

[Between us, ideas become reality.]



Armstrong - reaching new heights

A guide to sustainable suspended ceiling systems

Increasing Environmental Awareness

The impact that today's lifestyles and essential industries have on the environment is an issue that affects us all. In particular, the construction industry – which accounts for one tenth of the UK's GDP – has a major effect on resources and changing landscapes and is therefore key to the preservation of the future environment.

Although businesses are increasingly responsible for implementing their own environmental policies, public concern has led to a heightened awareness of 'green issues'. Confusion still exists amongst manufacturers, specifiers and end users as to how products and their potential impact on the environment should be properly assessed, from production through to long-term application.

In response to the problem, the government's Sustainable Buildings Task Group has produced a report, 'Better buildings, better lives', which highlights the need 'to rationalise what is sometimes a confused picture and provide clear direction on what needs to be done, when and by whom, so that we build and maintain buildings more sustainably'.

With different markets across Europe employing a variety of schemes and accreditation methods for measuring sustainability, many ambiguities exist in today's international business climate. While some product claims may be relevant in one marketplace, in another they will be virtually meaningless.

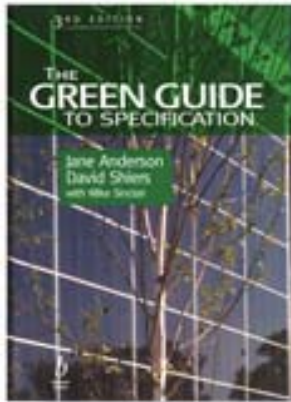
At Armstrong, we are experiencing more and more requests for detailed information on our products, with the main issues being

- **Environmental impact**
- **Life Cycle Assessment**
- **Recycling**

From this, we have recognised an urgent need in today's global marketplace for credible, independent, and fact-based assessment of our products.

A policy of openness

As the world's foremost producer of suspended ceiling systems, we know how important it is to be transparent in regard to the effect our operations have on the environment. To get an objective look at us and our current process, we have identified the BRE and their method of profiling construction products and systems as the leading method of environmental assessment available in the UK today.



BRE (Building Research Establishment)

As the country's leading centre of expertise on buildings, construction, energy, fire and risk, the BRE provides research-based consultancy, testing and certification services through its sister company BRE Certification Ltd. Authors of the 'Green Guide to Specification', the BRE has devised a methodology in partnership with Government and 24 trade associations from the construction products sector, to provide a single, consistent approach for applying LCA (Life Cycle Assessment) to all types of construction products. This approach enables manufacturers and specifiers to compare products against others and helps to raise general awareness of Life Cycle issues.

LCA (Life Cycle Assessment)

The data at the core of the 'Green Guide' is generated using a technique known as Life Cycle Assessment (LCA). LCA is a method of evaluating the environmental impacts of a system throughout its full life cycle, taking into account all the effects associated with use, from production to disposal.

The Life Cycle Assessment methodology used for Environmental Profiles complies with ISO 14041, an internationally established approach for analysing the environmental impacts of products and processes, and is a system that complements the ISO 14001 environmental management principles.

About Environmental Profiling

Life Cycle Assessment (LCA) scheme for construction products

Claims about the environmental performance of building products are easy to make, but difficult to substantiate without a universal measuring system.

A solution can be found in Environmental Profiles, which provide a suitable measurement which enables manufacturers to independently demonstrate the performance of their products. They also help clients, designers and specifiers to identify products that will best fulfil a sustainability brief.

As well as underpinning claims of environmental performance, manufacturers can use Environmental Profiles to compare their products against others and demonstrate improvements that have been made and help raise general awareness of life-cycle issues.



LCA Methodology

STAGE 1 – ‘Classification’

The impact categories are selected and the burdens from the study system are then assigned to the appropriate impact category.

- Climate change**
- Acid deposition**
- Ozone depletion**
- Pollution to air: Human toxicity**
- Pollution to air: Low level ozone depletion**
- Fossil fuel depletion and extraction**
- Pollution to water: Human toxicity**
- Pollution to water: Ecotoxicity**
- Pollution to water: Eutrophication**
- Minerals extraction**
- Waste disposal**
- Transport pollution and congestion: Freight**
- Water extraction**

STAGE 2 – ‘Characterisation’

The relative importance of the different burdens in each impact category are measured by comparison to a reference unit (eg. for climate change the reference unit is “1kg of CO₂ equivalent over 100 years”).

STAGE 3 – ‘Normalisation’

To enable comparison between data that is expressed in different units. This is important for it enables the characterised data to be placed into perspective against a baseline level.

Ecopoints – a single score environmental assessment

The environmental impact of construction covers a wide range of issues, including climate change, mineral extraction, ozone depletion and waste generation. Assessing such different issues in combination requires subjective judgments about their relative importance. To enable such assessments to be made, BRE has developed the Ecopoints system.

An Ecopoint score is a measure of the overall environmental impact of a particular product or process. This is derived by adding the score from each of the impact categories above, and is calculated by multiplying the normalised impact with its percentage weighting. For reference, the annual environmental impact caused by a typical UK citizen is 100 Ecopoints, the higher the Ecopoints score, the greater the environmental impact.

How Armstrong achieved an 'A' rating

Meeting the criteria outlined in the Green Guide

The latest edition of the Green Guide to Specification (Anderson, Shiers and Sinclair; Blackwells) contains tables showing the summary ratings as measured in Ecopoints per m², for all the elements.

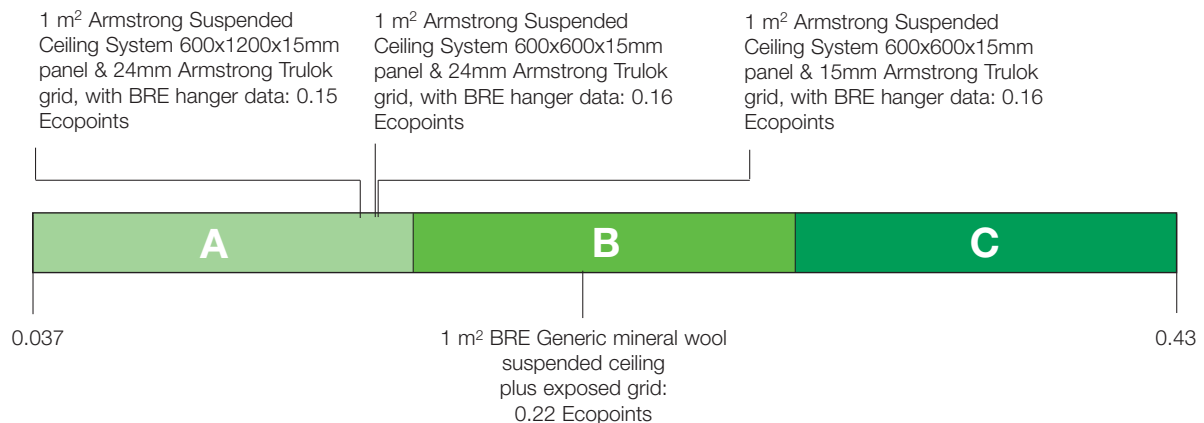
The Green Guide to Specification ratings are based on a 60-year project life (including raw materials, transport to site, replacement and disposal data etc) and a 25-year product life for suspended ceilings.

Green Guide ratings are obtained by calculating the environmental impacts associated with all the common construction specifications for a particular element, which in this case is the Armstrong suspended ceiling system.

The range of impacts, from lowest to highest, is then divided into three, and any specification with an impact in the lowest (best) third of the range gets an A rating, in the mid part of the range, a B rating, and in the part with the highest impact, a C rating.

The diagram below shows the impact for the Armstrong Suspended Ceiling Panel and Armstrong Suspension Ceiling Grid in a suspended ceiling finish and to the specifications labelled.

The diagram shows that all of the Armstrong Suspended Ceiling System specifications assessed receive a Green Guide rating of A.



Analysis of Environmental profile

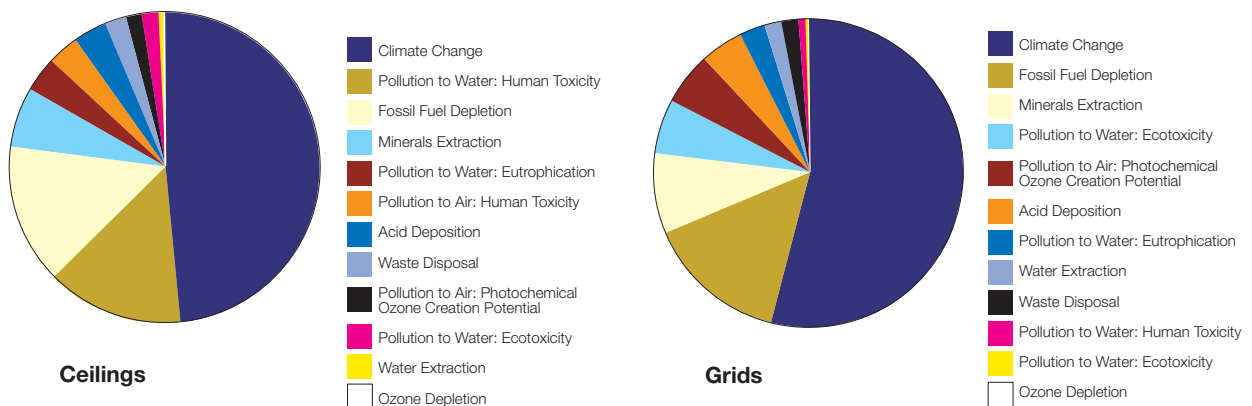
Our work with the BRE has allowed us to understand the environmental impact of each raw material and process within our UK manufacturing plants for both ceiling tiles and suspension systems.

For both cases, the key impact is on climate change and the primary driver is energy use during manufacture.

As an example, we have pioneered the use of Perlite within our wet felt board formulations. One of the key drivers being that we require less energy to process our products. With energy comprising a large part of our products environmental impact, any savings here will provide a major benefit. However, not only has this energy saving helped us to improve our result against the generic model, but we better understand for example, the environmental impact of Perlite compared to other raw materials. Within our UK grid manufacturing plant (and beyond), we have developed new grid 'stitching' techniques and section profiles that allow us to strengthen our grid systems without adding more raw materials. With galvanised mild steel as a raw material having the largest potential environmental impact, these developments have a direct and positive impact on our environmental performance.

We have always been aware of the importance of energy consumption during our own processes, however we are now able to accurately quantify the environmental impact of this component. Today for example this comprises approximately 60% of the total impact across both tile and grid components.

Team Valley plants



Environmental Profile Data

BRE **BRE Certification Limited** **Approved Environmental Profile**
 Characterised and Normalised Data for
 1 square metre over 60 Year Life: Ceiling Finish: Ceiling
 Finish: Armstrong Suspended Ceiling System 60x60x15mm
 panel & 15mm girt

Quality of Data for Profiled Material (Data for other constituent materials are available from BRE)
 Start Date: 1 January 2000
 End Date: 31 December 2000
 Source of Data: Production records
 Geography: UK
 Representativeness: 1 factory producing Armstrong Suspended Ceiling Panels and 1 factory producing Armstrong Suspension Ceiling Girt
 LCA Methodology: BRE Methodology
 Allocation: 100% by value
 Date of Data Entry: 23 August 2004
 Boundary: Cradle to Grave over 60 Year Building Life
 Comments:

Issue	Characterised Data	Unit
Climate Change	36	kg CO2 eq. (100%)
Acid Deposition	0.006	kg SO2 eq.
Ozone Depletion	0.0000021	kg CFC11 eq.
Pollution to Air: Human Toxicity	0.02	kg tox.
Pollution to Air: Photochemical Ozone Creation Potential	0.004	kg ethene eq.
Pollution to Water: Human Toxicity	0.00071	kg tox.
Pollution to Water: Ecotoxicity	91	m ³ tox.
Pollution to Water: Eutrophication	0.0002	kg PO4 eq.
Fossil Fuel Depletion	0.0074	ton
Minerals Extraction	0.016	tonnes
Water Extraction	0.014	tonnes
Waste Disposal	0.014	tonnes
Transport Pollution & Congestion: Freight	100	tonne.km

Issue	Normalised Data	UK (2000) average
Climate Change	0.002	10000 kg CO2 eq. (100%)
Acid Deposition	0.0011	88.8 kg SO2 eq.
Ozone Depletion	0.0000011	0.200 kg CFC11 eq.
Pollution to Air: Human Toxicity	0.00008	90.7 kg tox.
Pollution to Air: Photochemical Ozone Creation Potential	0.0011	32.2 kg ethene eq.
Pollution to Water: Human Toxicity	0.0002	0.0177 kg tox.
Pollution to Water: Ecotoxicity	0.0046	170000 m ³ tox.
Pollution to Water: Eutrophication	0.0011	0.01 kg PO4 eq.
Fossil Fuel Depletion	0.0018	0.09 ton
Minerals Extraction	0.002	0.04 tonnes
Water Extraction	0.0027	470000 litres
Waste Disposal	0.002	7.18 tonnes
Transport Pollution & Congestion: Freight	0.024	4740 tonne.km
Primary Energy	0.28	GJ
BRE Environmental Score	0.16	Excellent

BRE Certification Limited
 Environmental Profiling is an independent environmental information service run by BRE. The profile is based on data provided by manufacturers to the general market. BRE has no responsibility for the environmental performance of the product. Profiles may only be distributed in their entirety and in accordance with the terms and conditions of any contract.
 © Green and Building Research Establishment 2004

BRE **BRE Certification Limited** **Approved Environmental Profile**
 Characterised and Normalised Data for
 1 square metre over 60 Year Life: Ceiling Finish: Ceiling
 Finish: Armstrong Suspended Ceiling System 60x60x15mm
 panel & 15mm girt

Quality of Data for Profiled Material (Data for other constituent materials are available from BRE)
 Start Date: 1 January 2000
 End Date: 31 December 2000
 Source of Data: Production records
 Geography: UK
 Representativeness: 1 factory producing Armstrong Suspended Ceiling Panels and 1 factory producing Armstrong Suspension Ceiling Girt
 LCA Methodology: BRE Methodology
 Allocation: 100% by value
 Date of Data Entry: 23 August 2004
 Boundary: Cradle to Grave over 60 Year Building Life
 Comments:

Issue	Characterised Data	Unit
Climate Change	38	kg CO2 eq. (100%)
Acid Deposition	0.008	kg SO2 eq.
Ozone Depletion	0.0000021	kg CFC11 eq.
Pollution to Air: Human Toxicity	0.075	kg tox.
Pollution to Air: Photochemical Ozone Creation Potential	0.004	kg ethene eq.
Pollution to Water: Human Toxicity	0.00071	kg tox.
Pollution to Water: Ecotoxicity	91	m ³ tox.
Pollution to Water: Eutrophication	0.0002	kg PO4 eq.
Fossil Fuel Depletion	0.0074	ton
Minerals Extraction	0.016	tonnes
Water Extraction	0.014	tonnes
Waste Disposal	0.014	tonnes
Transport Pollution & Congestion: Freight	100	tonne.km

Issue	Normalised Data	UK (2000) average
Climate Change	0.002	10000 kg CO2 eq. (100%)
Acid Deposition	0.0011	88.8 kg SO2 eq.
Ozone Depletion	0.0000011	0.200 kg CFC11 eq.
Pollution to Air: Human Toxicity	0.00007	90.7 kg tox.
Pollution to Air: Photochemical Ozone Creation Potential	0.0011	32.2 kg ethene eq.
Pollution to Water: Human Toxicity	0.0002	0.0177 kg tox.
Pollution to Water: Ecotoxicity	0.0046	170000 m ³ tox.
Pollution to Water: Eutrophication	0.0011	0.01 kg PO4 eq.
Fossil Fuel Depletion	0.0018	0.09 ton
Minerals Extraction	0.002	0.04 tonnes
Water Extraction	0.0027	470000 litres
Waste Disposal	0.002	7.18 tonnes
Transport Pollution & Congestion: Freight	0.024	4740 tonne.km
Primary Energy	0.28	GJ
BRE Environmental Score	0.16	Excellent

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Dave Cookson, Senior VP Building Products in Europe, accepts the BRE Certificate on successful completion of Environmental Profiling work at the Team Valley Ceiling plant and WAVE (Team Valley) Grid plant, from Dr Jeremy Hodge Director, BRE Certification Ltd.*

*The Building Research Establishment (BRE) owns and operates the environmental profiling methodology. BRE Certification Ltd are an independent, third party certification body.

BRE **BRE Certification Limited** **Approved Environmental Profile**
 Characterised and Normalised Data for
 1 square metre over 60 Year Life: Ceiling Finish: Ceiling
 Finish: Armstrong Suspended Ceiling System
 60x60x15mm panel & 15mm girt

Quality of Data for Profiled Material (Data for other constituent materials are available from BRE)
 Start Date: 1 January 2000
 End Date: 31 December 2000
 Source of Data: Production records
 Geography: UK
 Representativeness: 1 factory producing Armstrong Suspended Ceiling Panels and 1 factory producing Armstrong Suspension Ceiling Girt
 LCA Methodology: BRE Methodology
 Allocation: 100% by value
 Date of Data Entry: 23 August 2004
 Boundary: Cradle to Grave over 60 Year Building Life
 Comments:

Issue	Characterised Data	Unit
Climate Change	35	kg CO2 eq. (100%)
Acid Deposition	0.007	kg SO2 eq.
Ozone Depletion	0.0000021	kg CFC11 eq.
Pollution to Air: Human Toxicity	0.073	kg tox.
Pollution to Air: Photochemical Ozone Creation Potential	0.004	kg ethene eq.
Pollution to Water: Human Toxicity	0.00071	kg tox.
Pollution to Water: Ecotoxicity	90	m ³ tox.
Pollution to Water: Eutrophication	0.0002	kg PO4 eq.
Fossil Fuel Depletion	0.0069	ton
Minerals Extraction	0.014	tonnes
Water Extraction	0.014	tonnes
Waste Disposal	0.014	tonnes
Transport Pollution & Congestion: Freight	99	tonne.km

Issue	Normalised Data	UK (2000) average
Climate Change	0.0018	10000 kg CO2 eq. (100%)
Acid Deposition	0.001	88.8 kg SO2 eq.
Ozone Depletion	0.0000011	0.200 kg CFC11 eq.
Pollution to Air: Human Toxicity	0.00008	90.7 kg tox.
Pollution to Air: Photochemical Ozone Creation Potential	0.00094	32.2 kg ethene eq.
Pollution to Water: Human Toxicity	0.0002	0.0177 kg tox.
Pollution to Water: Ecotoxicity	0.0046	170000 m ³ tox.
Pollution to Water: Eutrophication	0.0011	0.01 kg PO4 eq.
Fossil Fuel Depletion	0.0017	0.09 ton
Minerals Extraction	0.002	0.04 tonnes
Water Extraction	0.0026	470000 litres
Waste Disposal	0.0019	7.18 tonnes
Transport Pollution & Congestion: Freight	0.021	4740 tonne.km
Primary Energy	0.28	GJ
BRE Environmental Score	0.16	Excellent

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Linking Environmental Profiles to other sustainable construction tools



BRE has developed a software tool called Envest 2 which is intended for use at the initial design stage. Envest 2 allows designers to enter their designs and identify those elements with the most environmental impact.

The system also includes an indication of the operational energy demands, allowing designers to investigate the trade-off between the life cycle impacts of their design structure and the operational impacts of a building's use.

Envest 2 is largely based on the same data as the Green Guide. While the majority of data has been derived from the BRE Environmental Profiles project, the same weighting system as in the Green Guide has been used to produce Ecopoints, which act as the overall measure of environmental impact.

Look out for Armstrong ceiling systems data within Envest 2.

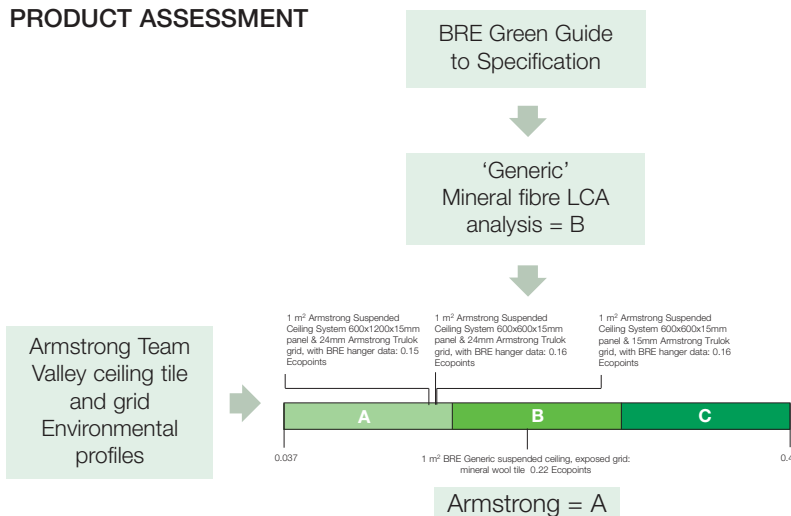


The BRE's Environmental Assessment Method (BREEAM) is a design and management stage assessment tool based on good practice that provides a credible and transparent environmental label for buildings. One of the aims of BREEAM is to encourage the use of materials that, taking into account their full life cycle, have lower impact on the environment.

BREEAM is widely used to specify an overall environmental performance. The holistic structure of this approach ensures a high level of flexibility for the design team.

Construction materials relate to 10% of the total score available within BREEAM 98 for Offices, making the selection and reuse of materials a significant factor in a building's overall score. The assessment can be applied at the design stage in new build and refurbishment schemes, as well as in existing buildings.

PRODUCT ASSESSMENT



PROJECT ASSESSMENT



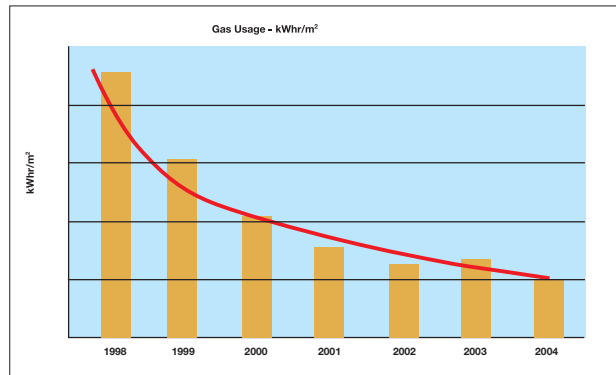
Our policy in action

Our use of the BRE profiling method has confirmed that energy use has the greatest environmental impact during manufacture and hence our continued focus on this area will continue to enhance our top environmental rating

Energy

Since 1998, projects such as our 'gas reduction project' have been focussed on the control of energy during product manufacture. As the graph shows, these programmes have achieved significant reductions in gas usage (measured in kWh/m²), through:

- Introduction of gas measurement devices on all machinery
- Implementation of best energy practices for energy production
- Improved insulation of dryer stations



China clay

Our Team Valley ceiling plant uses over 4,000 tonnes of china clay per annum as one of the main ingredients in its paint manufacturing process. UK China clay is a fine white powder found and mined only in Devon and Cornwall. The clay is literally "washed" out of the ground and then dried into powder form to be bagged, palletised and delivered to our plant.



New clay silo

Our manufacturing process involves adding water to turn the product into paint, and we identified that there were a number of environmental benefits to be gained by improving on the traditional process. Through close co-operation with our supplier we identified an opportunity for significant reduction in the energy used to dry the clay, which would also give us a number of extra environmental benefits.

By changing our method of transportation and handling of the product to a system where the clay could be delivered in a bulk tanker without being totally dry and therefore eliminating the need for bagging, we could save both on the paper bags and the pallets. As our supplier already had a rail terminal in Stoke, it was possible to have the road tankers filled there before driving to Team Valley, Gateshead. To complete the project, a single silo had to be installed in Team Valley to hold the wetter clay, and modifications were made to the paint mixing plant.

After analysing the cost against the potential savings, it was clear that this change would not only provide a benefit in reduction of energy usage, but would also result in less waste of both raw material and packaging. Early tests still using paper bags confirmed the energy benefits and led to the full capital project of hardware investments.

Benefits

- Less energy used in producing the raw material
- Elimination of paper bags and disposal
- Elimination of pallets and disposal
- Reduced road traffic mileage
- Less road traffic in Cornwall

This project was adopted in 2002 and is one more example of how Armstrong constantly seeks to improve our overall environmental performance.

Recycling



For over a decade, Armstrong has successfully recycled process scrap within our manufacturing plants as part of our long standing commitment to protecting the environment. Now we have a product available to building owners and specifiers that can not only be recycled in the future by Armstrong, but will also be collected free* and returned to our manufacturing plant in the UK. For us, its a natural extension of our commitment to the environment to offer recycling of materials from job sites at the end of their useful life.

Recycling ceilings

All Armstrong ceiling tile products listed in the recycling programme are capable of being recycled within the Armstrong process (see 'Armstrong requirements for recycling').

Financial considerations

- Labour costs associated with single material retrieval
- Organisation of Armstrong collection

Cost of using other services

- Local handling, transport and landfill fees
- Mixed material consolidation in jobsite waste containers

For more details of the Armstrong Recycling Programme and brochure please contact our Internal Technical Sales department on **0800 371849**

* Full trailer loads of product sold and installed in the UK/Rol after 1st December, 2002.



Ceiling tiles for recycling



Waste wool arriving at plant



Waste paper awaiting recycling

Meet the 'A' Team



Ceiling plant

Representatives of our ceiling and grid plants in Team Valley



Grid plant

Looking ahead

While we're delighted that our UK manufactured products have achieved an 'A' rating throughout, our story doesn't end there. Although current results demonstrate that our products are in the very top category of sustainability, we have an ongoing commitment to ensure that our environmental performance continues to improve, and that our systems provide the most environmentally-friendly suspended ceiling option for our customers and end users.

Our Environmental Policy

Looking after the environment through careful use of resources

Armstrong's Corporate Policy reflects our longstanding commitment to protecting the environment.

We recognise the importance of using resources intelligently today to ensure a safer, healthier world for tomorrow. This philosophy is applied to our dealings with customers, employees, government and community neighbours, encouraging the same high standards in all areas of business.

Our overall goal is to make sure that our activities as an organisation are in harmony with the natural world around us. To achieve this, we adhere to a clearly defined corporate policy on the environment that encompasses all our production processes.

Resources

We aim to exercise care in the selection, use and conservation of energy and raw materials, especially natural resources, and to avoid unnecessary waste.

Research and Development

Armstrong continually seeks to make use of research and production technology to provide protection for the environment both in our workplaces and the wider community, reducing risk to our surroundings and the natural elements.

Rapid response

We remain constantly alert to the possibility of accidents and other incidents occurring that may put our employees or the environment at risk, and are prepared to act promptly and responsibly to emergencies.

Environmentally friendly products

We ensure that all our products are compatible to the environment in which they are installed. Armstrong provides customers with relevant information regarding application, maintenance and disposal of products in every situation.

Waste reduction and recycling

Our aim is to prevent pollution by reducing waste and using effective recycling in all our operations. Where disposal of materials is unavoidable, it is carried out in a manner appropriate to the environment.

United Kingdom / Republic of Ireland

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Building Products Division
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All product specifications are subject to modifications without prior notice.
Printed on chlorine free paper from sustainable resources.

