the most up to date information is given at the end of this document.

At a national level there are research initiatives aiming to clarify a number of issues, which, although already in the consciousness of many building producers, have not reached a stage of development to allow them to be comprehensively applied. These include the development of an agreed framework for the calculation of embodied energy and the agreement of suitable criteria for eco-labelling of building products.

Further along the line there is the development of tools for the designer: benchmarking schemes for labelling the environmental impact of particular building types, computer programmes which can make a calculated assessment of the environmental impact of different construction systems and 'green' specification libraries.

At one level it is simple to make a choice about the use of products for health or environmental reasons: under COSHH Regulations and the relevant regulations in the Republic of Ireland, materials fall into different categories according to the hazards they present. However, making a comparative assessment of products which fall into the non-hazardous category, gypsum for example, is far more complex and requires a careful understanding of the issues.

### Life cycle assessment

A life cycle assessment gives a profile of a material from extraction of raw materials,

through the manufacturing process, construction process, life of the building, to demolition and disposal. The main criteria for assessment are the minimization of natural resource inputs and waste outputs, but there can also be assessments of noise, dust and transportation.

**Embodied energy**

Embodied energy figures establish some broad indicators for considering not only the energy consumption over the life of the building (over 90%) but also the energy involved in its manufacture.

The construction industry is currently working towards agreed standards for calculating the embodied energy in materials used in building.

**Eco-labelling**

Eco-labelling is a method of identifying that a particular product has reached an agreed standard in terms of its environmental impact in use. The voluntary application of eco-labelling is already taking place for certain building products in a number of EC member countries.

**The role of the designer**

Designers and builders need to make a subjective judgement on the importance of environmental issues in the overall design and understand the impact on cost and performance which any decisions will make.

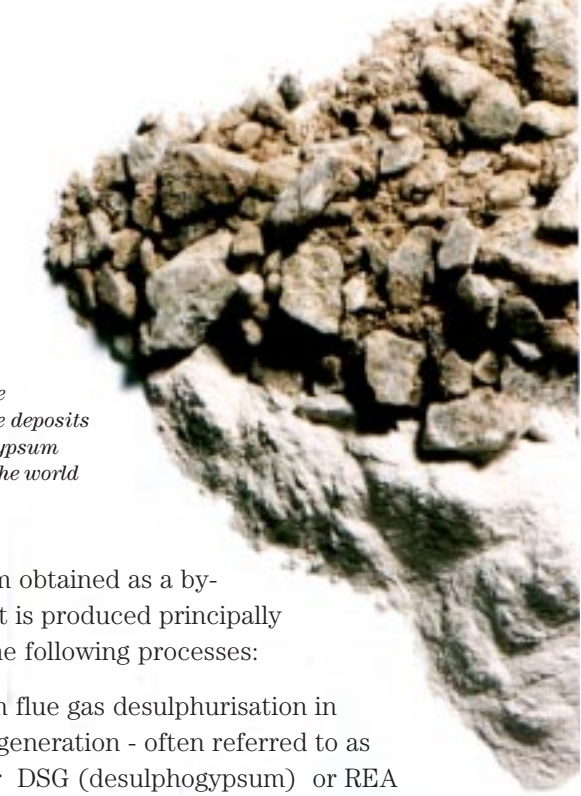
Designers need to beware of the development of the various comparative indices, understand their basis, and apply them with professional judgement.

All member companies of the GPDA have an environmental policy which is available on request

**Some complexities**

- The assessments, calculations and labels which are beginning to be produced are simplifications (embodied energy calculations are subject to infinite regression if say, the energy used in the manufacture of manufacturing plant is brought into the equation).
- They are also in part subjective (nobody has proposed a method of quantifying a comparative measure for life cycle assessments).
- They can be subject to local economic considerations (for instance, the amount of materials recycled at the end of a building's life is often directly influenced by the cost of disposal).
- The comparative evaluation of different materials needs to take into account not only the product in isolation but also its performance as part of a building system and as part of a particular building in a particular location.

# Life cycle profiling



*There are extensive deposits of raw gypsum around the world*

The following life cycle profile of gypsum products provides a basis for both formal and informal assessment. The gypsum industry has responded positively and creatively to the environmental challenge - particularly in the use of by-products in the manufacture of gypsum wallboard. It will continue to respond both in anticipation of new regulatory demands and to the growing awareness of the construction industry and its clients to provide products which satisfy the environmental needs of the 21st century.

**What is gypsum?**

Gypsum is a common mineral consisting of hydrated calcium sulphate ($CaSO_4 \cdot 2H_2O$) and is obtained from natural sources or as a by-product of certain industrial processes.

There are extensive deposits of gypsum both in the UK and the Republic of Ireland and around the world which are either mined or quarried depending on the nature of and depth of the reserve.

Gypsum obtained as a by-product is produced principally from the following processes:

**1.** from flue gas desulphurisation in power generation - often referred to as FGD or DSG (desulphogypsum) or REA gypsum. It is produced by coal fired power stations that have desulphurisation scrubbers installed. These remove sulphur dioxide from the exhaust gases.

**2.** from the production of titanium oxide pigment used in white paint. Here waste sulphuric acid used to remove the titanium from the ore is reacted with limestone to produce gypsum.

Gypsum products in the UK are produced from both natural and by-product gypsum sourced locally and by importation, and in the Republic of Ireland from natural local gypsum deposits.

The paper used in gypsum wallboard is made almost entirely from recycled fibres.

*Gypsum can be a by-product of flue gas desulphurisation, which reduces acid rain*

**Mining and quarrying of raw gypsum**
Mining and quarrying operations are governed by national and regional regulations. In addition national bodies provide good practice guidelines which are adhered to by GPDA members.

In the UK and the Republic of Ireland, the planning application process requires a proposal for suitable aftercare or restoration. In the UK, for example, if a quarry is to be subsequently landfilled, there is a financial provision requirement under the Environmental Protection Act 1990 which obliges operators to demonstrate that they have sufficient resources to operate the facility in accordance with the waste management licence - which includes restoration and post-closure monitoring of leachate and gases (this may be necessary for more than 30 years after closure).

**Location of manufacturing plants**
The location of manufacturing plants is generally based on availability of, and proximity to the source of raw material. Consequently, they are either close to mines or quarries or close to sea ports where raw materials are imported.

*A modern manufacturing plant*

*The mining of naturally occurring gypsum*

The majority of manufacturing plants in the UK are modern installations and therefore have been subject to the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988.

All GPDA members have environmental policies which reflect a commitment to a sensitive and creative approach to managing sites throughout development, use and decommissioning. Gypsum is transported to the plants by either direct conveyor, rail or through short road transport routes.

In comparison to, say, the manufacture of Portland cement, gypsum processing and manufacturing is a simpler and less energy intensive activity. This means that sites tend to be more widely distributed and are smaller in scale and have a corresponding smaller impact on the environment.

*Manufacture of gypsum wallboard is highly automated*

**Manufacturing process.**

In the manufacture of gypsum plasters and wallboard products the main constituent is plaster often referred to as stucco. To produce stucco, gypsum is crushed to a fine powder and heated in a kettle under a process known as calcination. This involves heating to temperatures of around 150 degrees Centigrade using gas, fuel oil or electricity, to drive off three quarters of the chemically combined water of the gypsum, leaving a hemihydrate product (or plaster). The by-product of this process is predominantly steam.

*Plaster*

In the manufacture of building plasters other components are added to the hemihydrate typically expanded perlite and vermiculite. In addition chemical additives are introduced to the mix which control the setting and working characteristics of the plaster. Plaster is then packaged in paper sacks.

*Gypsum wallboard*

The core of the gypsum wallboard is again formed primarily from the stucco plaster to which is added other components and additives to control setting times, achieve bond with the paper liners and generally provide the performance characteristics.

The plaster is mixed with water and spread between two sheets of board liner paper. The gypsum wallboard travels along a conveyor until it has solidified and then cut into the required lengths. The gypsum wallboard is then dried by passing through ovens before being packaged.

**Reduction of waste - manufacturing process**

Gypsum wallboard plants run to high levels or efficiency and therefore there is relatively little waste generated during the production process. Many manufacturing sites now have reclamation plants for recycling waste gypsum wallboard from the manufacturing process. Where feasible, waste from manufacturing sites without reclamation plants is now taken to the nearest site with a reclamation plant. Landfill is used only as a last resort.

Waste plaster in powder form is generally returned to the stock pile of raw materials for reuse.

Within the manufacturing process dust collected from bag filters and electrostatic precipitators is used within the process. Liquids emanating from the processes are discharged to controlled waters in accordance with the discharge consents issued by the Environment Agency and the Environmental Protection Agency in the Republic of Ireland.

**Embodied energy**

The embodied energy in gypsum products varies according to the type of material - either gypsum wallboard or wet plaster. There are also factors brought in by use of composite systems, the framing system used and other variables in the overall construction system employed. No agreed figures are, as yet, available.

**Construction and buildings in use**

The environmental impact of a product during construction and during the life of a building is also a component of the life cycle profile. These are considered in the associated parts of the Healthier Building Series - 1 The CDM Regulations & Safety, Health and Work (Construction) Regulations 1995 and 3 The Building Regulations.

*Waste gypsum wallboard being loaded into the reclamation plant*

**Further information - organisations**

National Council of Building Material Producers, 26 Store Street, London WC1E 7BT. Tel 0171 323 3770

Building Research Establishment, Environmental Assessment & Futures Section, Garston, Watford, Herts, WD2 7NG. Tel 01923 664462

Construction Industry Environment Forum, CIRIA, 6 Storey's Gate, London SW1P 3AU. Tel 0171 222 8891

UK Eco-labelling Board, Eastbury House, 30-34 Albert Embankment, London SE1 7TL. Tel 0171 820 1199

**Further information - publications**

BREEAM (BRE Assessment Method)
*New superstores and supermarkets* 1991. BR 207
*New homes* 1995. BR 278
*New offices* 1993. BR 234
*Existing offices* 1993. BR 240
*New Industrial Units* 1993. BR 252

*Environmental impact of materials, volume A - Summary*, Special Publication 116, CIRIA, 1995

*Ecolabelling of building materials and building products*, C J Atkinson, R N Butlin. BRE IP 11/93.

*Green Design - Sustainable Building for Ireland*, Office of Public Works, 1996

*European Directory of Sustainable and Energy Efficient Building*, James & James 1996

The Gypsum Products Development Association (GPDA) comprises a permanent Secretariat and member companies, in the UK and the Republic of Ireland, all engaged in the manufacture of gypsum products. The primary function of the GPDA is to develop and encourage the understanding of gypsum-based building products and systems and to pioneer new applications for these products.

It also has an ongoing commitment to advise on matters of environmental impact, energy conservation and health and safety, wherever gypsum based products are used. The members promote the use of systems which maximise the conservation of energy and give a high priority to waste reduction and recycling initiatives.


British Gypsum

British Gypsum Limited, East Leake, Loughborough, Leicestershire, LE12 6HX 0115 945 1000

Gypsum Industries

Gypsum Industries plc, Clonskeagh Road, Dublin 14
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KNAUF

KNAUF UK, PO Box 133, Sittingbourne, Kent ME10 3HW
01795 424499

LAFARGE PLASTERBOARD

Lafarge Plasterboard Limited, Wray Coppice, Oaks Road, Wray Common, Reigate, Surrey RH2 OLE
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