



**ENVIRONMENTAL  
TECHNOLOGY  
BEST PRACTICE  
PROGRAMME**

# CUTTING COSTS AND WASTE BY REDUCING PACKAGING USE



**GOOD PRACTICE:** Proven technology and techniques for profitable environmental improvement

# CUTTING COSTS AND WASTE BY REDUCING PACKAGING USE

This Good Practice Guide was produced by the  
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# SUMMARY

If you can optimise the amount and type of packaging you use, you are likely to achieve significant cost savings, improve your profit margin and minimise both your consumption of resources and the quantities of waste for disposal. Reducing the amount of packaging you pass on will also help you to meet any obligations you have under the UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997 at least cost. It will also improve your company's image in the eyes of customers, shareholders and the general public.

If you are interested in reducing both the quantities of packaging that your company uses/handles and the associated costs, then this Guide is for you. It is applicable to **all** companies, irrespective of size, including those that are seeking to make savings within the framework of an environmental management system such as EMAS or ISO 14001.

To manage waste effectively you need to have a good basic understanding of your existing packaging use. You can then select improvements from a wide range of options to meet carefully targeted objectives.

Your first task should be to reduce packaging consumption at source. To achieve this you should:

- consider the materials and designs you use;
- examine ways of eliminating or reducing your packaging requirement - changes in product design, improved cleanliness, better handling, just-in-time delivery, bulk delivery, etc;
- optimise your packaging use, ie match packaging to the level of protection needed.

You may be able to benefit from using re-usable transit packaging. There are two possible approaches. One is to use dedicated re-usable packaging within a closed-loop distribution system. The other is to re-use so-called one-trip packaging, which is often sturdy enough to be used again, either for its original purpose or for the onward delivery of parts and products.

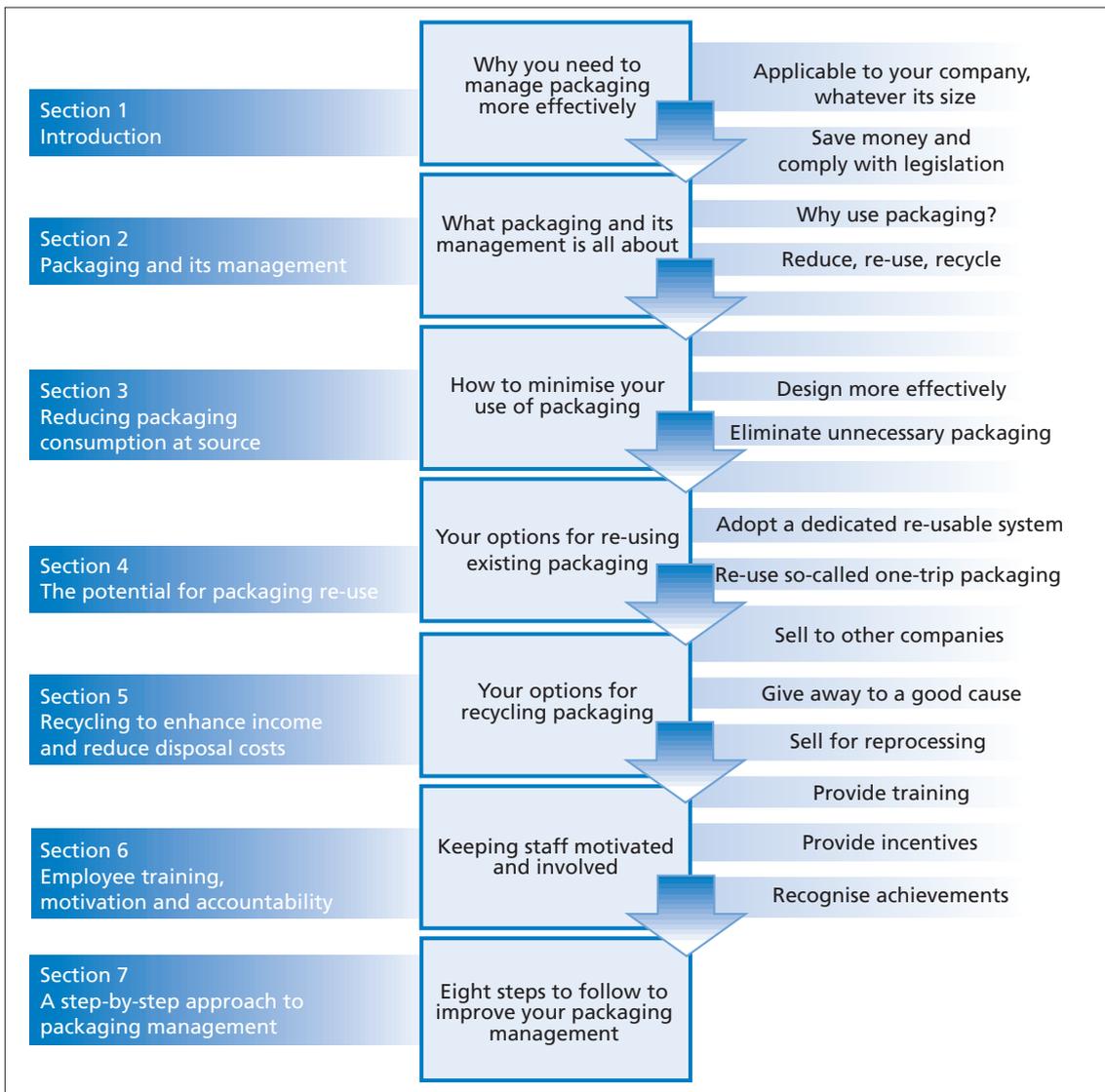
Further details about the design and management of re-usable packaging systems are given in Good Practice Guide (GG141) *Choosing and Managing Re-usable Transit Packaging*, available free of charge through the Environmental Helpline on freephone 0800 585794.

You may also need to consider other re-use or recycling/recovery options - selling packaging either to a company that can re-use it directly, or, failing that, to a waste merchant for reprocessing.

Whichever packaging management options you select, you will achieve better results if you involve all relevant employees during the improvement process. Not only will your employees be able to make useful and practical suggestions, their participation will encourage them to adopt a more responsible approach to packaging and its use.

The Guide encourages you to adopt a step-by-step approach (Fig 1), identifying why you need to manage your packaging more effectively, examining what is meant by packaging management, and then considering, in order, packaging minimisation, re-use and recycling/recovery. It also provides a checklist for estimating the savings that can be made.

Further information can be obtained by ringing the Environmental Helpline on freephone 0800 585794.



**Fig 1 Guide structure and key issues addressed**

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Packaging is the term used to describe any material used for the containment, protection, handling, delivery and presentation of goods (from raw materials to processed goods) from the producer to the end-user or consumer.

Broadly speaking there are three categories of packaging:

- Primary (sales) packaging, around the goods at the point of purchase by the user or consumer; an example of primary packaging is the crisp packet.
- Secondary (collation) packaging, which groups a number of items together until the point of sale; an example is the box in which packets of crisps are supplied to retailers.
- Tertiary (transit) packaging, which allows handling and transport of a number of grouped items as a unit; examples are the pallet on which the boxes of crisp packets are stacked and any banding or shrink-wrap used to hold them fast.

## 1.1 WHY MANAGE PACKAGING EFFECTIVELY?

Packaging plays a crucial protective role in the distribution of items ranging from raw materials to manufactured goods and perishable foods. However, as the Industry Examples at the end of this Guide make clear, companies that are carefully managing their packaging use are saving money and increasing profits. They are also saving valuable resources and reducing disposal of waste.

This Guide is applicable to all sectors of manufacturing industry and to goods distributors, wholesalers and retailers. It will also be of interest to packaging suppliers. It is particularly relevant to those involved in, or responsible for:

- the design and specification of packaging and products, including packaging designers and product developers, packaging technologists, and sales and marketing staff;
- the procurement of packaging, raw materials and components;
- factory management, including the managing director, the technical or production director, general/works managers, manufacturing engineers and production schedulers;
- environmental management, including health, safety and environmental managers and waste managers.

### 1.1.1 Benefits of packaging management

Focusing on packaging management will benefit your company by:

- improving its overall profitability;
- allowing it to comply with legislation;
- enhancing its environmental performance.

Packaging management can improve profitability by:

- reducing your direct packaging and material costs;
- reducing your suppliers' costs, from which you can benefit;
- helping to minimise levels of product damage and customer returns;
- reducing your UK producer responsibility obligation and therefore the cost of compliance;

- helping to minimise recovery and rising waste disposal costs;
- increasing revenue from the sale of packaging waste;
- improving overall site efficiency.

### 1.1.2 Packaging waste regulations

There are also regulatory reasons why you should minimise packaging use and the waste that packaging creates.

The UK Producer Responsibility Obligations (Packaging Waste) Regulations 1997 require all companies that have a turnover above a specified minimum, and that handle more than a certain quantity of packaging, to undertake or arrange for some recovery and recycling of packaging waste. The more packaging your company handles, the greater is your obligation to recycle and recover, and the higher is the likely cost of compliance.

#### **Producer Responsibility Obligations (Packaging Waste) Regulations 1997**

The Regulations:

- Apply to companies that handle more than 50 tonnes of packaging per year and have a turnover of more than £5 million (£1 million from the year 2000).
- Require the companies that meet these conditions to take responsibility for the recovery and recycling of their 'obligation' for packaging waste. Calculation of the obligation quantity is complex and is a function of:
  - the amount of obligated packaging handled;
  - the activity obligation (raw material manufacturer 6%, converter 11%, packer/filler 36%, seller/final retailer 47%);
  - UK recovery/recycling targets.<sup>1</sup>

There are a number of exemptions from the regulations, eg returnable packaging that has been re-used.

Companies can register individually with the appropriate regulator<sup>2</sup>, or pass on their obligations to a third party operating a compliance scheme. In all cases companies are required to collect data by weight.

<sup>1</sup> Recovery: 1998/99 = 38%; 2000 = 43%; 2001 and beyond = 52%  
Recycling (by material): 1998/99 = 7%; 2000 = 11%; 2001 and beyond = 16%.

<sup>2</sup> Contact the Environmental Helpline on 0800 585794 for further details.

The Packaging (Essential Requirements) Regulations 1998 legally require certain conditions to be met in relation to the manufacture and composition of packaging and to its re-usability and recoverability. They also require that 'packaging should be so manufactured that the packaging volume and weight be limited to the minimum adequate amount to maintain the necessary level of safety, hygiene and acceptance for the packed product and the consumer'.

## 1.2 HOW THIS GUIDE WILL HELP YOU

The purpose of this Guide is to help your company, whatever its size and turnover, to save money by managing its packaging effectively. This will require you to monitor your packaging consumption so as to use packaging efficiently, and hence reduce your packaging costs; and minimise the amount of packaging waste produced - achieving all this without compromising product protection and handleability.

The Guide focuses mainly on the collation and transit packaging that is used to supply materials, components and finished products, whether these are solids, powders, liquids or gases. It deals particularly with:

- corrugated cartons;
- plastic bags;
- filler materials - expanded polystyrene (EPS), foam and paper;
- shrink-wrap;
- stretch-wrap;
- layer pads;
- pallets and slip sheets;
- drums and other containers.

The Guide is not concerned with primary packaging, except where the primary packaging is also the transit packaging.

The Guide provides companies with clear, concise information and practical advice on a range of issues, including:

- packaging design;
- avoiding the need for packaging;
- minimising packaging use;
- re-using existing packaging;
- recycling packaging materials and reducing disposal costs.

It also sets out the practical steps that you will need to take if you are to manage your packaging effectively.

The Industry Examples included at the end of the Guide show how some companies have already achieved significant cost savings and other important benefits by managing their packaging more effectively.



## 2.1 THE ROLE OF PACKAGING

Packaging, irrespective of its type, serves a number of different purposes: it protects and/or contains the product; it facilitates handling and storage; and it eases product identification.

### 2.1.1 Protection

The primary purpose of distribution packaging is to protect the product. It must therefore be 'fit for its purpose' and capable of withstanding the rigours of storage and distribution.

Your packaging will need to meet some or all of these criteria:

- be strong enough to withstand sustained loads (eg from containers stacked on top of it), and puncture by sharp objects;
- be able to limit the acceleration experienced by the product when the product/packaging combination is subjected to certain shock levels (eg drops), and dampen out high and low frequency vibrations;
- be properly sealed (and/or constructed of appropriate materials) to prevent the entry of air and moisture that might carry contaminants;
- be insulated to a level that will allow the product to maintain a given internal temperature for a specified time against external factors including high and low temperatures, humidity, etc;
- be tamper-proof: it should either resist unauthorised access or show that it has been opened;
- be able to resist damage resulting from external exposure.

### 2.1.2 Containment

Your packaging and the materials from which it is made will need to prevent the contents escaping from the container. This is particularly important where the materials contained - whether solids, liquids or gases - would constitute a hazard if they were to leak out.

### 2.1.3 Handling and storage

Packaging must be compatible with handling and storage systems and equipment, and allow suitable stacking of containers to make good use of storage space.

### 2.1.4 Identification

Your packaging can ease product identification if it:

- has a label attached (or printed/painted on it) that identifies the key properties of the contents, eg type of product, batch, hazards (such as flammability);
- has a unique identifier or serial number for each unit, possibly including details of consignor and consignee;
- has a label or shape that is designed to give a marketing or advertising impact identifiable with a particular company and brand.

## 2.2 WASTE MINIMISATION AND THE PRINCIPLES OF PACKAGING MANAGEMENT

### 2.2.1 Waste minimisation

Waste minimisation has become increasingly common in recent years, and many companies have benefited enormously from waste minimisation initiatives.

#### What is waste minimisation?

Waste minimisation reduces unnecessary resource consumption and material disposal in order to reduce operating costs and minimise the environmental impact.<sup>1</sup>

The phrase **'Reduce, re-use, recycle'** has now become something of a cliché. However it does neatly describe the waste minimisation hierarchy:

- **Reduce** - Prevention at source should be your first priority since this tackles the root cause of material wastage. In terms of packaging this means optimising packaging design/use and, in some cases, reducing the need for packaging without increasing product damage or waste.
- **Re-use** - Most packaging, even that which is designed as 'one-trip' packaging, can be re-used, either within a company/group or by another organisation. You can take various steps to facilitate re-use. However, you should note that re-use is not **always** preferable to one-trip use, and the relevant issues are discussed further in Section 4.
- **Recycle** - If packaging re-use is not an option, then you should consider material recycling/reclamation, probably with the help of a local recycling specialist (eg a waste merchant). Again, there are various steps you can take to make used packaging more attractive to recyclers, and further details are given in Section 5. An associated option might be to install an energy-from-waste incinerator.

**Disposal should normally be your last resort.** Even where disposal is necessary, there are steps that you can take to minimise the volumes and costs involved.

### 2.2.2 The principles of packaging management

The term packaging management, in the context of this Guide, can be defined as:

a systematic approach that allows the most efficient use of packaging and packaging materials in order to reduce costs and materials wastage without compromising product protection, handling and storage.

If packaging management is to be effective, it should adhere to certain important principles:

- It must be undertaken within the context of the whole manufacturing and distribution system (from manufacturer to consumer). Dealing with packaging in isolation is likely to be counterproductive, resulting in product damage and other difficulties.
- Packaging management involves both monitoring and control. Monitoring is an essential part of any quality management system. It involves measurement, record-keeping and analysis, but it should, in the case of packaging, provide you with a better understanding of packaging flows and the associated waste streams. As a result, you should be able to make sure that your packaging is designed for efficient use of materials and that its use is effectively controlled. This will help to improve the efficiency of your operation.

<sup>1</sup> For further details of waste minimisation initiatives, please ring the Environmental Helpline on freephone 0800 585794.

- You can nearly always improve an existing system. Remember that, as technologies and costs change, what was impossible or uneconomic a few years ago may be a viable option today. Don't be put off by those in your organisation who adopt the attitude: 'That's the way we've always done it'.
- It is usually easier and more effective to encourage evolution rather than revolution. Introduce changes gradually; keep things simple; and, if possible, avoid measures that require significant changes to the manufacturing process.
- Remember that it is people who make things happen. Involving all your relevant employees - from packer to production director - will make the waste minimisation process more effective.
- The time you spend on packaging management is never wasted. It can significantly reduce material costs and it can help to minimise component and product damage.

### **The relationship between waste reduction and profit**

Assume that a company with a £4 million turnover makes a profit of 5%, or £200 000, each year. Waste costs the company around £120 000/year, or about 3% of turnover, and is the result partly of unnecessary material purchases and high disposal costs. Reducing these costs by only 10% will enhance the annual profits by £12 000, or an extra 6%.

Environmental performance is also a key part of your company's image and may affect your business success:

- Many large industrial and retail customers now demand high standards of environmental performance from their suppliers. If your performance in this sphere is poor, it could increasingly prevent you from supplying key parts of your market. If it is good, it will make your company more attractive to 'green' customers.
- The growing public awareness of environmental issues means that your company's approach to the environment can affect employee morale.
- Environmental image can also affect how public companies are perceived by shareholders and the City. This can have an impact on share prices.

### **Major savings in transit packaging achieved by Marks and Spencer**

Since reviewing its transit packaging in the early 1990s, Marks and Spencer has reduced its use of corrugated board by 30%, mainly through elimination, lightweighting and the introduction of re-usable packaging systems. The Company expects this figure to reach 60% when new transit packaging policies are fully implemented by 2000. In addition, almost all packaging waste is now recycled, virtually eliminating the disposal of waste to landfill. The Company also de-packages goods at its distribution centres, wherever possible. The associated benefits include:

- more space in the stores themselves;
- lower labour and waste disposal costs as a result of centralisation (eg only one compactor is now required per 25 stores).

Since 1991/92 Marks and Spencer has reduced its net transit packaging costs by 30% and its waste disposal costs by 50%.

## 3.1 DESIGN ISSUES

Ideally, the design of your packaging should be part of the overall product design process rather than an afterthought. It should reflect the entire manufacturing and distribution system context, in some cases, including the packaging's final destination.

Transit packaging may have to protect the product from a range of events, including:

- various types of load, eg compression from stacking;
- being dropped from various heights on to faces, edges and corners;
- low-frequency and/or high-frequency vibration cycles;
- puncture by sharp objects;
- the ingress of water and/or spilled chemicals;
- variations in temperature and humidity.

### 3.1.1 The manufacturing and distribution context

To provide the correct level of packaging protection for any product, you will need to understand both the associated manufacturing process and the distribution system that will handle it once it leaves the factory. The packaging chosen will need to meet the requirements of both.

You can ease handling operations if your packaging:

- Has appropriate handles for manual handling, access points for fork-lift trucks, attachment points for cranes, etc.
- Is sized correctly. The length, breadth and height should be appropriate for the product, for the handling equipment (including people), for any containers in which it is packed, and for the vehicles used for transport. The total weight of product and packaging should be below the permitted maximum for handling equipment (including people) and vehicles.
- Is limited in length, breadth and height so that, either singly or in multiples, it will fit the storage space.
- Is of an appropriate shape that allows individual packaging units to be stacked one on top of the other (possibly with interlocks to stabilise the stacks) or to fit inside intermediate containers or racks.
- Is made of materials that are strong enough to resist damage when stacked (within specified limits).

Consider the following questions carefully. Your answers should help you to make an appropriate choice.

- How will the product - or the product in its primary packaging - fit into the distribution packaging? Will it add to the strength and rigidity of the distribution pack? Will it damage the distribution pack in any way? Will it be adequately protected?
- How will the packaging work within the production line context? A fully-automated, high-speed packing line will only be able to handle certain types of packaging and adhesive (eg wrap-around corrugated and hot-melts). A manual packing process offers much more flexibility in terms of the type of packaging that can be used.

- How will the pack be stored and distributed? Will it go into a larger outer pack? Will it be palletised? Will shrink-wrap be applied, either manually or automatically? Will a re-usable packaging system be used? Will a fork-lift be used? Will the packaging be stacked or racked? How big will the lorry be? Will your customer break the pack into smaller units for onward distribution?

You are more likely to make a better choice if you work closely with your packaging designers, engineers, suppliers, customers and distributors. Many companies make use of the NAMAS accredited physical, analytical and material testing laboratories and distribution test house at Pira International - the UK's independent packaging association. Others carry out their own practical trials. In most cases both laboratory tests and distribution trials are necessary before new packaging systems can be approved.

### 3.1.2 Destination and end use

It is also important to understand the packaging's final destination and end use. Will the pack be returned to you or re-used by your customer? Will it always be used for the same purpose?

So-called one-trip packaging can often be re-used safely at least once. For example, the drums used for transporting chemicals must have sufficient additional strength to provide an appropriate safety margin and hence can often be re-used many times. If your packaging is likely to be re-used - even once - it may be appropriate to design for this. In some instances, simply adding 10% to the thickness of the material may allow/encourage re-use.

If your packaging is unlikely to be re-used, your best environmental option is to design true one-trip packaging, ie packaging that only meets the requirements of a single journey.

There are no simple rules. It is a question of making the trade-offs between packaging avoidance, optimisation and re-use that are relevant to your circumstances and those of your customer.

### 3.1.3 Materials

There is no such thing as the 'best' packaging material. You should select your materials and packaging types to combine fitness for purpose with the minimum environmental impact. There are however, certain material characteristics that you should take into account when deciding which packaging to use, and these are highlighted in the following discussion of corrugated board and expanded polystyrene (EPS).

#### ***Corrugated board***

Corrugated board is cheap, reasonably light and flexible: it offers good product protection, can be re-used and is easy to recycle. Furthermore, it is relatively simple to alter the design of corrugated packaging: the lead time involved is much shorter than that required to re-tool for plastic mouldings.

Corrugated board comes in various forms, from coarse-fluted tri-wall and double-wall designs to smooth micro-fluted designs that provide excellent printing surfaces. It generally contains a high proportion of recycled materials (70% in the UK) and comes, in any case, from a renewable source (trees).

Cases made from corrugated board are collapsible and therefore efficient to transport.



### **Expanded polystyrene**

Expanded polystyrene (EPS) is light (98% air) and strong (under compression). It offers extremely good cushioning and thermal insulation. It is also resistant to moisture, salt, numerous types of acid and most oils, but does dissolve in certain organic solvents.

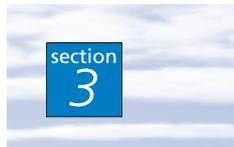
Expanded polystyrene comes from a non-renewable source, and most EPS packaging generally contains only a small amount of recyclate. Recycling schemes are now in place throughout the UK, although the storage and transportation of such low density material still presents a barrier (a heavy goods vehicle can, typically, carry only 0.5 tonnes of EPS).

#### **3.1.4 Standardised or bespoke packaging?**

Packaging standardisation can offer various benefits - economies of scale, flexibility, reduced warehousing needs, etc. However, the more standardised packaging becomes, the less well it tends to suit the product: this often means more wasted space and a greater use of filler materials.

The alternative is bespoke packaging in which the packaging is designed to match the requirements of both the product and the manufacturing/distribution system. Industry Example 2 shows the considerable potential benefits of bespoke packaging in a particular application.

Choosing between standardised and bespoke packaging can be difficult. Standardisation is more likely to benefit companies with a large product range involving relatively little variation in size and shape. Bespoke packaging is more likely to be the best approach where companies have a small but varied product range. For many companies there is no simple answer. They will need to assess the costs and benefits of each approach and make their decision accordingly.



## **3.2 ELIMINATING OR REDUCING THE NEED FOR PACKAGING**

You can sometimes eliminate or reduce the need for packaging, eg by changing your working practices or introducing a new item of equipment. Some possible options are outlined below, and details of a practical waste minimisation programme by Ambler of Ballyclare in Northern Ireland are given in Good Practice Case Study (GC89) *Reduced Packaging Brings Significant Savings*, available free of charge through the Environmental Helpline on freephone 0800 585794.

### **3.2.1 Changes in product design**

Sometimes, a minor alteration in product design, eg a slight change in a dimension or a material, will allow you to make significant reductions in the packaging used to protect it. For example, modifying the primary packaging for a liquid product may enable better utilisation of secondary packaging. Ask yourself whether your products really need to be as fragile as they are, or as awkward a shape.



### Ceramics company rationalises packaging supply to save money

During 1994, following a rise in corrugated board prices, the Dudson Group (a Midlands ceramics company) set up a team to examine board purchases against the amount of product packed. The team, led by the System Resources Manager of Dudson Armorlite, was tasked with producing a spreadsheet that clearly identified the product, the associated packaging and its unit cost.

The team knew that the two divisions/sites (Armorlite and Duraline) packed almost identical products differently. With the help of the spreadsheet analysis, the following facts were established:

- Six boxes at each site had different part numbers but were physically identical and from the same supplier.
- The supplier was charging the two sites differently for the same product, due to the quantities purchased.
- Four boxes at each site were very similar in size and could be standardised, reducing by three the total number of box types used.
- One product range (Holloware), which is produced by both divisions, was packed differently at each site (12 pieces per pack at one site, six pieces per pack at the other). Eliminating this practice would allow a further reduction in the number of box sizes used.

As a result of this analysis, the Company has been able to rationalise its packaging supply by increasing the number of packaging items common to both sites. **Improvements in the associated economies of scale have reduced packaging costs by around 15%, saving the Company approximately £25 000/year.** Other benefits include:

- greater flexibility, reducing the possibility of packaging shortages;
- faster turnaround of packaging, keeping it and the stores cleaner;
- less need for segregation during storage, thereby reducing warehousing requirements and freeing up space for production activities.

The Company is now investigating the benefits of just-in-time packaging delivery and design optimisation. It has also found its spreadsheet database to be extremely useful in calculating its obligation under the packaging waste regulations.

### 3.2.2 Improved handling

Improved product handling, as a result of employee training or improved equipment, can reduce the risk of product damage and hence the need for packaging.

#### Textiles companies eliminate/reduce the use of plastic bags for the supply of yarn

Several UK textiles companies have eliminated or reduced their use of plastic bags for the supply of yarn. Cones of yarn were originally packed in individual plastic bags within a sealed cardboard case. Most companies now find that one large plastic bag is adequate. In the case of darker coloured yarns, where the risk of noticeable contamination is small, it is possible to dispense with plastic bags altogether if the cardboard case is well sealed with tape. Many companies have adopted this simple measure and achieved substantial cost savings in relation to both material and waste disposal costs.

### 3.2.3 Just-in-time delivery

Just-in-time delivery usually means that the product spends less time in the warehouse. It is therefore less likely to become contaminated and/or suffer damage, and this can minimise both the amount of packaging required and the level of packaging specification. For example, because packs are less likely to be stacked, JIT delivery minimises the need for compression strength.

### 3.2.4 Bulk delivery

Liquids and powders can often be delivered in bulk. This eliminates the need for drums, intermediate bulk containers (IBCs), etc.

### 3.2.5 Alternative on-site handling and distribution

You may be able to dispense with on-site (internal) packaging by using alternative techniques for moving products around your site. Liquids and powders, for instance, can be piped, while certain light materials such as wool can be moved pneumatically. Even delicate solid objects can be transported using conveyors (see Industry Example 1).

## 3.3 PACKAGING OPTIMISATION

Optimisation means matching the level of packaging to the level of protection required and is perhaps the most important approach to packaging management in that it tackles the root cause of material wastage. Optimisation involves both good packaging design and appropriate working practices in its use.

### 3.3.1 Good packaging design

Although great strides have been made in recent years through the so-called 'lightweighting' of primary consumer packs, much less has been achieved in relation to transit packaging and, in many instances, the grade of material used (eg corrugated board) is still too heavy.

It is possible to optimise packaging design by giving proper consideration to:

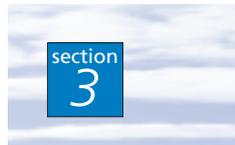
- the format of the container/collation unit;
- the size and shape of the container;
- the type and grade (eg thickness) of the material used.

You can use computer-aided design (CAD), and sophisticated analysis and prototyping techniques to optimise the design process. These allow you to assess the effect of a specific design change, eg varying the thickness of a plastic moulding, and to calculate the stresses as loads are applied. Many packaging suppliers already use these techniques for designing primary packaging such as detergent bottles.

The installation of new automated packaging equipment may provide you with an opportunity to redesign your packaging to meet better the needs of your product.

The aims of design optimisation can be summarised as follows:

- to achieve fitness of purpose;
- to minimise the amount of packaging material used per item of product;
- to maximise the amount of product per pallet/container/lorry;
- to maximise the amount of product in a given warehouse storage area.



### 3.3.2 Appropriate working practices

Poor working practices in relation to packaging are often of the 'belt and braces' kind. They result, in many cases, in products being packaged in an unnecessary number of layers (the 'Russian doll' effect). For example, goods are often wrapped in plastic bags within boxes that are then filled with polystyrene filler: these boxes are then packed into larger boxes, which are stacked on pallets, wrapped in plastic film and loaded onto lorries. Removing at least one of these levels of packaging could save money and reduce the number of handling steps. You may even be able to use some of your in-house containers for delivery to customers. Both the example below and Good Practice Case Study GC89<sup>2</sup> address this type of issue.

#### More efficient packaging of cloth pieces

A small spinner/weaver in Lancashire used to pack several individually wrapped cloth 'pieces' in a single polypropylene (PP) bale. Pieces are now only wrapped individually in polyethylene (PE). There are several benefits:

- Polypropylene is no longer purchased and has been eliminated as a waste stream.
- Pieces can now be carried by hand: the original bales had to be moved using a crane.
- Bales do not have to be sewn, thereby reducing both labour costs and expenditure on bale hooks.
- More efficient use is made of container and aircraft hold space, reducing transport costs and permitting a lower export price.

The reduction in packaging material purchase and waste disposal costs alone has saved the company several hundred pounds per year. Improved use of labour and lower transport costs are saving thousands of pounds each year.

### 3.3.3 Optimisation tips

It is clear from the above that those who are responsible for specifying and designing a transit packaging system need to examine each type of packaging proposed and answer some pertinent questions.

#### **Boxes/cartons**

*Do you really need to use a box?* In some cases shrink-wrap can be more efficient. Sainsbury's, for example, has estimated that shrink-wrap can offer the same level of protection as a corrugated box for some of its products, and for only 30% of the weight.

*Is your box of the optimum design?* Do the flutes run vertically, thereby providing the maximum compression/stacking strength? Could you reduce the size of box required by re-orientating the product within the box or using less filler? Could you alter the box dimensions to reduce the amount of material required, while maintaining the same enclosed volume?

<sup>2</sup> *Reduced Packaging Brings Significant Savings* is available free of charge through the Environmental Helpline on freephone 0800 585794.

## Minimising material use: a design example

It is possible to reduce the amount of material required to manufacture a box, without reducing the volume, by altering the dimensions, as summarised below.

A low, wide box 300 mm long, 300 mm wide and 150 mm high has a volume of 0.0135 m<sup>3</sup> and requires 0.556 m<sup>2</sup> of material (a 1 209 mm x 460 mm sheet) in its manufacture.

By altering the dimensions to produce a tall, slim box, 300 mm long, 150 mm wide and 300 mm high, the volume is retained, but the amount of material required falls by almost 25% to 0.418 m<sup>2</sup> (a 909 mm x 460 mm sheet) as a result of the more efficient cutting/construction that this arrangement allows.

NB: Because the boxes are constructed with the flutes running vertically to provide strength, the same effect cannot be achieved by turning the low, wide box on its side.

The change in dimensions examined above has an additional benefit. It increases the loading potential of a 1 200 mm x 800 mm pallet by 25%, from 48 of the low wide boxes (six layers of 4 x 2) to 60 of the tall slim boxes (three layers of 4 x 5).

*Is the box space fully used?* It is essential to minimise any empty space both between the packaged items and in the 'head' of the box. This is fundamental to reducing your distribution costs. If the head space is greater than 5 - 6 cm you should probably be using a smaller box. Computer software is available for calculating which items fit best in which order so as to maximise the use of box space. Industry Example 4 describes such a system.

### **Drums and intermediate bulk containers**

*Have you considered the alternatives to steel drums?* Steel drums offer a number of important advantages in many applications, including strength and durability. However, depending on your actual requirements, it might be worth considering lighter and less expensive alternatives for the distribution of fluids and of fluidic materials such as powders and beads. Essentially there are three other options:

- Plastic drums and containers are a lighter (8 kg rather than 18 kg for a 210-litre drum), re-usable (15 or more trips are achievable), recyclable and long-lasting (rust-free) alternative to steel. They are usually made of high density polyethylene (HDPE), which is very resistant to attack from chemicals such as hydrocarbon solvents, although it is important to make sure that the plastic used is appropriate for the chemical to be transported.
- Intermediate bulk containers, with a typical capacity of 1 000 litres, fit well onto standard pallets. Being approximately cube-shaped, they use transport space efficiently and offer stable stacking. They represent a good delivery compromise between drums (which are flexible in use) and tankers.
- Corrugated drums can be used for dry fluidic materials (like plastic polymer beads) that tend to bulge out ordinary rectangular corrugated cases. Corrugated cases are obviously much lighter than steel drums, can offer improved transport efficiencies because they use space more efficiently, and can be re-used and easily recycled.

*If you do need to use drums, are they of the optimum design?* Drums should be as lightweight as possible (within the usual fitness-for-purpose constraints), and their construction should take into account whether or not they will be re-used. Techniques such as improved seam construction and blow moulding have encouraged innovation in drum design, with the result that many steel and plastic drums are considerably lighter than they used to be. Ask your supplier about drum weights and construction.

If the drums are to be used for the transport of dangerous substances, make sure that they meet the relevant UN Recommendations.

### UN Recommendations and UK CHIP Regulations

The UN Recommendations set out standards for hazardous materials packaging in what is known as the 'Orange Book'. UN-certified packaging is performance-tested to different levels that correspond to these standards. In the UK, this testing is undertaken only by NAMAS-accredited laboratories. Certificates are issued by Pira International acting on behalf of the Department of the Environment, Transport and the Regions (DETR).

Packaging for certain chemicals supplied in the UK also has to meet the Chemicals (Hazard Information and Packaging for Supply) Regulations 1994 (known as CHIP 2). These cover labelling, safety data and safe packaging. Carriage requirements are covered by the Carriage of Dangerous Goods (Classification and Packaging, Labelling) and Use of Transportable Pressure Receptacles Regulations 1996. Full information is available from the Health and Safety Executive (see Appendix).

#### **Collation packs**

*Are collation trays necessary?* Many companies are finding that shrink-wrap alone is adequate (see Industry Example 4).

*Can you alter formats or quantities?* Putting more items into a box (ie larger denomination packs) can reduce the consumption of packaging material, while simply changing the pack format can also bring significant benefits (see Industry Examples 1 and below). It is worth asking your customers whether an increase in pack size would be acceptable to them and whether it would create any warehousing or transport problems.

### The benefits of more efficient collation formats

Working with one of its main customers, CCL Custom Manufacturing, a packer-filler company in Scunthorpe, devised a more stable and trayless collation unit for its canned hairspray products. This involved switching from a 3 x 4 shrink-wrap format to a 6 x 2 format. This simple change reduced the amount of shrink-wrap used, increased the amount of product carried per pallet load by 10% and, as a result of the increased stability, allowed double stacking on vehicles. Material and transport savings have been significant.

#### **Filler material**

*Can you reduce or eliminate the use of filler material by altering box design?* If vertical loads and jolts are not a problem, you may be able to use filler material in the lateral spaces only, thereby eliminating the use of head-space filler. Some companies have eliminated filler materials such as EPS altogether by using new wraparound boxes and other designs.

You may, in some cases, be able to use corrugated board partitions to provide the separation cushioning required. Even the most delicate of objects, such as electronic lightbulbs and glasses, can be protected in this way.

### **Packaging design alteration eliminates the use of EPS filler**

Polaroid, in Scotland, has completely eliminated EPS from camera display boxes and multi-camera transit boxes by replacing thin cartonboard boxes with a sturdy microflute corrugated design. Pira International trials have shown that the new box provides the same level of protection as the old carton/EPS combination. The change has also significantly reduced the size of the box, allowing far more units to be shipped in the same palletised volume. This one measure is saving the Company more than £200 000/year.

Details can be found in Good Practice Case Study (GC131) *Profit from Packaging Changes*, available free of charge through the Environmental Helpline on freephone 0800 585794.

*Are corrugated separators being used in the optimum way?* The side walls of a corrugated box provide vertical compression or stacking strength, so any separator flutes used should run horizontally to provide lateral strength. Partitions should protrude a little above the inside depth of the box to ensure that they are held firmly when the box lid is closed.

*Is the best filler material being specified/used?* In some instances, a paper ruffle material or used corrugated board may be both an adequate and a cheaper alternative to EPS blocks, foam and loose fill (see Industry Example 3). The use of one type of material also facilitates material recycling.

Moulded fibreboard, airbags, etc are also effective for certain types of product and distribution system. Low density foam is usually of limited use.

### **Re-usable paper filler materials eliminate the use of polystyrene beads**

In February 1997, an electronics company near Manchester replaced its polystyrene bead product packaging with crushed paper. The company, Zetex, now purchases rolls of inexpensive recycled paper which are crushed into a concertina ruffle by a small dedicated machine. The machine cost a few thousand pounds, but the savings in material costs resulted in a payback period of only seven months. In addition, the paper ruffle is able to withstand several trips and is regularly re-used in packages transported between Zetex and its sister company in Germany.

#### **Box closures**

*Can you avoid using staples?* As well as sometimes causing injury to the individual opening the box, staples usually result in the box being torn, reducing the possibility of re-use. Staples can also make a box more difficult to recycle.

*Is it really necessary to use adhesive tape as a closure?* If contamination and theft/damage are unlikely to be a problem, you may be able to close a corrugated box simply by interlocking the flaps. As well as reducing the use of expensive adhesive tape, this approach again makes recycling easier.

Where adhesive tape really is necessary you may be able to:

- optimise the amount of tape applied by using an automatic taping machine (see Industry Example 3), by selecting an appropriate tape width (5 cm is usually adequate), or by only using H-shaped taping, ie taping along the open edges as well as along the flap join, when the box contains a heavy load or where dirt must be prevented from entering the box;
- use H-shaped taping to provide a seal in place of internal plastic bags;
- use kraft paper tape rather than plastic tape to facilitate recycling;
- take advantage of any improved box rigidity associated with tape use.

*Is strapping a better option?* Plastic strapping or banding is often the better option where a box has a separate/detachable lid and/or base. Edge protectors are only needed for high strapping loads, eg when attaching the box to a pallet.

*Is it possible to use removable plastic tabs to lock the base and top to the rest of the box?* This is becoming an increasingly common approach for large boxes where re-use may be necessary (eg computer equipment packaging).

### **Shrink-wrap, stretch-wrap and plastic bags**

*Can you use a different thickness of material?* Many companies find that they can reduce the grade of material used, say from 50 µm to 30 µm, without any reduction in product protection (see Industry Examples 3 and 4).

*Could a different polymer provide the same level of protection at a lower cost and/or weight?* Some plastic wrapping materials are far stronger, eg in terms of stretch and puncture resistance, than others.

### **Pallet loads**

*Is the pallet area fully utilised?* Keeping to ISO standard box footprints will ensure this. For example, you can get four 600 mm x 400 mm boxes on a 1 200 mm x 800 mm pallet and five of them on a 1 200 mm x 1 000 mm pallet. Palletisation software will help you to optimise the load: it will also allow you to assess the implications of possible changes in box dimensions.

### **The benefits of switching from roll cages to pallets**

In 1988, Safeway, the supermarket company, began to phase in pallets as a replacement for roll cages. The benefits have been considerable and include:

- an increase of up to 40% in the load carried per vehicle;
- a reduction in the amount of product damage;
- more options for back-hauling used packaging from stores and products from suppliers.

The Company is also benefiting from the use of slip sheets (see below) in the distribution of wines and spirits.

*Is the load stabilised efficiently?* Using stretch-wrap for pallet load stabilisation can be wasteful. In many cases the amount of overlap (roping technique) and the number of complete layers is excessive. Where the use of stretch-wrap is essential, make sure that the amount used is appropriate for box size, weight, stack height, etc. Low stacks of lightweight items, for example, normally need less stretch-wrap than high stacks of heavier items. Furthermore, machine-applied stretch-wrap is generally more effective than manually applied stretch-wrap and provides a better quality (more uniform) wrap. Effective and efficient pre-stretch pallet wrapping machines are now available for this purpose.

In some instances you may find that shrink-wrap or strapping/banding is a better choice. You can use strapping to attach the load firmly to the pallet and to put loads into compression, thereby stabilising them further. Vertical strapping, for instance, can be used in conjunction with layer pads and trays to provide stability to a stack of glass bottles. Strapping can also be used to stabilise very heavy loads such as engines and gearboxes.<sup>3</sup> Steel, as opposed to plastic, strapping is necessary only for particularly heavy loads.

<sup>3</sup> Details can be found in Good Practice Case History (CH75) *Packaging Redesign Increases Profits and Efficiency*, available free of charge through the Environmental Helpline on freephone 0800 585794.

You can also stabilise loads using:

- spot gluing;
- adhesive tape;
- clips (eg for open boxes and trays).

You can use fork-lift load stabiliser attachments, which exert pressure from above or from the side, to keep a load stabilised during movement. This might eliminate the need for stabilisation packaging.

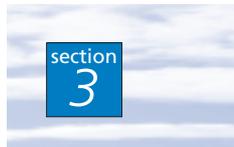
*Is the pallet of the optimum design?* If the pallet is not part of a closed-loop re-use system, there are ways of minimising its material content. Lightweight, one-trip wooden pallets are now available that weigh up to 10 kg less than a regular pallet. New corrugated-board pallets have also recently been introduced. These are very strong and light (typically around 2.5 kg for a two-way 1 200 mm x 1 000 mm pallet) and usually contain a high proportion of recycled material. They are particularly attractive to those using air freight where weight is crucial.

Try to ensure that wooden pallets have been correctly manufactured from the appropriate materials. Companies that are members of TIMCON (see Appendix for contact details) should provide pallets of a high standard that meet your specifications.

*Is it possible to eliminate pallets altogether?* While particularly light loads can be moved by hand (as long as they fall within health and safety limits for manual handling), you may be able to move quite heavy loads using slip sheets and push-pull units. Slip sheets are plastic or corrugated sheets that can be placed under loads as an alternative to a pallet. They are handled using a special type of fork-lift attachment called a push-pull unit. This hydraulic device allows loads of more than two tonnes to be pulled onto polished platen forks, lifted and then pushed off again. While the attachment typically costs around £6 000 and load handling can be a little slower than with a conventional fork-lift, there are many advantages:

- much lower palletisation costs (a pallet typically costs £7, a slip sheet £1 - £2);
- lower transportation weights (a typical pallet weighs around 30 kg, a slip sheet less than 2.5 kg), better fuel efficiency, less pollution and lower distribution costs;
- the potential for improving the use of vehicle/container space by up to 10%, thereby reducing distribution costs;
- a reduction in waste disposal or pallet return costs.

Independent research in the USA has shown that, over a five-year period, the cost of a slip-sheet system is, typically, only 25% that of an ordinary pallet system. Slip-sheet systems are particularly attractive where transport costs are high, eg for overseas shipments.



Dedicated re-usable packaging systems, ie those designed for many years of use, are becoming increasingly common in the UK, both within industry and in the retail sector. Systems of this type include:

- pallets and pallet systems;
- drums and IBCs;
- separators, layer pads and collars;
- slip-sheet and push-pull systems;
- plastic boxes;
- metal crates and stillages.

Closed-loop systems, where back-haulage allows the packaging to be readily returned for re-use, provide the most economic and environmentally responsible conditions for packaging re-use. Re-usable systems are also effective where transportation distances are relatively short. However, packaging re-use is much less appropriate where clients or suppliers are overseas and the loop cannot be closed easily. In these cases, lightweight one-trip packaging is likely to offer the better solution.

**Further details about the design and management of re-usable packaging systems are given in Good Practice Guide (GG141) *Choosing and Managing Re-usable Transit Packaging*, available free of charge through the Environmental Helpline on freephone 0800 585794.**

Packaging re-use is not only applicable to dedicated systems, many opportunities exist for re-using so-called one-trip packaging. To decide whether or not you could encourage greater packaging re-use, answer the following questions:

*Are your customers happy to have products delivered in re-used packaging?* Re-used packaging is likely to look less attractive cosmetically than new packaging because of normal wear and tear in service. This may be irrelevant to some or all of your customers provided the packaging does its job properly and is clearly marked. In other cases, re-used packaging could reflect badly on your company's image unless you explain that it is a deliberate environmental policy on your part. It is clearly important to involve customers and get their approval before you introduce packaging re-use. Possible approaches include:

- sharing the benefits by charging customers less for products delivered in re-usable containers;
- making packaging re-use a positive feature by labelling it appropriately, thereby demonstrating your 'green' credentials.

Waste Exchange Services, a company specialising in recovering waste plastics and other materials for re-use, has suggested that companies could attach a label that includes their company logo and a message such as 'THIS BOX IS BEING RE-USED TO REDUCE THE IMPACT ON THE ENVIRONMENT'.

Labelling in this way can also give you the opportunity of re-using packaging from other companies without causing confusion. You can buy used and reconditioned packaging (cardboard boxes, etc) for about one-third of the new price: this not only minimises your packaging costs, it helps to stimulate the market.

*Can nominal one-trip packaging be re-used?* In many cases, what is nominally one-trip packaging is sufficiently durable to survive several trips. If you adopt this approach, you will need to inspect the packaging as it comes on site and either refurbish or reject sub-standard containers that might fail during subsequent use. If the proportion rejected is - or becomes - high, then re-use is unlikely to be a cost-effective option.

If re-use involves returning the packaging to the supplier or recovering your own product packaging, you will also need to consider the effort involved in collection and return. Is back-haulage an option? Will your customers collect and store packaging ready for return?

Don't be put off initially by the work involved in setting up a system. The benefits of packaging re-use can be considerable.

### **Benefiting from the re-use of corrugated trays**

In the UK, Lever Brothers' bottle suppliers deliver empty plastic bottles to the factories in collapsible corrugated trays. These trays are re-usable and last, on average, for about four trips. This means that, of the 1 200 tonnes of corrugated trays required annually for bottle delivery, 900 tonnes are now eliminated from the waste stream as a result of re-use. The associated cost saving is around £900 000.

### **Re-using corrugated multipacks**

In the mid-1990s, Brook Hansen, a manufacturer of small industrial motors, switched from using individual motor packs to corrugated multipacks, thereby reducing both packing time and material wastage. The multipacks, which were designed in collaboration with both the corrugated suppliers and the customers, contain up to 45 motors. Separation is achieved using internal fluted divisions. Although designed to be one-trip cases, the packs have been found to withstand up to five trips without damage to the motors, and Brook Hansen has now established a closed-loop system for most of its customers. In addition, some customer stillages have been adapted to hold up to 16 motors.

The net result of this change is a reduction in packaging material costs to as little as 50p/motor, giving weekly savings of around £200. There have also been savings in labour costs.

These savings have helped Brook Hansen to offset increased operating costs in other areas, while customers have benefited from reduced waste disposal costs and a reduced obligation under the packaging waste regulations.

*Can any of your packaging be multipurpose?* New corrugated and plastic transit cases are now available that double as in-store display cases, and several of the large retail chains now use such transit packaging, sometimes in conjunction with a pallet-style or wheeled base.

*Could any of your packaging be re-used on site or by other local companies?* You may be able to re-use the cardboard boxes and plastic bags in which raw materials or components are supplied in one of several ways:

- to package the final product (eg as filler material);
- to transport the product around the site;
- to store waste materials.

This type of re-use often requires careful thought and planning if it is not to be counterproductive, for instance by causing product contamination.

You may find that neighbouring or sister companies can make use of used packaging. There are various local and nation-wide waste exchange schemes, environment business clubs, waste

minimisation clubs, etc that can facilitate such exchanges. The Environmental Helpline (0800 585794) can provide more information on such schemes and clubs.

*Does the design of your product packaging or that of your suppliers discourage re-use?* You may be able to encourage the re-use of corrugated cases by eliminating staples and using perforations for easy opening. You may also be able to reduce the range of pack sizes and colours and/or move towards packaging standardisation. You may be able to use label pouches to allow easy removal and replacement of labels.

### **Designing for re-use reduces corrugated case requirements**

Lever Brothers found that occasional promotions within the UK required product to be modified and repacked after it had left the factory. In the past this meant the destruction of the original wraparound cases and the repacking of products in new (0201-style) cases. The Company investigated the options with its corrugated case suppliers and has now adopted a new corrugated wraparound case that incorporates perforations along the top panel. This effectively converts the case into a pseudo-0201 case and allows it to be opened for repacking and then resealed using tape.

This design change essentially halves the amount of packaging required. In one recent promotion involving 600 tonnes of fabric liquid, the new design reduced the quantity of corrugated cases required by about 16 tonnes and achieved packaging cost savings of approximately £14 000.

*Can you modify your existing packaging to encourage re-use?* One-trip packaging is normally less robust than containers designed specifically for re-use: it is chosen to be as inexpensive as possible and to use relatively flimsy materials (typically cardboard or thin plastic). However, you may be able to modify your existing packaging so that it can be re-used. This usually involves adding components that will increase its durability, strength, and resistance to damage, or improve its resistance to contamination and make it easier to clean between uses. Modifications might include:

- Adding protection, eg edge protectors, to cardboard boxes at the points most vulnerable to damage. These protectors are usually made of stronger materials such as plastic or metal, and take the form of edging strips and fitted corner pieces with a 'V' cross section.
- Replacing chipboard end-plates on wooden pallets with plastic ones that are more robust and have a longer life.
- Using plastic liners to extend the useful life of a steel drum. This means that the condition and cleanliness of the drum's inner surface is no longer critical because it is not in direct contact with the product. Liners are normally easier to clean between uses and, even if disposed of frequently, should have less environmental impact than drum disposal. In some cases, liners reduce the amount of product left in the container after emptying, thereby improving raw material use.
- Using some form of internal container cushioning, eg corrugated paper ruffles or moulded paper pulp inserts and wood wool.
- Applying a new external finish to refurbish existing containers, eg galvanising steel drums, treating wooden pallets with wood stain, or applying a plastic coating to boxes to make them water resistant.
- Grouping existing containers into a new, re-usable container such as a wheeled roll cage. This will protect boxes and improve stackability. Furthermore, although it introduces an additional handling step at both ends of the distribution chain, it makes handling and loading/unloading easier. Disadvantages include a poorer use of lorry space and, sometimes, the difficulty of ensuring that roll cages are returned because customers find them very useful too.

Obviously, modification of one-trip packaging again requires careful consideration of the manufacturing and distribution context.

*Can you separate used packaging effectively at source?* Separating mixed packaging is a time-consuming activity and is generally uneconomic on a small scale.

*Can you minimise contamination of used packaging to encourage re-use and reduce disposal costs?* The careful emptying of drums, for example, will improve the chances of those drums being taken for reconditioning. In some cases, it can even mean that a drum that contained chemicals is classified as ordinary waste rather than special waste.

*Can you set up a system for preparing drums and other liquid containers for re-use?* Some companies are benefiting greatly from the on-site drainage, washing, relabelling and re-use of drums and other containers. An example of how a company has made substantial savings from re-using drums can be found in Good Practice Case Study (GC16) *Sites Set on Cost Savings*, available free of charge through the Environmental Helpline on freephone 0800 585794.

*Can you make use of reconditioned and other used drums?* CEN (European) standards, covering sizes, closures, etc, have been developed to encourage drum re-use throughout the EU. In the UK, at least 64% (by weight) of steel drums and more than 15% of plastic drums are already reconditioned for re-use. You can help to increase these percentages.

### **Profiting from the use of reconditioned drums and pallets**

A major US company is reported to be saving nearly \$2.3 million each year by reconditioning 150 000 drums for re-use rather than using new drums. The company is saving a further \$530 000/year by repairing and re-using damaged wooden pallets.

*Can you sell your packaging for re-use rather than for recycling?* You may be able to sell your waste corrugated cases to a cardboard box merchant for re-use rather than to a paper/board merchant for recycling. This will maximise your revenue. Similarly, you may be able to send used drums for reconditioning and sell wooden pallets to a pallet merchant.

*Can you give your waste packaging away for re-use by others?* If you cannot profitably re-use your packaging yourself or sell it for re-use or recycling, it may be appropriate to give it away. You could donate it to schools, scout groups, theatres, etc, or to the many not-for-profit scrap stores in the UK. Although this approach does not bring in any income, you will reduce the volume of general waste and the associated disposal costs. You will, however, need to investigate the implications for your Duty of Care for disposal of waste.

Once you have minimised your use of packaging and considered every opportunity for packaging re-use, your next option is to collect and sell materials for recycling. This is a very acceptable option in many cases: it provides a source of income, and it reduces waste disposal costs. Furthermore, you will find that many waste materials can be sold, or at least removed free of charge, if you identify the right merchant, recycler or waste exchange company. The careful storage and stockpiling of materials will help you to secure an acceptable price.

You can help to establish your own policy towards recycling by providing answers to the following questions:

*Are you using recycled materials wherever this is practicable (paying due regard to hygiene, performance, etc)?* As a packaging user, you can help to stimulate the market for recycled materials, which can be just as cost-effective as virgin materials, by specifying their use wherever possible. Technology is developing: in the area of plastics, for instance, co-extrusion can allow potentially contaminated recycled materials to be sandwiched between layers of virgin plastic. Furthermore, the use of recycled plastics in containers used to transport dangerous substances will be permitted in Europe from 1999.

*Is your packaging designed to encourage recycling?* Certain laminated (eg PE-covered) boards and adhesives (eg regular hot melts and cold seal) can cause serious problems for reprocessors. You may be able to use the newer low- and high-density hot melts that are easier to remove in the recycling pulp preparation process. In the plastics field, unpigmented plastics offer greater reprocessing flexibility.

Packaging that uses a mixture of materials, eg metal or plastic closures on cartons, can also present recycling problems. You can aid the subsequent recycling process by using only single materials, even to the point of specifying a single type of polymer (eg PP or PE) provided the functionality of the package can be maintained. Labels should also be of the same material as the rest of the package, or be readily removable by using low-tack adhesives or label pouches.

*Is the packaging correctly marked to indicate clearly the types of material used?* This is important to allow easy material separation from mixed waste streams. Plastics, for instance, can be embossed with the appropriate symbol eliminating the need for a separate label. A harmonised EU labelling system is currently being developed and this should be adopted when available.

*Can you effectively separate wastes at source to make recycling easier?* Many companies use colour-coded boxes around the shop floor to allow the easy segregation of materials. However, these boxes need to be close to the waste-producing process and certainly nearer than any true waste bin. The sorting of mixed waste is invariably uneconomic.

*Can you ensure that materials remain uncontaminated, thereby increasing their value and reducing disposal costs?* By carefully storing your waste in covered and clearly labelled skips, etc, you can help to prevent the mixing and contamination (eg by oil or water) of waste materials. Similarly, as indicated in Section 4, the careful emptying and cleaning of chemical drums may turn them from special waste into ordinary waste, again reducing disposal costs. The use of a disposable liner in such drums can reduce the amount of contaminated material for disposal as special waste and allow the drum to be re-used.<sup>4</sup>

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<sup>4</sup> Consult the appropriate regulator for full details (see Appendix).

*Can you dispose of contaminated materials cheaply?* You may be able to find suitable outlets for contaminated materials, thereby either reducing your disposal costs or even obtaining some revenue. Contaminated glass, for example, can sometimes be used for relining furnaces.

*Are you using the best types of skip?* Ask your waste management company if, instead of ordinary open skips, they can supply covered front-end-loader (FEL) or rear-end-loader (REL) units that can be emptied into a waste collection compactor vehicle. You will find that this is cheaper than having whole skips removed and replaced.

*Are you getting the most out of your skips?* Skips are often used inefficiently. Where you have several skips, make clear which are in use at any one time, if necessary locking those that are not in use. This should prevent all the skips being filled up at the same rate - and none of them being full on collection day. To reduce your costs, use the largest skips available: fewer skip lifts means cheaper disposal.

*Is it worth buying or leasing a baler, compactor or drum crusher?* A baler or compactor can reduce the volume of low-density general waste to about 20% of its original volume. You will need fewer collections and this will significantly reduce your waste disposal costs. Similarly, a drum crusher can reduce the volume of steel waste; many UK companies use a drum crusher.<sup>5</sup>

### **Segregation and the use of a baler significantly reduces disposal costs**

Prompted by the packaging waste regulations, Mailway Northern, a contract packaging company for UK food companies, investigated all aspects of its packaging, including waste disposal. The Company realised that, while corrugated transit cases were kept separate for disposal, all other packaging wastes were being thrown into a general waste skip. It immediately began to segregate these wastes, replacing the single large skip with three smaller units for, respectively, cardboard, plastic and general waste. Waste removal costs fell by 45%.

Mailway Northern is now recovering around 30% of its packaging, more than twice its 13.7% obligation under the packaging waste regulations. The Company has also installed a baler to reduce disposal costs further.

*Are you getting the best waste disposal deal?* Waste removal costs can vary greatly between waste management companies and you are advised to shop around for the most appropriate deal. Some companies offer waste minimisation services, and you may wish to take advantage of these.

*Do you produce sufficient waste to make the installation of an energy-from-waste incinerator or a combined heat and power plant a viable option?* Most packaging waste, and particularly plastic packaging, has a high calorific value, and large companies may be able to bring together the waste from several or all of their sites to make installing energy plant a feasible option. If you are interested in this approach it is advisable to talk to a specialist consultant who can assess the viability of such an idea and inform you of any financial support that may be available and the appropriate environmental regulations. The Energy Efficiency Best Practice Programme can also advise on this and can be contacted via the Energy Efficiency Enquires Bureau on 01235 436747.

*Could you purchase and operate high-value items such as a compactor or incinerator jointly with other companies?* This is likely to be the most practicable approach for companies that are part of a group or that have close relationships with companies in the local area, perhaps through a local waste management or minimisation 'club'.



<sup>5</sup> Details can be found in Good Practice Case Study (GC16) *Sites Set on Cost Savings*, available free of charge through the Environmental Helpline on freephone 0800 585794.

Employee training and awareness-raising is important in any quality management system, and this is certainly true of packaging management. You are more likely to optimise the process of improving your packaging management practices and maintaining those improvements if, at the same time, you implement a wide range of appropriate employee-related activities:

- Train all new packers and machine operators:
  - to operate machinery correctly (a legal requirement);
  - to use materials efficiently;
  - to follow quality-control and fault-recognition procedures and practices.

Thorough initial training is better than on-the-job training as the latter will inevitably result in production errors and therefore waste. Regular refresher courses can also be useful. Below are a few suggestions on how to involve staff at all levels in a packaging waste reduction programme.

- Provide employee training that emphasises the environmental and economic implications of waste as well as its health and safety aspects. Short lectures and site visits can really help employees to understand the issues and motivate them to do something about them.
- Make operators aware of the financial value of the materials that they are handling and of the environmental consequences of waste generation. Remember that it means more if you say, 'We can save £10 000 per year' than if you say, 'We can reduce waste by 1%'.
- Prepare written procedures and manuals that, for example, help employees to use equipment efficiently. Display written procedures on posters/charts close to the relevant area.
- Encourage employees to report changes in waste levels immediately and to talk to management about particular production problems. Operators usually 'know their machines' and are therefore in the best position to observe changes and recommend corrective action and improvements.
- Involve key employees in your waste minimisation teams to encourage ownership and the flow of ideas from operating staff.
- Establish a waste-saving suggestions scheme for all employees, preferably with a reward attached. Where a suggestion cannot be implemented, you should explain to the employee concerned why this is the case. If you fail to do this, the sense of motivation and participation can be lost.
- Provide feedback at all levels. Disseminate your findings about waste production, and publicise your waste minimisation progress reports prominently within the company. Noticeboards and newsletters can be a useful way of doing this.
- Recognise the achievements of your employees in relation to waste minimisation. If employees are doing well, tell them so: this will help to maintain their interest and motivation. If it is practicable, you may wish to consider a reward scheme that is linked to the savings being made as a result of the reductions in material use and waste production.
- If your company is a multi-site operation, encourage the environmental/waste representatives to meet/communicate on both a formal and an informal basis for the exchange of ideas and the dissemination of information.

## **Employee training and awareness-raising at Boots Contract Manufacturing**

Boots Contract Manufacturing adopts a comprehensive approach to employee training. Packaging developers, for example, are given extensive training through the Company's 'Environmental Challenge' course which addresses, amongst other things, design for the environment in general terms, and design for recycling.

As part of their training, the packaging developers are taken round a materials reclamation facility where packaging is manually and automatically separated for recycling. This gives the designers a more practical and focused view.

There are also site environment newsletters, describing waste minimisation and energy efficiency initiatives and the progress that is being made.

Accountability is also an important issue. It is important for employees to be made aware that they have a responsibility to minimise waste generation, thereby helping to maintain company competitiveness - and ensure their own job security. It can also be useful to make departments, divisions, etc accountable for the packaging they use and the waste they produce. This, again, encourages employees to focus on waste minimisation in their own work areas and to take responsibility for material use and waste generation.

Further information on staff involvement in a waste reduction programme can be found in Good Practice Guide (GG27) *Saving Money Through Waste Minimisation: Teams and Champions*, available free of charge through the Environmental Helpline on freephone 0800 585794.

The best way to make things happen is to adopt a systematic, continuous improvement approach. Fig 2 shows a simple sequence of steps that you can follow.

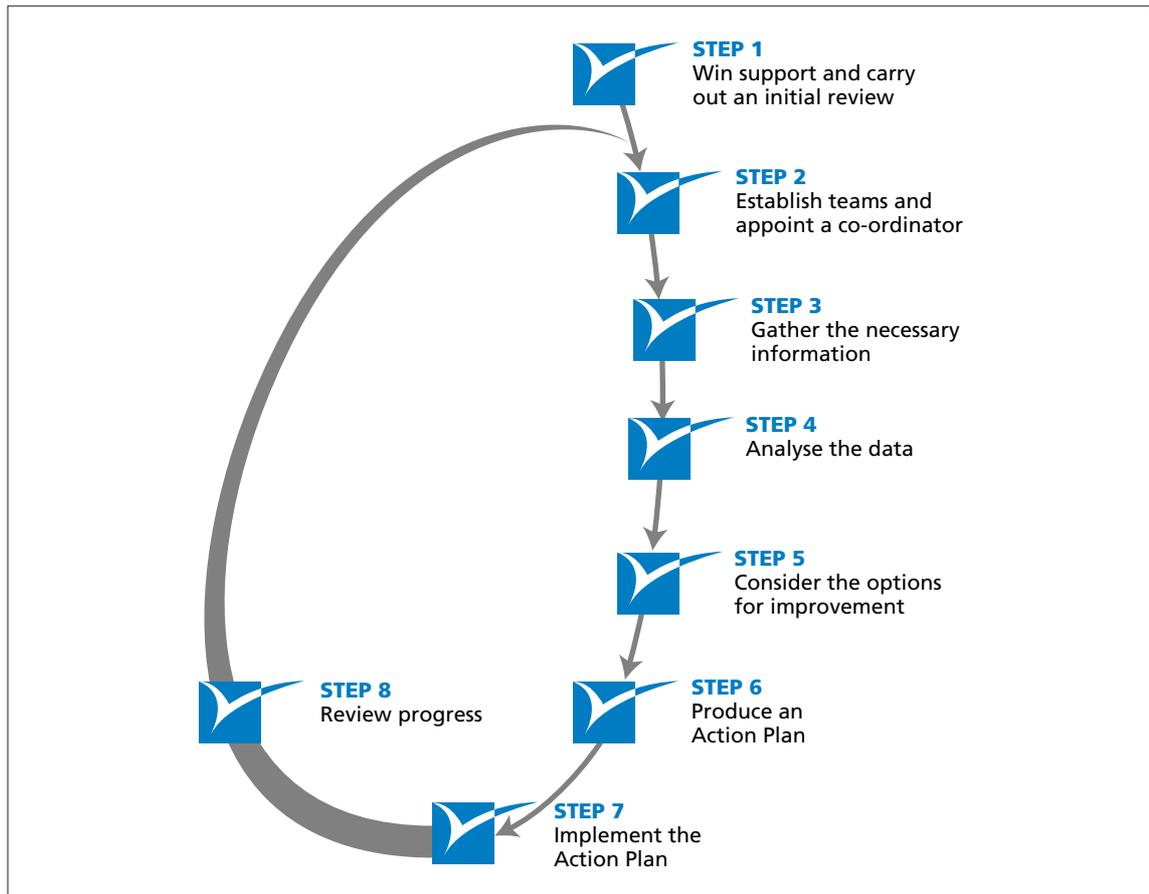


Fig 2 The systematic packaging management approach

## STEP 1 - WIN MANAGEMENT SUPPORT AND CARRY OUT AN INITIAL REVIEW

Your first step must be to convince senior management, for example the production director or the managing director, that packaging is an area that would benefit from a waste minimisation approach. This may be difficult without some supporting evidence gained in an initial review. You can undertake such a review as follows:

- Walk around the site and identify areas of waste (eg the excessive use of EPS by a supplier) and opportunity (eg the possible redesign of a corrugated box). The checklist following Step 5 should help. Guidance on how to do this can be found in the software package WMIT (*Waste Minimisation Interactive Tools - IT96*), available free of charge through the Environmental Helpline on 0800 585794.
- Estimate the approximate savings that might result from a few of the more promising measures identified. You will need to consider roughly how much material can be saved per unit (eg pallet load); the cost of that material and the total number of units involved per year. The worksheet following Step 6 should help in this respect.
- Present the potential savings to senior managers to gain their full support for further work.

## STEP 2 - ESTABLISH TEAMS AND APPOINT A CO-ORDINATOR

In most companies responsibility for, and the impact of, packaging and packaging waste is spread over a number of functions/departments. Your first essential step is therefore to establish a multidisciplinary team that includes representatives of as many of the following as possible:

- packaging designers and technologists/developers;
- manufacturing engineers and production schedulers;
- marketing and product development staff;
- procurement/purchasing staff;
- environmental/waste management staff;
- material and component suppliers;
- packaging suppliers;
- customers.

Not all members of the team will be involved at every stage of the process. However, all should be identified at the start and called upon as necessary.

If your company is too small to have packaging designers/technologists, you should ask your packaging suppliers for assistance.

In some cases, eg if there is more than one company site or division, you may need to establish more than one team.

It is useful to have one overall project co-ordinator or Champion to lead and facilitate the work. The person selected should ideally have:

- sufficient authority to make things happen - or direct access to someone with that authority;
- a good understanding of how all parts of the company operate, and appropriate personal contacts;
- an ability to listen to the views of others and make objective decisions;
- enthusiasm for and a belief in waste minimisation.

For most companies, particularly those small and medium-sized, there is no need for the co-ordinator's job to be a full-time appointment. For more information on this area, see Good Practice Guide (GG27) *Saving Money Through Waste Minimisation: Teams and Champions*, available free of charge through the Environmental Helpline on freephone 0800 585794.

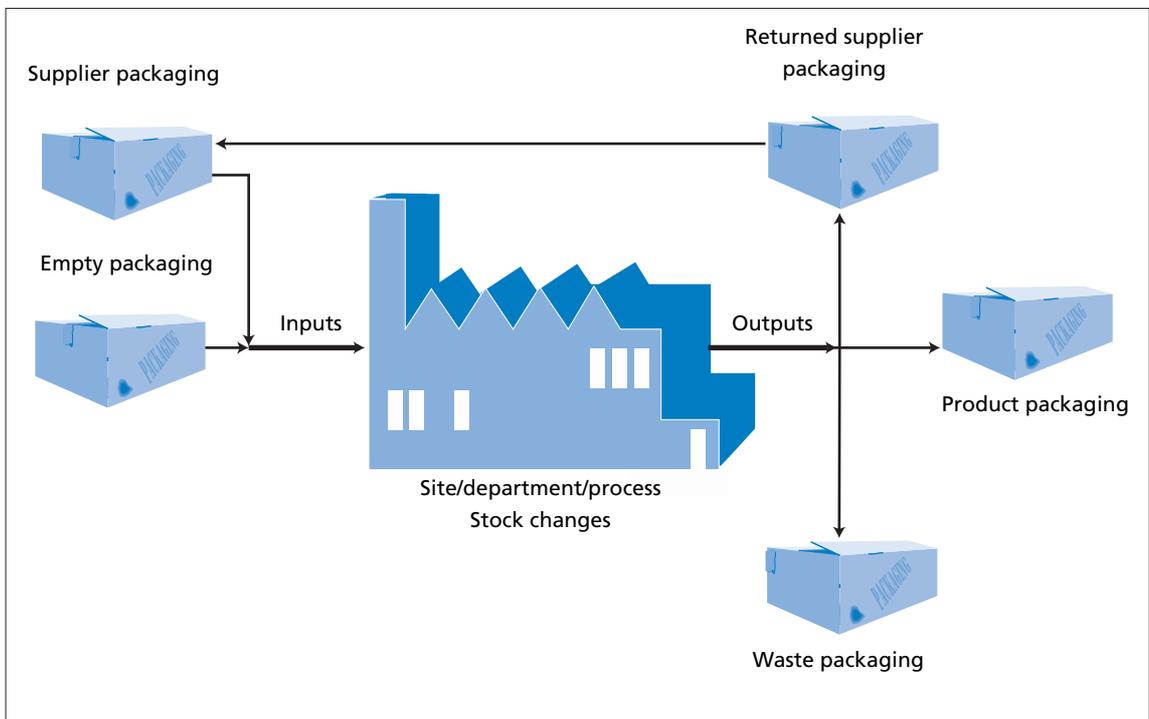
## STEP 3 - GATHER THE NECESSARY INFORMATION

Before you can make any improvements to your packaging management, you need to understand fully what packaging is used and where, and what packaging wastes are generated. To achieve this you must monitor your packaging use and disposal. **If you don't measure it, you can't manage it.**

Most companies have clear records of purchases and sales but cannot necessarily relate these figures to the actual quantity of packaging used. Until the advent of the packaging waste regulations, most companies had very little information about the weight and volume of packaging materials handled. Many companies are now obliged to report the weight of packaging handled, and many have established spreadsheets and databases that record the exact amount of packaging material associated with each product.

Think first about how packaging moves through your site. A schematic of a simple example is outlined in Fig 3, overleaf.





**Fig 3 Typical packaging flows**

To make sense of your packaging flows, consider the packaging inputs, outputs and stock changes (increases and decreases) separately.

In this particular example, your inputs consist of:

- packaging used by the supplier to provide parts, materials, etc for your operation;
- empty packaging (new or used) that is used to pack your product.

You can express your site packaging inputs as follows:

$$\text{Inputs} = \text{supplier packaging} + \text{empty packaging}$$

Your outputs consist of:

- Product packaging that is used in the onward movement and supply of your product.
- Supplier packaging that is returned to your suppliers.
- 'Waste' packaging. This usually includes waste supplier packaging, and waste product packaging from the packing lines, etc. This may be sold or disposed of to a waste contractor.

You can express your site packaging outputs as follows:

$$\text{Outputs} = \text{product packaging} + \text{returned supplier packaging} + \text{waste packaging}$$

Your stock changes consist of:

- changes in stocks of empty packaging;
- changes in stocks of supplier packaging for re-use.

The total change in stock levels can be expressed as follows:

$$\text{Stock change} = \text{empty packaging stock change} + \text{supplier packaging stock change}$$

Note that a stock increase is positive, a decrease is negative.



Overall we must have a balance by mass (since the packaging has to go somewhere), and this can be expressed as follows:

$$\text{Inputs} - \text{stock changes} = \text{outputs}$$

or, in words:

the *inputs* minus the *stock changes* equal the *outputs*.

The total quantity of product packaging can be calculated as follows:

*Product packaging is supplier packaging plus empty packaging minus total stock changes, total waste and returned supplier packaging.*

You can use this technique to estimate and check packaging consumption and flows both for packaging management and any packaging waste regulations purposes. In terms of your obligation you also need to record, for each type of material, what is imported, passed on to another part of the chain, subsequently exported, etc.

To acquire the necessary data you will need access to the following information for each item supplied and for each of your products:

- **Packaging specifications.** These should include:
  - the weight and volume/area of each material used, and the recycled content;
  - the type and number/weight of materials/components/products supplied in each item of packaging;
  - whether the packaging is being re-used or disposed of as waste.
- **Bill of materials/recipes.** This information identifies how many items of each type of packaging/material go to make up a 'unit'. For example, one palletised load (unit) might be made up of eight corrugated transit cases, 16 corrugated partitions, 0.5 m<sup>3</sup> of foam filler material, 30 m of stretch-wrap and one pallet.
- **Purchase and sales information.** This allows you to identify how many units have come on to the site (in the case of purchases) and gone off the site (in the case of sales) during the period under consideration (the previous year in the case of packaging waste regulations requirements).
- **Waste disposal/sales information.** This information will be of greatest use if the various materials are segregated. For example, it will only be possible to get accurate weight data on corrugated packaging waste if it is kept separate from office paper waste. It is also useful to record waste data by department, etc so they can be related to that department's packaging use.

You may have to rely on your parts/materials suppliers and your packaging suppliers to provide you with adequate information on packaging specifications and bills of materials. Furthermore, where accurate information is not available you may have to carry out actual weighing trials using ten or more measurements to be sure of obtaining a reliable average. Trials will nearly always be essential for estimating the amount of stretch-wrap used.

You may also find it helpful to obtain the *Packaging Regulations Ready Reckoner* from the DETR (see Appendix for contact details). This will help you to establish the weights of packaging items where actual measured or specification data is not available.

Where your packaging is complex it may be better, initially, to gather accurate data for only the most significant items of packaging (ie those that make up the majority of your packaging by volume) and then scale up for the remainder. In many cases, perhaps 20% of the packaging components account for 80% of the volume.



Once you have obtained all this information, you should be able to calculate the weight of packaging used per product, apportioning shared packaging such as stretch-wrap accordingly. You should also be able to calculate the total amount of packaging for each type of material, as required for your packaging waste regulations obligation.

Monitoring and estimating your packaging flows is not a simple process. You will almost certainly have to establish some sort of spreadsheet or database.

### Different approaches to data collection and recording

Companies vary in their approach to the collection of packaging data. One ceramics company, for example, has recently spent 18 months collecting data from packaging suppliers and accurately weighing empty packaging. It has now entered all the data into a spreadsheet for reporting and analysis purposes.

Other companies are adopting a very sophisticated approach. Boots Contract Manufacturing, for example, has developed a database that automatically incorporates all packaging specifications, bills of materials, sales and weight information to allow detailed analyses to be carried out. This database even deals with different types of plastic (eg PP, PE, PVC) and composites separately. In this it goes beyond the obligatory packaging waste regulations reporting requirements. The database is seen as a long-term investment that will optimise packaging management and allow all future reporting and analysis needs to be met.

The worked example below shows the sort of practical mass-balance calculation that you will have to make in reality, taking into account the factors mentioned above. It may look daunting, but it can be managed easily using a careful, step-by-step approach. Above all, remember the simple principle: What goes in must come out.

### Worked example: calculating product packaging and waste levels

A company supplies car headlight bulbs in small corrugated cases to an automotive manufacturer. Each case contains 25 bulbs, the bulbs being separated by corrugated board partitions. Additional paper ruffle material fills up the void space in each box.

According to the various supplier specifications, the corrugated cases weigh 400 g each, total partition weight is 80 g/box, and the paper ruffle material weighs 100 g/box.

The warehouse bill of materials notes that eight corrugated cases go onto a standard 30 kg Euro pallet and that the load is stabilised using 30 m (1200 g) of 40 µm, 1 m wide stretch-wrap.

Material use per bulb can therefore be calculated as follows:

Corrugated board	$(400 + 80)/25$	= 19.2 g
Paper	$100/25$	= 4 g
Stretch-wrap plastic	$1\ 200/(25 \times 8)$	= 6 g
Wood	$30\ 000/(25 \times 8)$	= 150 g

The company supplies around 50 000 bulbs per year. The automotive manufacturer therefore acquires:

- 960 kg corrugated board;
- 200 kg paper;
- 300 kg plastic;
- 7 500 kg wood.

These quantities represent only part of the automotive manufacturer's total supplier packaging. The company will have many other suppliers of parts and will have to do equivalent calculations for each one to derive an overall total figure.

The rest of this worked example assumes that the automotive manufacturer has only one supplier and that, during the year for which calculations are being made:

- it returns 10% (96 kg) of the corrugated cases to the supplier;
- it buys in 4 500 kg of empty corrugated cases;
- the stock of empty corrugated packaging increases by 100 kg (comparing the end of the year to the start);
- the stock of supplier corrugated packaging stays static (ie = 0);
- 600 kg of waste corrugated board is sold to recyclers.

The quantity of corrugated product packaging is calculated using the equation derived earlier:

$$\text{Product packaging} = \text{supplier packaging} + \text{empty packaging} - \text{stock change} \\ - \text{waste packaging} - \text{returned supplier packaging}$$

or

$$\text{Product packaging} = 960 + 4\,500 - (100 + 0) - 600 - 96 = 4\,664 \text{ kg}$$

Since the total supply of empty packaging is 4 500 kg and the stock of empty packaging has actually increased by 100 kg, we can deduce that at least 264 kg of product packaging must be coming from the re-use of supplier packaging. By measuring the amount of supplier packaging waste, we can work out the amount of empty packaging waste:

$$\text{Empty packaging waste} = \text{waste packaging} - \text{supplier packaging waste}$$

Assuming that supplier packaging waste = 550 kg,

$$\text{Empty packaging waste} = 600 - 550 \\ = 50 \text{ kg}$$

We can now do a separate mass balance on the empty packaging part of the system to determine how much of the empty packaging is actually used as product packaging.

Using the equation:

Empty packaging used as product packaging = supply of empty packaging – stock change of empty packaging – empty packaging waste (ie all the empty packaging has to go somewhere)

$$\text{Empty packaging used as product packaging} = 4\,500 - 100 - 50 \\ = 4\,350 \text{ kg}$$

Since supplier packaging re-used = product packaging – empty packaging used as product packaging (by the definitions above)

$$\text{Supplier packaging re-used} = 4\,664 - 4\,350 = 314 \text{ kg}$$

Fig 4, overleaf shows all this diagrammatically.



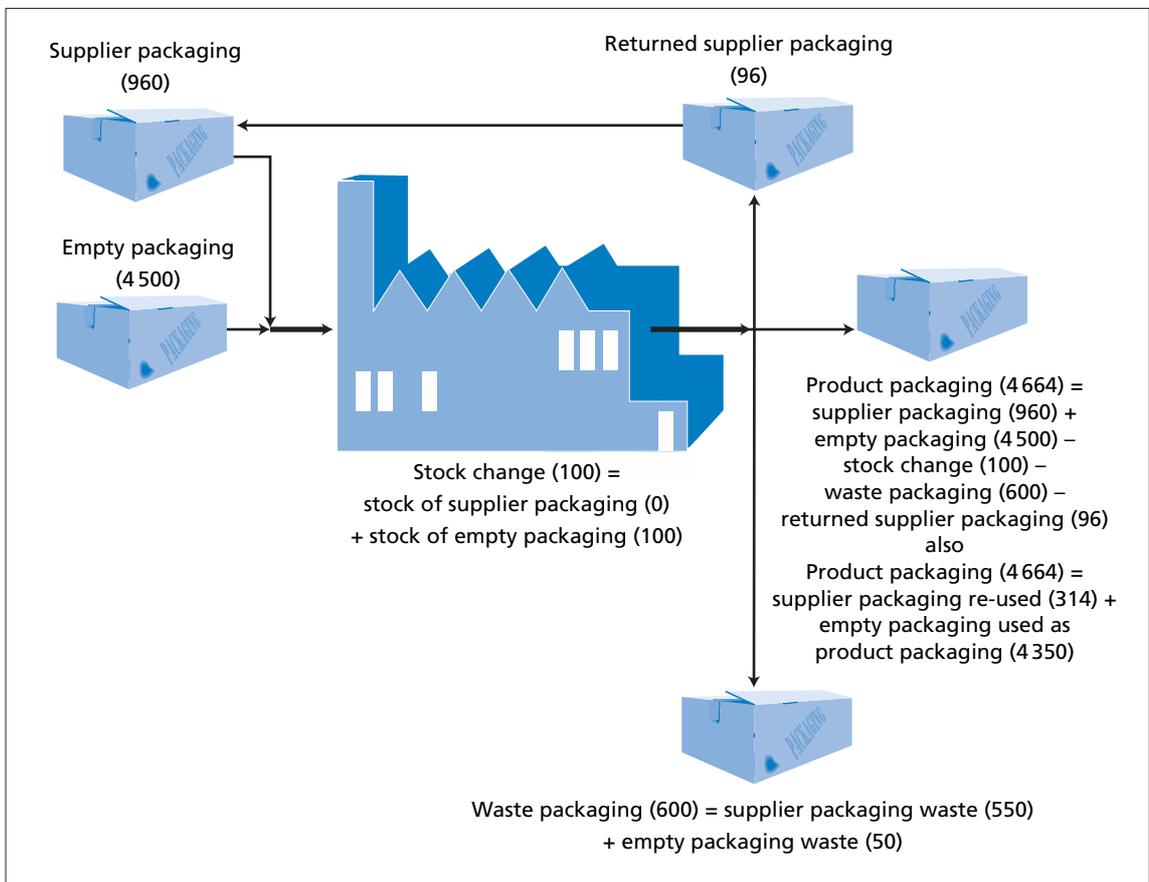


Fig 4 Packaging flows: a worked example

## STEP 4 - ANALYSE THE DATA

Your next step is to analyse the data obtained, either for the whole site or for an individual department, product or process (eg packing machine). This will allow you to identify opportunities for saving money.

Data analysis can provide answers to a number of immediate questions:

- How does the packaging of one department, division, site or product compare with that of another in terms of the weight of materials used per unit and the levels of waste creation? Does one product appear to be using excessive levels of packaging and, if so, is it really a special case? Is it possible to identify good practice in terms of the types and levels of packaging used?

### Packaging analysis at Comet plc

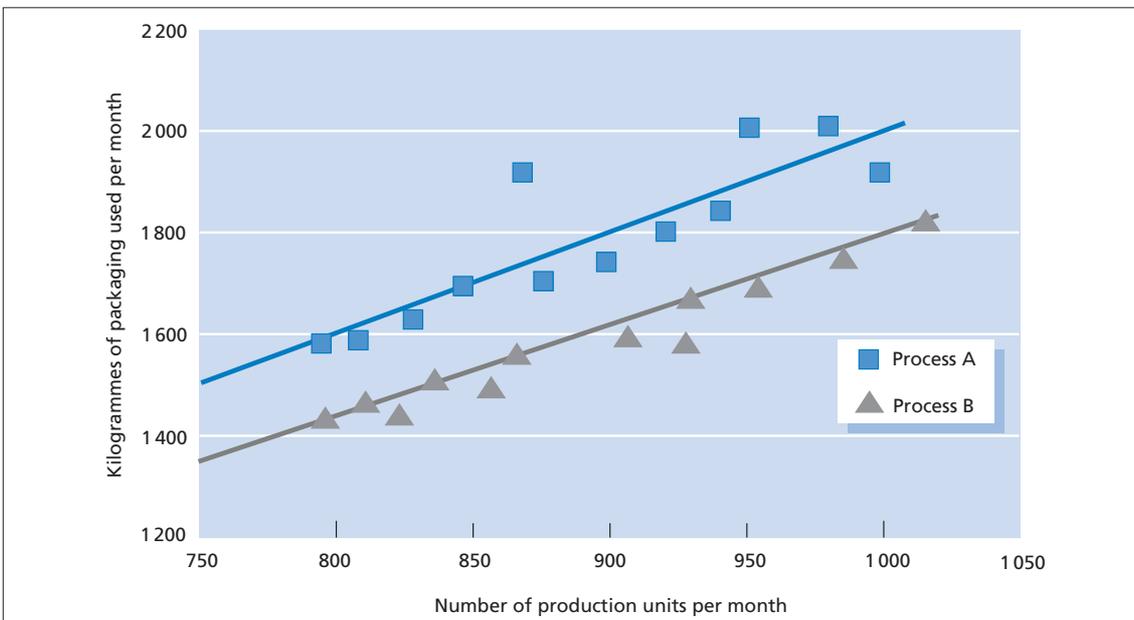
Comet, a leading electrical retailer, has taken its obligations under the packaging waste regulations very seriously, and has policies designed to standardise, simplify and minimise the packaging used in its 260+ stores.

Comet has already acquired high-quality packaging information from its suppliers for more than 50% of its products. The data have been analysed to determine the average weight of packaging for each type of product supplied. This has allowed Comet to identify those suppliers with packaging that deviates from the norm and, hence, to encourage them to optimise their packaging.

Comet plans to carry out further supplier audit work in the near future, gathering data and encouraging design for both packaging minimisation and recycling.

- Are certain packs very similar in size and could the packaging supply be rationalised? Is any of the incoming packaging appropriate for re-use as product packaging?
- Where is the non-supplier packaging waste coming from? Are the packing procedures wasteful? Is packaging being damaged and, if so, how is this related to product damage?
- Is one department producing more waste than another per production unit? If so, why?
- How do packaging and consumption and waste levels vary with production volumes? Is the variation linear or non-linear? Are there processes with particularly high consumption and/or waste levels?

Fig 5 is a scatter diagram showing how product packaging might vary for two processes (eg two packing lines) with changes in production volume. Each point plotted shows the amount of packaging consumed by each process for a given manufacturing output in one month of a hypothetical year. A 'line of best fit' has been drawn through each set of plotted points. Points that lie above the line indicate a higher than normal packaging consumption, while points that lie below the lines indicate a lower than normal consumption. The position of the lines on the plot indicate that Process A consumes more packaging than Process B for an equivalent manufacturing output. Similar plots could just as easily have been constructed for other parameters, eg supplier packaging against manufacturing output or total waste against manufacturing output.

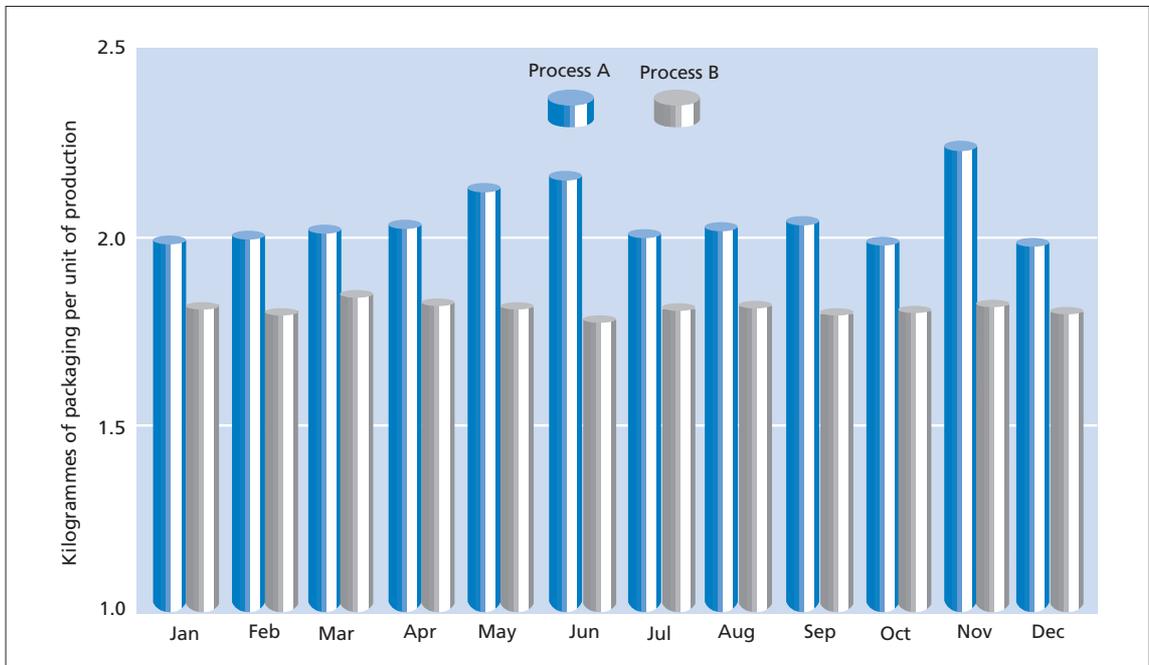


**Fig 5 Variation in packaging consumption with changes in production volume**

Fig 6, overleaf, uses the same data as Fig 5, but the data have been adjusted to show packaging use per unit of production for each month. This provides a clearer comparison of the two processes, with Process A clearly consuming significantly more packaging than Process B, with particularly high consumption in May, June and November.

Analysis of this type should help you to identify areas for investigation, ie areas of high or inconsistent packaging consumption and wastage. Your investigations should, in turn, identify the real issues and problems, but it is important to involve all relevant staff, including shop floor staff, in these investigations. Remember that the people at the 'coalface', for example, the packers themselves, are often in a good position to make constructive comments and suggestions.

As well as analysing the data, it is useful to convert each waste quantity into a financial value that takes into account both material and disposal costs. Cost data of this type will provide useful ammunition when you are trying to persuade senior management to investigate and implement packaging improvements.



**Fig 6 Packaging consumption per unit of production - monthly variations**

## STEP 5 - CONSIDER THE OPTIONS FOR IMPROVEMENT

Once you have identified where there may be scope for improvement, you can consider the options open to you and rank them in order of priority. The checklist below may be useful here. It may help you to identify opportunities for packaging avoidance, optimisation and re-use. Further relevant information is available in Sections 3, 4 and 5 of this Guide.

It is particularly important to involve all your team’s personnel at this stage, including suppliers’ representatives. Furthermore, when ranking the options, remember that the best approach is to put the easier and lower-cost measures at the top of the list of priorities so that results can be achieved - and be seen to be achieved - quickly. This will motivate everyone concerned and give them the confidence to tackle more difficult and perhaps more costly measures at a later date.

In many cases you will need to carry out laboratory test work to investigate the effects of change on product protection in terms of load, resistance to shock vibration, etc. This work can be carried out either in-house or by an external specialist. You may also need to carry out distribution trials in association with relevant suppliers, distributors and customers.



**Packaging improvement options checklist**

Area/department .....

	Investigate further	Implement now
<b>Avoiding the need for packaging</b>		
Can you alter the product or its primary packaging (eg make it more robust)?		
Can you improve workplace cleanliness?		
Can you improve handling practices/equipment?		
Can you introduce just-in-time delivery?		
Is bulk delivery an option for raw materials?		
Can you improve raw material handling/equipment?		
<b>Optimising the level of packaging</b>		
Are you using the optimum type of packaging (eg box or shrink-wrap)?		
Are you using the best packaging materials (eg plastic or steel, HDPE or PP)?		
Could you use a lighter grade of material (eg stretch-wrap that is 20 µm thick rather than 40 µm)?		
Could you improve the structural design of the packaging (eg direction of flutes in corrugated containers)?		
Is packaging of the optimum shape and size, or is volume being wasted?		
Is packaging too standardised (ie would bespoke design be an improvement)?		
Is packaging too varied (ie is rationalisation an option)?		
Are collation trays really necessary?		
Could you use larger-denomination packs?		
Could you use less filler - or switch to wraparound cartons?		
Are you using the best filler material (eg paper or EPS)?		
Could you avoid using staples?		
Are you using tape efficiently?		
Are pallets really necessary or could you use a different system (eg slip sheets)?		
Are pallets of the optimum design for the purpose (ie one-trip or multi-trip)?		
Are you fully utilising pallet area?		
Are you using too much stretch-wrap?		



(continued)

**Packaging improvement option checklist (continued)**

	Investigate further	Implement now
<b>Optimising the level of packaging (continued)</b>		
Would strapping/banding be more efficient?		
Would layer pads help to stabilise the load?		
Would fork-lift stabilisers help to reduce the amount of packaging required?		
<b>Re-use of one-trip packaging</b>		
Can you re-use packaging in a closed-loop system?		
Can packaging be re-used in-house or by local companies?		
Could your packaging be multi-purpose (eg transit and display)?		
Is your used packaging segregated at source to encourage re-use?		
Does your or your suppliers' packaging design inhibit re-use?		
Can you reduce contamination to facilitate re-use?		
Could you buy used packaging (eg boxes, drums)?		
Could you sell packaging for re-use instead of for recycling?		
Could you give away your packaging for re-use?		
<b>Recycling packaging and reducing the cost of disposal</b>		
Could you use larger quantities of recycled packaging?		
Is your packaging designed to make recycling easier (eg single-material designs)?		
Is your packaging clearly and correctly marked?		
Is your used packaging segregated at source?		
Can your waste materials be kept unmixed and uncontaminated?		
Can your waste materials be disposed of more cheaply (eg given to other companies)?		
Are you using the most appropriate types of skip?		
Are you optimising skip use?		
Could you justify an on-site compactor, baler, shredder or drum crusher?		
Could you improve on your existing waste disposal deal?		
Could you purchase/operate high-value equipment jointly with other companies?		
Is an energy-from-waste incinerator or CHP plant an option?		



## STEP 6 - PRODUCE AN ACTION PLAN

Once you have considered the various options, your next step is to prepare an Action Plan. This should include realistic and achievable packaging reduction and waste reduction targets that are based on your knowledge of existing packaging consumption levels. You may find it appropriate to set targets for individual departments or processes as well as for the site/company as a whole. Targets might include:

- a specified percentage reduction in the level of shrink-wrap used per production unit over the next year;
- a specified percentage increase in the re-use of incoming corrugated cases over the next year;
- the recycling of all EPS by the end of the next year.

It is vital to consult with as many employees as possible when developing an Action Plan. Your employees should be able to offer useful comments on the practicality of the plan and the potential barriers associated with it: they will also feel that they 'own' the project.

You will need to establish whether employees can incur additional costs of any kind in order to achieve these aims.

It is equally important to make everyone aware of the potential benefits of the measures proposed in terms of improved profitability, increased job security, reduced environmental impact, etc. This can be achieved through presentations, newsletters and the use of notice-boards.

The Action Plan and its targets **must** be agreed at Board level, with the management fully committed to its implementation. The worksheet below will help to assess the likely cost savings for each action, to help gain management commitment.



**Worksheet for assessing likely cost savings**

**Area/department .....**

Potential cost-saving measure	Approx. capital cost	Packaging quantity affected per year	Approx. net saving per unit	Projected total saving per year	Payback period
	(£)	(units, kg, etc)	£	£	Months
	A	B	C	$B \times C = D$	$12 \times AD$
1.					
2.					
3.					
4.					
5.					
6.					
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8.					
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## STEP 7 - IMPLEMENT THE ACTION PLAN

Implementing the Action Plan will require considerable teamwork, which is more likely to be effective if you have already followed Steps 1 - 6 closely. Again, it is important to involve everyone in plan implementation, from the managing director to those who, for example, collect and segregate packaging materials. It is equally important to keep people informed of the measures being taken and the progress being made. Make full use of newsletters, etc to maintain interest.

## STEP 8 - REVIEW PROGRESS REGULARLY

Once the Action Plan is in place, review progress against targets on a regular basis - perhaps every six months initially, and later on a yearly basis. You may also find it helpful to review:

- how successful the monitoring system has been in terms of the accuracy and relevance of the data collected;
- how successful the team itself has been.

Remember that the composition of the team may need to change as the work progresses.

### **If necessary, obtain help.**

#### **The Environmental Helpline (0800 585794) can:**

- Send you copies of relevant Environmental Technology Best Practice Programme publications, such as Good Practice Summary (GS25) *Saving Money Through Waste Minimisation: Getting Started* and Good Practice Guide (GG38C) *Cutting Costs by Reducing Waste: A Self-help Guide for Growing Businesses*.
- Suggest other sources of information.
- Provide free, up-to-date information on a wide range of environmental issues, legislation, technology and equipment suppliers.
- Arrange for a specialist to visit your company if you employ fewer than 250 people, at the discretion of the Helpline Manager.



## Ceramics company achieves substantial savings by improving internal and product/transit packaging

**A UK tile manufacturer has reduced its level of internal (on-site) and product transit packaging. The Company has implemented several measures, some low-cost and others involving substantial capital outlay. Savings of more than £200 000/year have already been achieved in product packaging alone, and considerable additional savings are resulting from improvements in production efficiency.**



*Pallet wrapper and operator*

### Overall Savings

H & R Johnson has reduced its overall product packaging costs by 11%, thereby reducing the packaging cost per m<sup>2</sup> of tile produced from 27p to 24p. During 1996/97 this was equivalent to a total saving of around £205 000. Other benefits include:

- significant but unquantified productivity savings associated with the introduction of the internal conveyor system;
- a significant reduction in the Company's waste disposal costs and recovery/recycling obligations under the packaging waste regulations.

### Management Approach

H & R Johnson has, for many years, adopted a pro-active approach to quality management and waste minimisation, and continuous improvement teams (CITs) have been in place, working on particular topics.

The CIT responsible for packaging has included the Production Scheduler (as team leader), and relevant department managers, customers, suppliers and shop floor staff, as necessary. Although packaging consumption and waste have not been monitored at departmental level, both are tracked on a monthly basis. The findings are expressed in terms of total packaging cost per m<sup>2</sup> of tile manufactured. The CIT's main aim has been to drive down this cost by exploring various packaging elimination and optimisation opportunities, and implementing those where the payback is expected to be less than 2.5 years. Some of these initiatives are discussed below.

## Internal Packaging

Until 1995/96, the Company used small corrugated boxes and expanded polystyrene (EPS) filler material to transport the part-made tiles around the manufacturing site (eg the biscuit tile from first firing to the glazing stage) and the finished tiles from the manufacturing site to the warehouse. Although this packaging material was re-used, regular 'top-ups' were still required, and the packaging was time-consuming to fill and empty.

Tiles were then placed on re-usable plastic layer cards, and plastic strapping was used to strap the layers together on a pallet. This not only speeded up the process but required less packaging material. The most recent improvement, in 1996, was the installation of an internal conveyor system to provide packaging-free transportation around the site. This increased level of automation has also brought about significant labour savings and other production-related benefits. Savings have not been quantified precisely, but the payback is thought to be less than two years.

## Product Packaging

The Company has also examined its transit and sales packaging. In recent years the demand from the large DIY retailers has been for small-denomination packs of tiles (25 or fewer) that can be placed directly on the retailer's shelf. As a result, tiles (typically 25) were hand packed in small, standard boxes, with an EPS 'tile' in the end to take up any remaining space (not all tiles are the same thickness). The boxes were then packed in threes on a cardboard tray, sometimes with a top tray, and shrink-wrapped.



*The packaged product*

After discussion with customers, H & R Johnson realised that many outlets, particularly trade outlets, would prefer larger packs. Many customers now receive packs of 72 tiles in a single corrugated box. These are palletised, using stretch-wrap for stability, and no additional boxes, trays or shrink-wrap is required. This change alone is believed to be saving the Company at least £120 000/year.

Since it is still necessary to supply DIY outlets with small-denomination packs, the Company has invested in new packing machines for greater efficiency. The new machines automatically 'wrap' a standard printed corrugated box around the tiles, ensuring a snug fit and eliminating the need for EPS. Various creases on the flat 'box' allow for some variation in tile size.

## Other Measures

Other packaging measures that have been implemented include:

- a requirement for items produced at another Company site, or by a subcontractor, to be supplied in their final sales packaging, not just in transit packaging as had previously been the case;
- the return of glaze drums to external glaze suppliers;
- the re-use of glaze drums where glaze is mixed on site;
- packaging rationalisation to reduce the number of pack types and the number of packaging suppliers, thereby improving economies of scale;
- just-in-time delivery, thereby reducing stock levels by about 80% and minimising transit packaging requirements (eg the number of pallets required);
- pallet recovery from UK customers, wherever possible;
- the use of less substantial and cheaper one-trip pallets for overseas deliveries.

# INDUSTRY EXAMPLE 2

## Computer manufacturer benefits from the development of plastic-free packaging

**A computer company regularly reviews all aspects of its product packaging and initiates many improvements during the course of each year. The redesign of one keyboard delivery box alone has eliminated the use of plastics and saved the Company more than £450 000/year. Other measures, involving re-usable packaging, have brought total savings to well over £2 million/year.**



*Old (background) and new (foreground) keyboard boxes*

### Management Approach

IBM takes product quality seriously, and packaging plays a vital role in ensuring that computers reach its customers in perfect condition. While most of the packaging is designed in the USA, a UK packaging team carries out certain design work, provides inputs to the US design team and oversees the testing of new packaging.

Company philosophy is to work in partnership with component and packaging suppliers, thereby building up long-term relationships. In many cases the suppliers themselves will make cost-saving suggestions, in part to maintain their standing with the Company and in part to reduce their own costs. The Company does, however, carry out the occasional benchmarking exercise to ensure that it is still getting good value for money from its suppliers. It also publishes its own manual entitled *Packaging and Handling - Supplier and Interplant Requirements*. This provides comprehensive and detailed information and guidance on packaging design, pallet loading, etc.

### Packaging Redesign

Until recently one of the standard computer keyboards was delivered in a corrugated box with expanded polystyrene (EPS) end-caps for keyboard protection and with additional EPS to keep the keys firmly in place. This original packaging cost around £1.40 per keyboard and, because of the size of the carton, only 36 units could be loaded onto a pallet.

The UK packaging team suspected that similar performance could be achieved using less EPS, and probably no EPS at all. The high cost of disposing of the original packaging in the Company's large German market provided a significant incentive.

Various new boxes were designed and tested, including one that used less EPS, reduced the packaging cost by 25% and improved pallet utilisation by more than 120%. However, the design selected ultimately uses only corrugated board, with cleverly worked folds and cut-outs to ensure that the keyboard is suspended within the box and the keys are held in place.

Before acceptance, the new design was thoroughly tested in the Company's Product Quality and Reliability Laboratory. The tests ensured that the new design would meet Company specifications in terms of protection from compression loads, shock loads (drops onto an edge, corner, etc) and vibration profiles in severe environmental conditions, eg conditions involving extreme temperature and humidity variations.

## Overall Savings

The new slimline box costs 50p and allows 104 keyboards to be loaded onto a pallet, a 190% increase on the original loading. The corrugated board itself is made up of 60% recycled material, while the elimination of plastics facilitates box recycling after use. The Company estimates that it is saving more than £450 000 in reduced material purchases and transportation costs alone. Furthermore, around 200 tonnes of EPS have been eliminated from the waste stream each year.

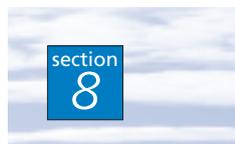
## Other Measures

Other recent measures have addressed the incoming supply of PC chassis and cases and the outgoing supply of finished laptop computers.

Chassis and cases are supplied by local Scottish firms, and the Company realised that it would be cost-effective to introduce a re-usable system for their delivery, instead of the one-trip corrugated cases and dividers used previously. Trials were conducted on a small sample of returnable plastic/corrugated pallet systems (of the tri-wall type), using foam layer pads between layers. These systems were found to be perfectly acceptable and are now used for all incoming deliveries of large components. Savings to the Company are estimated at around £600 000/year.

The packaging team has also investigated laptop computer packaging, again partly motivated by a desire to eliminate EPS. While initial attempts to use moulded board end-caps proved unsuccessful, the team is now considering other options, including the use of so-called flow-pack (air bubble) end-caps.

In addition, antistatic circuit board bags are now re-used within the manufacturing plant, and this measure alone is saving the Company more than £1 million/year.



# INDUSTRY EXAMPLE 3

## Computerisation, improved transit packaging and container re-use minimises costs and improves efficiency

**A national distribution centre handling toy construction sets has modernised its facilities, improved efficiency and reduced both costs and customer returns by installing a high-tech computerised despatch and packing system, and by changing some of the packaging materials used. It has achieved annual cost savings on packaging of £25 000.**



*Mixed-order packaging*

### Background and Management Approach

The LEGO Group supplies its UK distribution centre in Wrexham from factories in Denmark and Switzerland. All incoming products are either stockpiled as they are or are taken off their wooden Euro pallets and restacked in the picking areas of the warehouse.

The Company operates a continuous improvement programme, setting up project teams to investigate opportunities and implement change in key target areas. Warehouse managers are encouraged to be pro-active and to involve shop floor employees by asking them to report difficulties and make suggestions. The reporting of accidental damage to packaging or products is also encouraged, and employees know that they will not be criticised or penalised. This approach means that fewer damaged products now leave the warehouse, and there are fewer costly returns.

### Computerised Despatch and Packing System

LEGO UK has been under intense pressure over the last few years to meet the changing requirements of its customers, many of whom have switched to just-in-time delivery systems. Customers can 'call off' quite complex orders, consisting of many separate items, at very short notice, and it therefore became necessary to adopt a semi-automated despatch system that would improve response times. A project management team was established to evaluate carefully the key requirements of such a system and to ensure that the best features of the old system were retained.

A Danish project manager and the UK Distribution Centre Manager worked together on the initial conceptual design, but were then joined by employees from IT and Sales, together with a systems co-ordinator. The team liaised closely with the French software company contracted to develop and install the new system.

The £150 000 system, which incorporates complex volume packing algorithms, tells the operator from which zone(s) in the warehouse he/she must 'pick' the order, determines the most appropriate 'outer' box(es) (from six standard sizes), and prints both picking and despatch labels.

The box size selected depends on whether a '75% fill' criterion or an '82% fill' criterion is applied. A 75% fill is adopted during busy periods and allows the operator to achieve 75% utilisation of box volume without having to worry too much about the order in which items are packed. The 82% fill requires more carefully ordered packing and is used during quieter periods.

Although a 75% fill may not sound impressive, it represents, by normal standards, a very well-packed box. Packing the largest units first ensures that the whole order will fit into the box. This procedure increases packing speeds, avoids the need for box repacking and, as a result of the snugger fit, reduces product damage.

## Improved Transit Packaging

For some time LEGO UK had wanted to reduce levels of product damage during transit. The hand-crumpled paper conventionally used to fill the void space in boxes was proving inadequate, so the company tried out several filler materials, including polystyrene chips and airbags. It also sent out questionnaires to 200 customers to elicit their views. The findings showed that paper was still the most effective and attractive filler, with some customers regarding polystyrene chips as a 'nuisance'.

After investigating various paper packaging systems, a machine was identified that would produce a ruffled two-ply paper fill, the length of which could easily be adjusted as required. The new system, which cost £5 000, has dramatically reduced primary packaging damage and customer returns. It has also, when combined with other changes, helped to improve labour efficiency, with the quantity of goods formerly packed in a two-shift, 16-hour day now being packed in a single, ten-hour shift. The machine proved so successful that a second one was purchased after only three months.



*Two-ply paper-fill machine*

The cost of taping outers has also been reduced by installing an automated machine. Tape use has fallen by around 20% (210 rolls or 11 000 metres), saving £1 000/year.

Although an earlier attempt to reduce pallet-wrap thickness from 200 µm to 150 µm proved unsuccessful, a new, thinner film has now been successfully adopted in conjunction with an automatic pallet-wrapping machine. The machine, which cost £3 000 to install, applies an exact amount of stretch-wrap to each pallet load, reducing stretch-wrap usage by 30%. These two measures have generated total savings of £2 000/year.

## Packaging Re-use

About 80% of the construction sets are packed by the manufacturers in just two sizes of box. The distribution centre uses both sizes for delivering mixed orders and also re-uses them, thereby saving £22 000/year. The remaining delivery boxes (small quantities of each of 18 different sizes) are sold to a merchant for re-use/recycling.

The Company has also introduced re-usable plastic trays for delivery to LEGOLAND Windsor and to major customers in the retail market. It is now investigating the potential for the more widespread adoption of such systems in the UK.

All wooden pallets are returned to LEGO's manufacturing plants in Denmark and Switzerland for re-use.

# INDUSTRY EXAMPLE 4

## A packer-filler company benefits from packaging waste minimisation, re-use and recycling

**One packer-filler company, by working closely with its major customers and suppliers, has generated savings in excess of £263 000/year through changes in packaging use, the return and re-use of metal drums and other transit packaging, and the segregation of waste materials for recycling.**



*Shrink-wrapped aerosol cans*

### Management Approach

In 1995 CCL Custom Manufacturing in Scunthorpe initiated an Environmental Programme which provides a framework for the setting of annual environmental objectives. The programme is managed and co-ordinated by the site's General Manager, with assistance from the Central Risk Manager and key department managers including the Compounding Manager, the Materials Manager, and the Senior Service Engineer.

The management team recognised that progress in the packaging field would not be made until there was a clear understanding of existing packaging and its use. It now monitors packaging consumption and flows, a procedure that has become increasingly important with the advent of recent UK packaging waste regulations. New computer programs added to the Company's mainframe system allow automatic data capture, analysis and reporting. Industry standard item weights (eg for certain components) are used where appropriate.

The team has consulted widely with suppliers, customers, local authorities and local universities, to fine-tune the Environmental Programme. Various packing and distribution trials have also been conducted to ensure that performance requirements are met.

### Waste Minimisation

Personal care aerosols and liquids are traditionally packed into plastic trays before being shrink-wrapped in sales units of six or 12. CCL had always considered plastic trays to be essential, both as a protective layer and to facilitate handling. Around 800 000 trays, weighing a total of approximately 14 tonnes, were purchased each year for this purpose at a cost of £20 000.

Working closely with customers, the management team established that it was possible to eliminate the plastic trays entirely, without increasing either product damage or handling difficulties. The packing and shrink-wrapping process was subject to major modifications in 1995, including a £200 000 investment in new, high-speed shrink-wrapping machines. Manual packing has been eliminated, improving the efficiency of labour use, and the Company's customers are benefiting from reduced levels of packaging waste.

The Company has also respecified its shrink-wrap film and changed suppliers. This was done partly to optimise the grade of film used and partly to replace plastic cores with cardboard cores that could be recycled. To ensure fitness for purpose, CCL carried out extensive production and distribution trials using a range of shrink-wrap films from different suppliers.

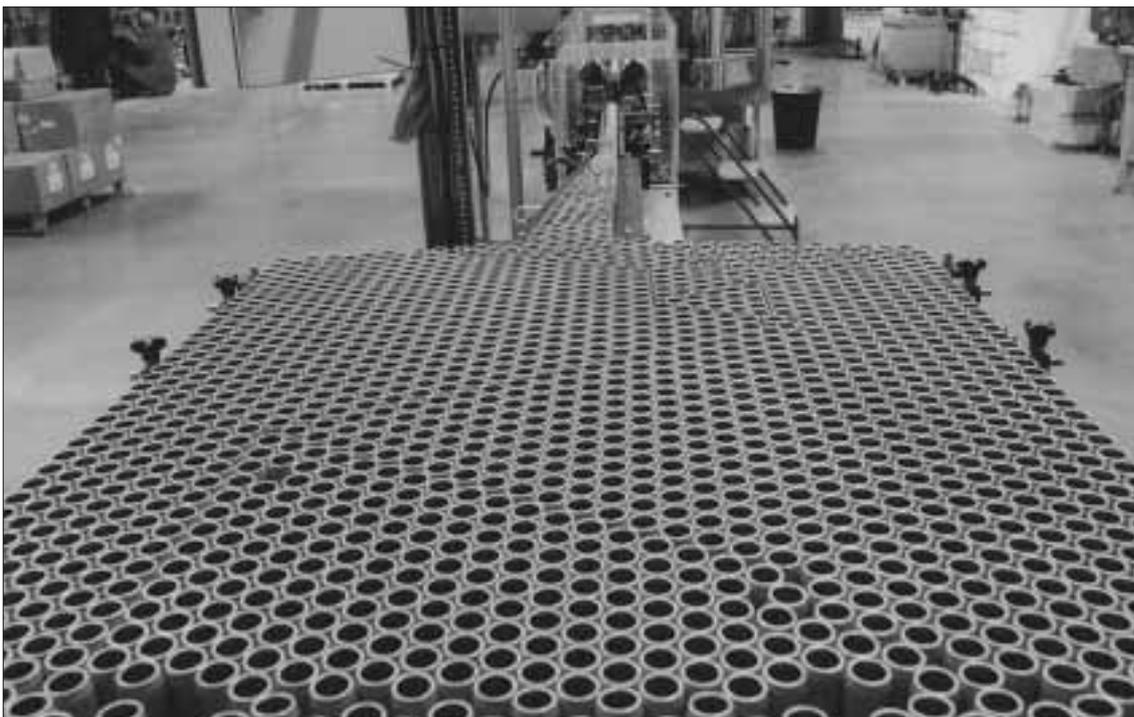
In addition, the management team realised that the plastic layer pads used to stabilise pallet loads were not being re-used as intended. Given the difficulties of recovery, these were replaced with one-trip cardboard layer pads. This move has reduced costs by around £10 000/year.

## Re-use and Recycling

In 1993, CCL made a commitment to return transit packaging to suppliers for re-use. Both wooden pallets and top frames (used to stabilise empty cans) are carefully segregated and returned using a dedicated inventory control system and specific production/warehouse procedures. Around 51% of the 45 000 pallets used each year are now returned to the suppliers. The remainder are sent for recycling. Benefits include a reduction of more than 1 000 tonnes/year in the wood used for packaging, a saving of £100 000/year in pallet supply costs, and a reduction of £30 000/year in top-frame costs.

Since 1995, the Company has also been returning plastic and steel drums (which cost £20 each) to chemical suppliers for re-use. Working with the suppliers, it established appropriate procedures for drum washing and return, and the initiative, which covers 188 tonnes of contaminated and damaged drums, has reduced drum purchases to the tune of £100 000/year.

The new cardboard shrink-wrap cores, which are recycled with CCL's other cardboard waste, have eliminated more than 8 000 plastic cores per year from the site's general waste stream. In order to maximise the revenue from scrap cardboard, by reducing the number of skip lifts required, the Company installed a compactor in 1994. Although there are large fluctuations in the market, about 500 tonnes of scrap cardboard are sold each year, currently generating around £2 500 of revenue.



*Aerosol cans on the production line*

**TYPE OF SERVICE**

Regulatory advice

**ORGANISATION*****Environment Agency***

Rio House, Waterside Drive, Aztec West,  
Almondsbury, Bristol BS12 4UD  
Tel: 0645 333111

***Scottish Environment Protection Agency (SEPA)***

Erskine Court  
Castle Business Park  
Stirling FK9 4TR  
Tel: 01786 457700  
Fax: 01786 446885

***Department of the Environment (Northern Ireland)***

Environment and Heritage Service  
Calvert House  
Castle Place  
Belfast BT1 1FY  
Tel: 01232 254754  
Fax: 01232 254700

Advice on packaging waste regulations

***Department of the Environment, Transport and the Regions (DETR)***

Packaging Unit, Room 6/F8,  
Ashdown House,  
123 Victoria Street,  
London SW1E 6DE  
Tel: 0171 890 6622  
Fax: 0171 890 6589

Regulatory/safety advice

***Health and Safety Executive (HSE)******Information Centre***

Broad Lane, Sheffield S3 7HQ  
Tel: 0114 289 2345  
Fax: 0114 289 2333

Advice on all aspects of packaging

***The Industry Council for Packaging and the Environment (INCPEN)***

Tenterden House, 3 Tenterden Street,  
London W1R 9AH  
Tel: 0171 409 0949  
Fax: 0171 409 0161  
e-mail: info@incpen.org

Advice on all aspects of paper/  
board packaging.  
Laboratory services

***Pira International***

Randalls Road, Leatherhead,  
Surrey KT22 7RU  
Tel: 01372 802000  
Fax: 01372 802243

Advice on cardboard packaging

***Corrugated Packaging Association***

2 Saxon Court, Freeschool Street,  
Northampton NN1 1ST  
Tel: 01604 621002  
Fax: 01604 620636

Advice on plastic packaging

***The British Plastics Federation (BPF)***

6 Bath Place, Rivington Street,  
London EC2A 3JE  
Tel: 0171 457 5000  
Fax: 0171 457 5045

Advice on wooden packaging

***Timber Packaging and Pallet Confederation  
(TIMCON)***

Heath Street, Tamworth, Staffordshire B79 7JH  
Tel: 01827 52337  
Fax: 01827 310827

Advice on drums and IBCs

***The Association of Drum Manufacturers***

c/o Van Leer (UK) Limited, Merseyside Works,  
Ellesmere Port, South Wirral L65 4EZ  
Tel: 0151 355 3644  
Fax: 0151 355 8187

Advice on packaging and distribution

***Institute of Grocery Distribution***

Letchmore Heath, Watford,  
Hertfordshire WD2 8DQ  
Tel: 01923 857141  
Fax: 01923 852531



The Environmental Technology Best Practice Programme is a joint Department of Trade and Industry and Department of the Environment, Transport and the Regions programme. It is managed by AEA Technology plc through ETSU and the National Environmental Technology Centre.

The Programme offers free advice and information for UK businesses and promotes environmental practices that:

- **increase profits for UK industry and commerce;**
- **reduce waste and pollution at source.**

To find out more about the Programme please call the Environmental Helpline on freephone 0800 585794. As well as giving information about the Programme, the Helpline has access to a wide range of environmental information. It offers free advice to UK businesses on technical matters, environmental legislation, conferences and promotional seminars. For smaller companies, a free counselling service may be offered at the discretion of the Helpline Manager.

FOR FURTHER INFORMATION, PLEASE CONTACT THE ENVIRONMENTAL HELPLINE

**0800 585794**

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world wide web: <http://www.etsu.com/etbpp/>

