

Project Tyneside Waste Minimisation Case Studies

The challenge for businesses today is to find ways of ensuring that they operate efficiently whilst minimising their impacts on the environment. This benefits both business and the environment. Those businesses that continue to pollute and use resources inefficiently will have a short future. Those businesses that take their environmental obligations seriously will have a long term future and will continue to receive the benefits that good environmental practice brings.

The following case studies have been prepared from work conducted by Project Tyneside with SMEs in the Tyneside area using waste minimisation techniques. Waste minimisation is a holistic approach to promoting economic and environmental improvements. I hope that the case studies will help to persuade you that it is in the best interests of your organisation to improve environmental performance. I also hope that the case studies show that many of the improvements are cost effective and easy to implement. In doing so you can be confident that you will be helping your business to be more profitable and contributing to a better environment for everyone.

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Case Study

Water Savings Opportunities in a Dye Manufacturer

Company Overview

Pointing Limited, based at their site in Prudhoe, Northumberland, manufacture a range of dyes and flavours for use throughout the food industry. The company employ a batch aqueous process to manufacture dyes, involving a number of stages. The raw materials are mixed together in a vat and heated to an optimal reaction temperature. After a period of time the product is then cooled and passes, in some cases, through a further washing process, to a filter process. The filter process can either concentrate the product prior to it being passed through a spray drier or produce a “cake” which is then dried in an oven. After drying the final product is packaged.

The company has long recognised the need to reduce waste. As part of its strategy to reduce waste, Pointing have worked through the Environment Agency’s 3E’s waste minimisation methodology. Initial work with the company indicated that a water mass balance would give detailed understanding of where water was used and effluent generated, leading to waste minimisation opportunities.

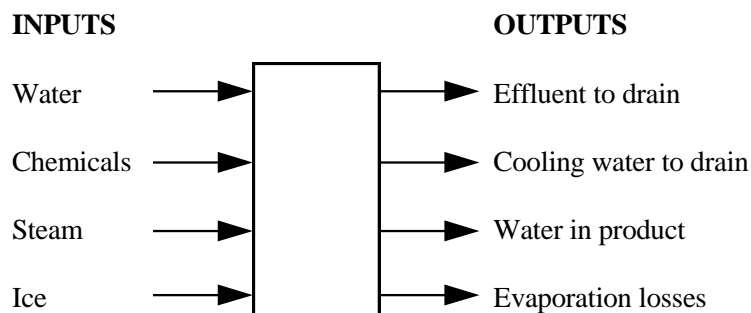
The Study Area

Water is used extensively in the production process, both as a raw material for the product, for cooling purposes in the production process, to wash equipment between batches of different colours and to clean the production areas. The company currently spend some £60,000.00 per year on fresh water and some £200,000.00 per year on effluent treatment and disposal. Reducing water use would have a subsequent impact on effluent generation and treatment. The site has a number of production units. The initial study focused on a single production unit.

Method

In order to understand how water was used and effluent generated, a water mass balance of the process was conducted. This involves collecting data for both inputs and outputs of the process as shown in Figure 1. This yielded data, both quantities and costs, that enabled opportunities for reductions to be investigated.

Figure 1



Data for the water balance was collected for three colour process, Sunset Yellow, Carmosine and Ponceau. The evaluation of the input data showed that some 40% of water is used for cooling, 15% is used for cleaning and the balance, including steam and ice, is used directly in the process. There are variations for individual processes, depending on which colour is being produced.

On the output side, cooling water, representing 40% of the input to the process, is used on a once through basis and then discharged directly to drain. Of the remaining 60% on the output side, 3% is incorporated into the product, 4% is lost due to evaporation and 53% becomes effluent to drain. This

includes water used for washing and cleaning down equipment between batches and maintaining the cleanliness level of the production area.

The purchase, treatment and effluent disposal costs associated with cooling and cleaning water are £14,500 and £5,000 respectively for this particular production area. The purchase, treatment and effluent disposal costs associated with the process fraction of water used is some £45,000.

Whilst the above costs are significant, further investigation into the cleaning operation showed that the costs of lost production were high. The operation involves the complete wash down of vats, filters, screen presses and associated pipework. During this time the equipment is not being used for production purposes, which makes the overall costs of the cleaning process about £40,000. On average there are 12 wash downs per year. On the basis of this data the company has introduced a production plan which has reduced number of wash downs per year to, on average, 4. This gives a benefit of over £300,000 per year. An element of this saving is water saved for cleaning purposes, which is estimated to be about £40,000 per year.

Summary

The initial study has focused on water, so that use and the associated costs could be determined. From this it was recognised that the costs of lost production were significant and that it would be more effective, in the first instance, to rationalise the production processes. This would have benefits for the company and also generate savings in water costs. Although the environmental benefit of this phase of the waste minimisation study is fairly small, the company recognises that there is now scope to use resources saved to initiate further studies that will both generate further economic benefit and reduce the environmental impact of the site. The company have embarked on an on-going waste minimisation programme.

Case Study

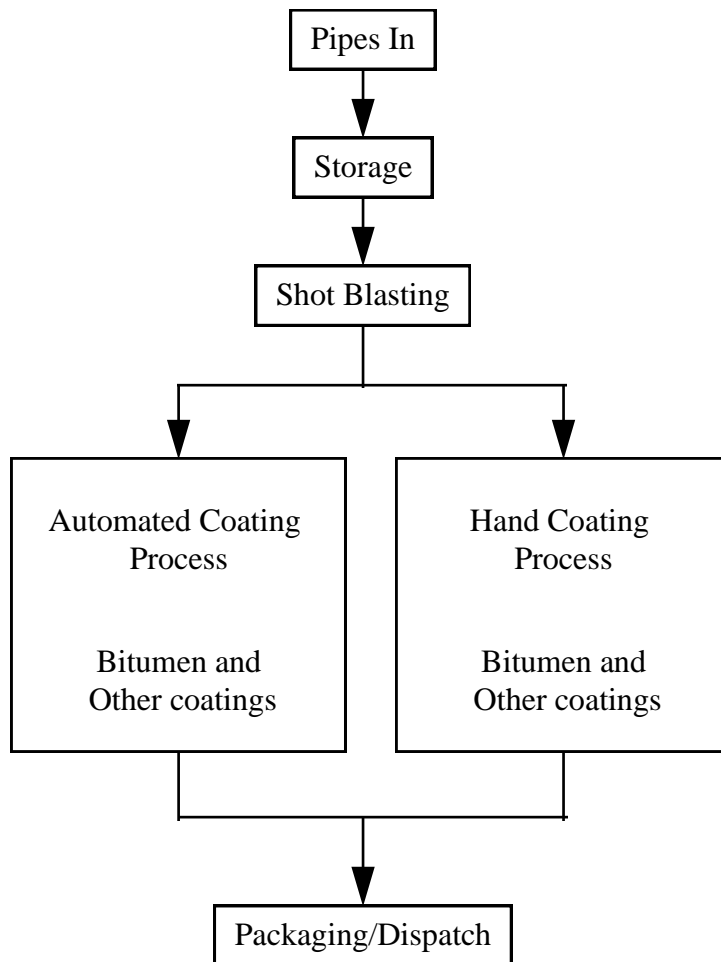
The Value of Segregating Waste

Company Overview

Pipeline Protection specialises in coating industrial pipelines that service the water, oil, gas and petrochemical industries. Prior to coating, the work is prepared by shot blasting. A range of coatings, including bitumen are used on site. As part of the coating and cleaning process a range of solvents wastes are produced on site. The aim of this study was to investigate the waste management practices on site.

The Study Area

The following diagram gives an overview of the steps in the production process.



Waste arises at a number of points:-

- shot blast area
- from both hand and automated coating process
- from solvent use

The company has three waste streams for disposal on site. In the case of solvent waste, the company stores this on site and is considering the best options for disposal. The coating processes produce liquid paint waste as well as bitumen waste. The shot blast area produces solid waste materials.

The company has three waste disposal facilities on site. The first comprises storage areas for drummed solvent waste. The second and third facilities are skips supplied by waste disposal contractors. One skip is for special waste and the other is for general waste.

An examination of the contents revealed that much of the waste placed in the special waste skip was not classified as special waste. An investigation into the reasons from this revealed the following:-

- Bitumen waste was believed to be a special waste. An investigation with the Environment Agency showed that bitumen was not a special waste.
- The shot blast waste was placed in the special waste skip, as it was covered. Complaints about dust arising from the site had been received by the company. The solution had been to place the waste in a covered skip. Employees were not aware that this was a special waste skip and that the disposal charges were considerably higher than those for the general waste skip.

Information was provided to employees about the types of waste that should be placed in each skip. In order to prevent dust arising for the shot blast waste, the material was collected in reinforced bags which were then placed in the general waste skip.

Summary

Waste minimisation studies are as much about changing culture and raising awareness about the nature of working practices. Often, simple changes can produce financial benefits. In this case the following benefits have been made by the company by simply informing employees of the correct waste disposal practices. The following tables illustrate the benefits that have been achieved and illustrate both busy and quiet periods of activity for the company.

| BUSY PERIOD (MONTHLY) | | | |
|------------------------------|-----------------|-----------------|-------------------|
| | REFUSE | SPECIAL | TOTAL COST |
| Previous | £ 81.50 | £ 609.30 | £ 690.80 |
| Current | £ 267.85 | £ 186.00 | £ 453.85 |
| Total Monthly Saving | | | £ 236.95 |

| QUIET PERIOD (MONTHLY) | | | |
|-------------------------------|-----------------|-----------------|-------------------|
| | REFUSE | SPECIAL | TOTAL COST |
| Previous | £ 43.05 | £ 309.30 | £ 352.35 |
| Current | £ 165.25 | £ 93.00 | £ 258.25 |
| Total Monthly Saving | | | £ 94.10 |

Often by demonstrating that savings can be made in quite simple ways will encourage an organisation to investigate further option to improve efficiency.

Case Study

Reducing Packaging and Ancillary Waste for a Garment Manufacturer

Company Overview

Cramptons, a garment manufacturer, are based on two sites at Tanfield Lea. One site cuts the fabric and collects all the other materials required for the finished product and the other assembles the finished garments. The raw materials used in the production process, fabric and thread, are delivered on cores and cones. In addition the company uses packaging during the production process when pre-completed garments are sent for further printing prior to finishing. An investigation was conducted into ways of minimising the amount of packaging material entering the waste stream.

The Study Area

Three sources of packaging waste were examined:-

- cardboard cores
- cardboard cones
- cardboard boxes

Cores

All fabric used by the company is delivered on cardboard cores. After use the cardboard cores are disposed to landfill. Some 10,000 cores are disposed of per year.

The company deals, mainly with two fabric suppliers. By recycling the cores to the suppliers the cost of land fill can be avoided. In addition there should be benefits for the suppliers as they will be able to reduce the amount of rolls they purchase. Best practice studies suggest that by introducing more durable plastic cores then they can be reused indefinitely, reducing costs and avoiding landfill.

Cones

The company uses some 9,000 cones of thread every year and the empty cones are disposed of to landfill. The thread supplier is responsible for delivering thread to the site and re-stocking storage areas. Discussions with the supplier have resulted in arrangements for the cones to be collected for reuse.

A best practice solution is to use multi-trip cones. Studies have shown that these cost between one quarter and one third of the price of one trip cones. Typically a one trip cone cost between 3p and 4p and multi-trip cones cost 1p per trip. This approach brings benefits to both the supplier and the user. The supplier has lower cost and the user avoids disposal costs.

Boxes

As part of the production process materials are transported between manufacturing sites. Some 7,500 cardboard cartons are purchased every year at a cost of 50p per carton for this purpose. In order to reduce waste a trial using 100 plastic boxes was conducted. Essentially plastic boxes can be reused on an going basis, both reducing purchasing costs and disposal costs. The trial was successful and the company is introducing the scheme progressively across the whole organisation.

Summary

Reusable packaging materials are often a simple solution to a problem. In this case the introduction of plastic boxes has reduced the amount of material being sent to landfill. From a waste minimisation perspective this is an example of introducing a reusable system that has both economic and environmental benefits.

In the case of the thread cones this shows that by discussing the problem with suppliers, often solutions that benefit both parties can be obtained. Waste minimisation is not always about technological solutions, often the most effective solutions can be achieved in the simplest way.

When fully implemented the amount of packaging waste will be reduced by 80-90%, resulting in both economic and environmental benefits.

Case Study

Energy Saving in a Nursing Home

Company Overview

The Ambassador Nursing Home is a residential care home for the elderly and infirm. For the comfort of residents it is essential to maintain temperatures as well as ensure that adequate lighting is available at all times. The purpose of this study is to investigate ways of reducing energy usage in a circumstance where comfort of residents is a primary concern.

The Study Area

The building was originally constructed as a hotel before being converted in 1987 to its present use as a home for the residence and care of the elderly and infirm. The building comprises a reception area, 36 bedrooms, a dining area and communal lounges. Other areas includes a laundry facility, staff accommodation and boiler room. There are 35 staff working at the home on a 24 hour shift system.

The organisation was very of the need to ensure that residents enjoyed comfortable condition within the home but also wanted to ensure that energy was being used as efficiently as possible.

In order to identify where how the building compared with best practice an energy audit was undertaken. The involved data collection concerning energy usage throughout the building. The detailed was compiled so that it could be compared to data from the Energy Efficiency Office. data has been compiled by the Energy Efficiency Office which gives benchmark or typical values for energy use in different building types or for buildings used for particular purposes. The following table shows the figures for nursing homes.

Energy Efficiency Office Performance Assessment for Nursing Homes

| Energy Type | Yardsticks in Gj/100m ³ |
|--------------|------------------------------------|
| Fossil fuels | Between 54 & 68 |
| Electricity | Between 6.0 & 7.5 |

The following table shows the values obtained from the energy audit for the Ambassador Nursing Home

Ambassador Nursing Homes Performance Assessment

| | |
|--------------|--------------------------|
| Fossil fuels | 40Gj/100m ³ |
| Electricity | 9.9 Gj/100m ³ |

From the above it can be seen that the nursing home compares favourably in terms of fossil fuel. Typical fossil fuel uses in this area are space heating.

However in terms of electricity consumption the nursing home is some 33% higher than a typical facility of this type.

On the basis of the above an analysis, a more detailed examination of electricity use was undertaken. One of the main users of electricity is lighting. Given the nature of the business then lighting use is high. The study showed that the costs of electricity for the nursing home is £6841 per year. By replacing the filament lighting stock with compact fluorescent stock then this could be reduced by £2200 per year. Other areas where efficiency could be improved are the promotion of an energy efficiency strategy for employees to ensure that any benefits obtained are maintained and a review of the energy efficiency of ancillary appliances.

Summary

This study has shown that by simply comparing performance against benchmark values then an insight into energy efficiency performance can be gained. Raising awareness in this way shows that many organisations can benefit. The initial gains for the organisation in this case were modest. However, by showing that real savings can be made, should encourage the organisation to move down the waste minimisation path.

Case Study

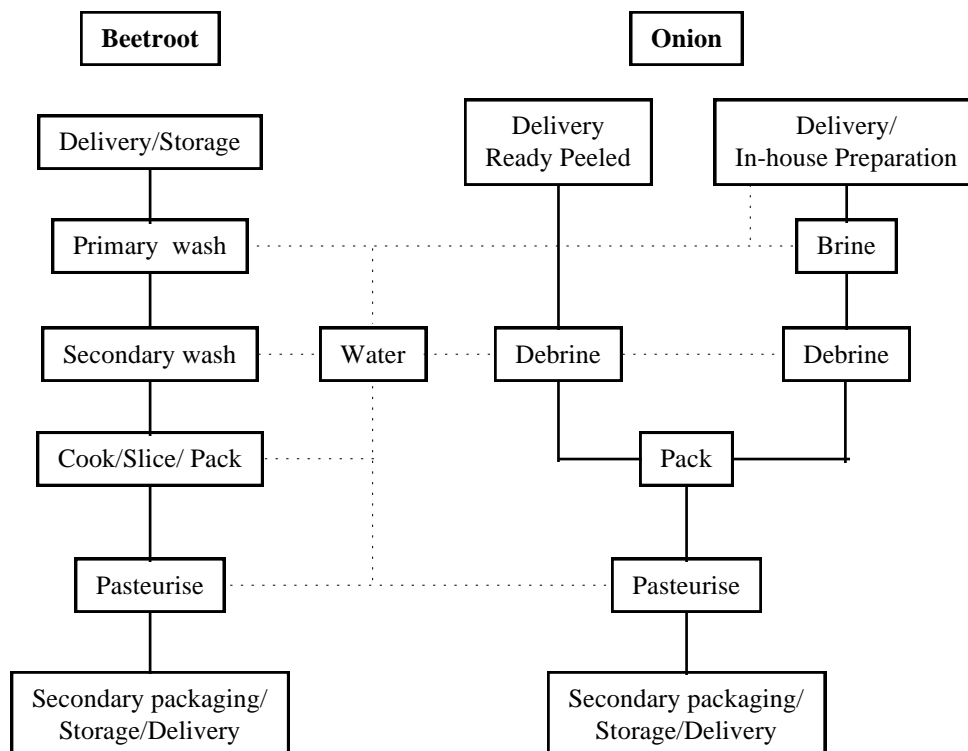
Water Use Study in a Food Processing Company

Company Overview

Ross Pickles is a family owned business based on Tyneside. The main activity of the company is the preservation of raw vegetables by pickling and packaging. The company operates in a highly competitive market and see quality and a commitment to continuous improvement as a key to their future success. As part of the commitment to continuous improvement Project Tyneside was invited to visit the company to see if a waste minimisation approach to water usage could offer any environmental and economic improvements.

The Study Area

The study looked at the overall process, from preparation of raw material, the process itself, through to the processing of raw materials through to packaging, and the clean up operations after each production run. In order to gain an understanding of water usage around the facility a water mass balance was conducted. The following diagram gives an overview of the main activities for two product runs.



Note: Water is used for wash down after each production run (end of each day)

Summary

The company are very proactive in their approach to improving efficiency. This derives both from the commitment of the management staff to continuous improvement and as a response to pressures exerted through the supply chain. The company operate in a very competitive environment and supply a range of major customers. In order to remain in business the company continually strives to improve.

From the study programme it became apparent that the management team are very knowledgeable of their sector and the processes within it. However much of this knowledge is empirical and gained from long experience of the processes operated on site. The conclusion from the study is that water usage on site is well managed. As part of its commitment to continuous improvement, there are some areas for the company to investigate:-

- installation of a monitoring system
- raising awareness amongst employees

Waste minimisation can be a valuable part of any continuous improvement programme. However to maximise the effectiveness information is crucial.

The installation of a comprehensive metering system would enable a baseline to be established for each type of process undertaken on the production line. At this stage any improvements in efficiency could be monitored to test the cost benefit. This would enable regular quantifiable reports to be generated that would enable the monitoring of performance of any introduced improvements. It would also have the further benefit of demonstrating to customer organisations, if required, progress made in improving efficiency. Given the increasing interest in customer organisations in “greening the supply chain.” This could be a source of competitive advantage.

Information about performance can be used as part of a training programme for raising awareness of staff. For any programme to be effective, it is necessary that everyone in the organisation is aware of what the company is trying to achieve and the steps they can take in helping to realise improvements.

Changing attitudes and raising awareness is a vital part of any successful waste minimisation initiative.

Case Study

Steam Rationalisation for a Bitumen Products Manufacturer

Company Overview

Jobling Purser, at their Paradise Works in Newcastle upon Tyne, manufacture and process bitumen products mainly for use in highway construction. Steam is used by the company to maintain the viscosity of raw materials in the manufacturing process. The purpose of the study was to identify ways of improving steam rationalisation on site.

The Study Area

Steam is produced by a boiler and directed to two manufacturing units on the site. The study looked at the following areas:-

1. efficiency of the boiler
2. efficiency of the steam distribution system

Steam Generation

Steam is generated by a single boiler installed in a boiler house on site. Testing of the efficiency of the boiler showed that it operated at an efficiency of 69%. Similar units are expected to operate at an efficiency of 80%.

Steam Distribution

Steam is distributed to point of use by pipes. The pipe to each manufacturing unit were well insulated. However inside the units pipes were not insulated. Some 86% of pipework by length was found not to be insulated.

A number of steam leaks were found in the distribution system:-

- Three main steam traps on the supply line to one of the manufacturing units were leaking heavily.
- Leaking pipework valves and connections were found.
- Five steam lines were open to drain (after providing heat to the final user) as opposed to returning condensate to the boiler.

Condensate Discharge

About 40% of the condensate is returned to the boiler. The rest, 60%, is discharged to drain.

Data was collected for the study to show the energy use of the boiler and steam system. Annual fuel cost data was then used to show the losses associated with the steam generation and distribution system. The results of this analysis is shown in the following table.

Fate of Energy and Annual Costs

| | % annual fuel costs | Cost per annum (£'s) |
|---|---------------------|----------------------|
| Boiler Energy Losses | 30 | 4983 |
| Steam Distribution System Energy Losses | 64 | 10314 |
| Useful Steam | 6 | 935 |
| Total | 100 | 16232 |

From the analysis it was shown that the existing systems was very inefficient and a number of no-cost and low-cost opportunities were identified.

No-Cost Options

1. Steam Trap Maintenance Programme: regular inspection and maintenance to prevent traps jamming open and losing steam.
2. Shutting off steam supply to non-operational areas: reduce losses through “deadlegs.”
3. Steam System Maintenance: repair leaks in valves, connections and pipework.

It is difficult to quantify the benefits associated with the above, but it was estimated that savings of about £1000 per annum could be made at minimal capital expenditure.

Low-Cost Options

A number of engineering solutions were identified. The cost of implementation and savings achieved was also identified. These are discussed below.

Boiler Maintenance Programme

Testing and regular tuning to optimise combustion conditions would lead to increased boiler efficiency.

| | |
|---------------------|----------|
| Capital Costs | £600 |
| Annual Fuel Savings | £1700 |
| Payback | 4 months |

Insulate Pipework

Losses associated with uninsulated pipework are £6500 per annum. The following shows the costs and payback of insulation for each of the manufacturing units.

Unit 1: cost of insulation £2000 payback 5 months
Unit 2: cost of insulation £310 payback 5 months

The above costs exclude installation.

Changing Steam Supply System

Manufacturing unit 2 has a small steam requirement and the majority of steam transferred is lost leading to losses of £2750 per annum. Replacement of the current system with an electric trace heating system would remove these losses.

| | |
|--------------------------|----------|
| Capital Cost: | £770 |
| Running Costs per annum: | £300 |
| Payback: | 4 months |

Summary

The study showed that the steam system on site was very inefficient. Options for no-cost and low-cost improvement showed that, in the case of no-cost options savings of up to £1000 per annum could be achieved by improving the maintenance programme. However, more significant savings could be achieved by investing in a number of areas. Improving boiler efficiency, insulating pipework and replacing the steam system in manufacturing unit 2 would incur capital costs of under £3500 and led to savings of just £10,000 per annum after payback. The payback in all cases is less than 6 months. It is often found in waste minimisation studies that a number of improvements in housekeeping measures and small capital investments can lead to significant benefits.

Case Study

Energy Savings for a Dye Manufacturer

Company Overview

Pointing Limited, based at their site in Prudhoe, Northumberland, manufacture a range of dyes and flavours for use throughout the food industry. The company employ a batch aqueous process to manufacture dyes. As part of their process the dye products are dried within steam heated cabinet dryers.

As part of the company's waste minimisation strategy, an investigation was conducted of the cabinet drying process in order to identify ways of:-

- reducing steam consumption
- reducing product drying time
- reducing product losses

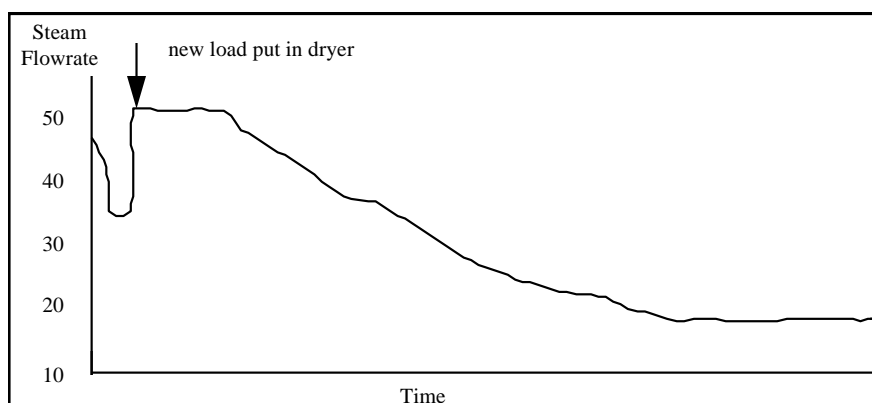
The Study Area

The cabinet dryers operate by drawing in cold air which is passed over two banks of steam heated radiators. Product is loaded onto trays, which are then loaded onto racks in the dryer. The dryer has a number of controls to regulate air flow throughout the system.

The company operate 27 similar cabinet dryer systems on site. A detailed energy audit of one dryer was conducted and the results used as a basis for identifying areas for efficiency improvements. In addition a study of operating practices of the dryers were observed in order to identify where further improvements could be introduced.

Data was collected of the steam flow rate during a complete drying cycle. A number of scenarios were tested so that the impact of a number of operating conditions could be assessed. In addition, operating procedures were observed in the drying area so that an assessment of these and the impact on steam use could be made.

When product is loaded into the dryer the steam requirement peaks, falls and then levels out as the product and trays reach the optimal moisture content. The following graph shows typical steam consumption over the drying cycle for a properly operated cabinet. The length of the drying cycle is typically two and a half days.



Data was collected for a number of operating scenarios of the dryers, after the product and trays had reached the optimal operating temperature. The following table illustrates typical results from that part of the study.

| Operating Scenarios | | | | | |
|---------------------|-----|-------|-----------|-------------------------|--------------------------------------|
| Door Position | Fan | Steam | Vents | Average steam flow rate | Percent. of maximum steam flow rate. |
| closed | on | on | closed | 21 | 42 |
| closed | on | on | roof open | 43 | 86 |
| closed | on | on | side open | 38 | 76 |
| fully open | on | on | closed | 50 | 100 |
| ajar | on | on | closed | 43 | 86 |
| closed | off | on | closed | 12 | 24 |
| closed | on | off | closed | 0 | 0 |

From the above it can be seen that variations in operating conditions has a significant impact on steam consumption.

During the study the following observations were made of operating practices:-

Cabinet Dryer Operation

A number of cabinet doors were partially open.

Empty dryers were left operating despite having no product in place.

A number of dryers were only partially filled.

Product Losses

Product losses were identified when the trays were filled and loaded and unloaded from the dryer. Although these were small, less than 1%, changes in operating practices would avoid this loss.

Equipment Maintenance

A number of dryers were observed to be in need of maintenance:-

- door latches missing or broken
- holes in dryer
- missing control handles on vents
- damaged side vents
- dented and misshapen doors
- non-functional temperature gauges.

Summary

The purpose of the study was to identify areas where improvements could be made. The findings indicate that many improvements can be made simply by improving operating practices and minor technical improvements. On the basis of the study a training programme is being introduced. Data from the study will be used to show the impact on efficiency of various operating practices. By implementing good operating practices it is estimated that steam consumption can be reduced by 20%, leading to savings of about £7000 per year. The company has started to install isolation valves on the cabinets so that the steam supply is cut off when the cabinet is not in use. Estimated savings from this improvement are some £5,600 per year. Capital cost of some £2700 per year. Waste minimisation studies often show that by improving operating procedures and making small improvements, savings can be made.

Case Study

Waste Minimisation Opportunities in a Coatings Manufacturer

Company Overview

Practical Compounds, located at Tyne Dock in South Shields, specialises in the manufacture and supply of a range of industrial coatings and coating products. The majority of the coatings are manufactured by blending the raw materials in open change pans. In addition bitumen and petrolatum products are manufactured in mixing boilers. Some 250 raw materials are used in the manufacture of its products. A study was undertaken to identify and quantify wastes in terms of the materials, goods and services purchased as well as material disposed from the site.

Study Area

The study covered a number of areas on the site; recycling solvent waste, recycling excess stock, drum disposal, waste segregation and housekeeping issues. The study was conducted by carrying out an audit of each area to ascertain what was being done and to identify areas for improvement. The following summarises the findings of the audit.

Solvent Waste

About 3,200 litres per year of solvent waste are generated from various cleaning operations on site. Solvent is classified as special waste and the company has opted for off-site recovery of solvent as the most cost effective way of dealing with these wastes. When compared to other routes, such as incineration or use as Cemfuel, then disposal costs are reduced by 90%, resulting in savings of between £1200 and £3450 per annum when compared with the other disposal options.

Minimising Excess Stock

Given the range of raw materials required by the company, inevitably there are instances where there is excess in the inventory, for example, where materials were originally purchased for products that are no longer manufactured. An investigation of this area showed that the company had a range of materials no longer needed. A specialist recycling company was contacted for reuse or recycling of these products. The company received an income of £500 for these products as well as avoiding waste disposal costs.

Drum Disposal

The disposal of drums (205 litre) is a problem for Practical Compounds as well as a number of other organisations. In order to reduce disposal costs as well as reduce environmental impact the company adopted the following measures:-

1. Wherever possible empty solvent drums were used for packing solvent based products for delivery to customers. Reusing drums in this way produces savings of about £26 per drum.
2. Identifying those suppliers that take back empty drums.
3. For those that could not be recycled or reused, the company now crushes on-site prior to disposal. This has reduced disposal costs by 20% and waste volume by 80%.

Waste Segregation

Waste disposal costs for special waste are considerably higher than those for controlled waste. Ensuring that wastes are disposed in the appropriate way can reduce disposal costs. This requires that employees are made aware of which waste should be disposed of as special waste and that facilities for that purpose are clearly identified. Typically reductions of 50% in the costs of special waste disposal are achievable. This would lead to a reduction of £1000 per year for the company.

House Keeping Issues

The company spends about £75,000 per year on packaging, ranging from small sacks to large drums. Poor handling and storage practices of these raw materials can result in damage. Implementation of the following could help to reduce losses:-

1. raising awareness about the need for careful handling of packaging materials;
2. ensuring that materials are not over ordered;
3. ensure that storage is weather proof.

It is estimated that would lead to a saving of about 1% or about £750 per year.

In terms of disposal of paper and cardboard waste, the company spends about £700 per year. By segregating these wastes the company can have these materials collected by a recycling company. The prices paid (or charges made) have varied enormously in recent years. However an investigation of current prices could enable the company to receive some income and avoid disposal costs.

Summary

Often waste minimisation studies can identify a number of areas where improvements can be made as well as being used as a tool to benchmark existing practices. This study has shown that it is important to ensure that current practices are in-line with best practice and to identify areas where practice can be improved. Also the study has shown the importance of raising awareness amongst employees. No matter the solution to a problem, it needs the involvement of everyone in order to be successful.

Case Study

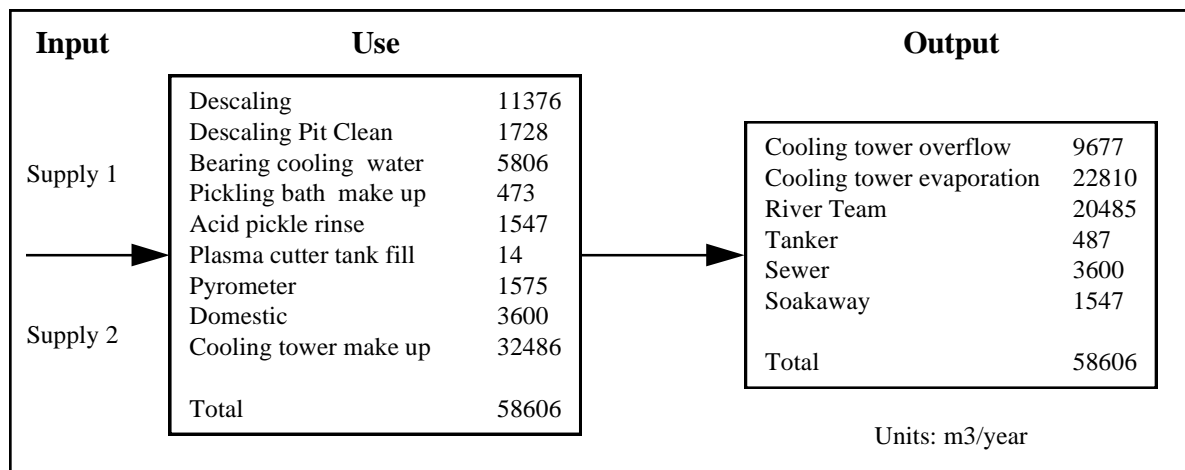
Water Savings for a Speciality Metals Manufacturer

Company Overview

Spartan Redhugh cut and roll steel slabs to produce steel plate, some of which has to be pickled, at a manufacturing site on Tyneside. The company use water on site for a variety of purposes such as roll cooling, de-scaling and pickling processes. The purpose of the study was to identify and quantify water use throughout the site and identify any water saving opportunities.

The Study Area

In order to identify areas for water saving a water balance of the site was conducted. The following figure illustrates the results of this part of the study.



From this the following table, showing use and costs, was developed.

| User | Usage (m3/year) | Cost (£/year) | % |
|----------------------------|--------------------|------------------|------------|
| Descaling | 11376 | 8873 | 19 |
| Cleaning of Scale Pit | 1728 | 1348 | 3 |
| Bearing cooling water | 5806 | 4529 | 10 |
| Pickling bath make up | 473 | 369 | 1 |
| Post pickling rinse | 1547 | 1207 | 3 |
| Plasma cutter bath make up | 14 | 11 | 0 |
| Pyrometer cooling | 1575 | 1229 | 3 |
| Cooling tower evaporation | 22810 | 17791 | 38 |
| Cooling tower overflow | 9677 | 7548 | 17 |
| Domestic | 3600 | 2808 | 6 |
| Total | 58606 | 45713 | 100 |

About 35% of water is used in the rolling mill operation and 55% used in the cooling tower. Investigations into these areas revealed a number of options to reduce water use. These are presented as no and low cost options.

No Cost Options

Bearing Cooling Water

Bearings on a furnace conveyor are cooled continuously to prevent seizure. Switching this off for period during the weekend, when the plant is not working, could lead to savings of some £1300 per year.

Pyrometer Cooling Water

The pyrometer measures temperature of work pieces passing through the mill. Shutting off this cooling water supply when the 4 High Rolling Mill is not in use could result savings of £640 per year.

Low Cost Options

Optimise Bearing Cooling Water Flowrate

An open ended pipe is used to cool bearings on the furnace conveyor. By replacing this with a dedicated spray bar the amount of water used can be optimised leading to savings of about £1600 per year. Cost of modifications is about £300, giving a payback of around 2 to 3 months.

Change Valve of Pyrometer Cooling Water Supply

It was observed that the valve was inappropriate for purpose, leading to a higher flow of water than needed. Installation of a more appropriate valve would allow finer adjustment leading to a reduction in water flow. This could save some £800 per year. The cost of a new valve is between £10 and £50, giving a payback of about one month.

Improve Cooling Circuit Control in Cooling Tower to Prevent Overflow

The overflow accounts for some 17% of water use on site at a cost of some £8300 per year. A series of recommendations were made to balance the system and hence prevent the overflow. Though no capital investment is needed, it will require the company conducting a number of operations in order to balance the system.

Other options were identified but not fully evaluated, for example, modifying the width of the descaling spray bar and treating water for reuse. In the first instance, work pieces are blasted with high pressure water to remove scale. The full width of the rolling mill is blasted irrespective of the width of the work. By having a variable width spray bar, about one third of the water used could be saved, leading to savings of around £3000 per year. However the cost is likely to be in excess of £40,000, making this option unrealistic. In the second instance it could be possible to reuse some 80% of the water from the effluent treatment system, leading to savings in water charges of some £13,000 per year. However, initial indications suggest that the capital costs would be high, leading to a payback of between 3 and 6 years.

For both of these options it has been recommended that the earlier options be implemented first, as the impact of these could have repercussions on the costing of the other options.

Summary

The study has a number of areas where savings in water can be made. The no and low cost options can lead to savings of over £12,000 per year and require minimal investment. In the longer term there are other options which could lead to savings. Waste minimisation can lead to long term benefits for organisations, but it is important to note that not every option can, or should be, tackled at once. By implementing the lowest cost options initially and monitoring the benefits and impacts, will help to strengthen the case for introducing more capital intensive solutions at a later time.

Case Study

Reducing Tooling Costs for an Automotive Parts Manufacturer

Company Overview

Express 2 Automotive, at their site at Tanfield Lea, manufacture a range of components for the automotive industry. An initial waste review established that the true cost of waste for the company was £41,000 per month, with the major waste costs resulting from:-

- Swarf (value as purchased metal) £21,000
- Scrap parts £10,600
- Tooling (use above target) £8,250

Swarf costs are unlikely to reduce in the short term and systems are already in place to monitor, manage and minimise the generation of scrap parts. However, the costs of tooling were known to be above budget projections. It was agreed that a study focused on finding the reasons why the actual and budget costs of consumable tooling differed, would be of value. The company operate a number of manufacturing cells and the study was conducted in one of those with a view to rolling out any findings across the site.

The Study Area

A range of consumable and durable tools, for example, turning (rough/finish), grooving (rough/finish), boring bars and drills are used on site. These are supplied, in the main, by two suppliers. An investigation was conducted into the management of the tooling system. Three areas were investigated:-

- stock management
- use of tooling
- reporting systems

Stock Management

The key findings are:-

- there is no robust system for managing consumable tooling stock;
- no one has responsibility for managing the consumable tool stock;
- without the input of the tool suppliers there would be no effective management of tool stock.

The management of the tooling stock has, by default, been assumed by the tooling suppliers. Although tools are stored in a lockable cupboard, this is accessible to all with no formal system for booking tools in or out. This leads to situations where stocks of replacement tools were exhausted, leading to lost production and wasted labour. To improve this situation a formal management system for consumable tooling is required. To be effective, one person should assume overall responsibility for receiving tools from suppliers and distributing the appropriate tools to production areas.

Use of Tooling

Investigation showed that the consequences of current operating practices are:-

- tooling life is not optimised
- effective stock control is not possible

Tool life is specified by the supplier, but this can be extended if the tool is still in good condition. Optimisation of tool life is done on an ad-hoc basis. The management of the tooling stock is informal, making the collection of data on tool performance virtually impossible. By formalising the tooling

management system, raising awareness amongst staff of the factors affecting tool performance and ensuring that best practice information is disseminated will help to optimise tool usage.

Reporting Systems

Although a monthly report is prepared on tooling costs, it was found that this was inadequate in a number of areas:-

1. generation of the report took an excessive amount of time;
2. data sources, particularly on number of tools supplied, was unreliable;
3. there is a limited amount of management information available from existing data;
4. insufficient internal communication of the tooling report.

Improvement in this area are:-

- data collection needs to be simplified;
- monthly tooling costs to be analysed in more detail;
- a new tooling cost spreadsheet to be implemented;
- increase frequency of reporting;
- disseminate information to all concerned employees.

An analysis of a current production run of a particular component, showed that unit tooling costs were some 100% above the budget figure, leading to a projected overspend of some £68,500 by the end of the run. By setting targets, introducing a tool management system and raising awareness amongst employees, it should be possible to reduce these costs, based on a roughly linear improvement path, by at least £35,000, by the end of the production run.

Summary

Waste is often viewed as the residual material left after a production process has been completed; in other words waste is raw material that could not be converted into product, liquid effluent or solid wastes associated with either the production process or the way in which materials are delivered. Waste comes in many forms and often the mismanagement of resources associated with the manufacturing process can be as costly as the mismanagement of raw materials. In this study it has been shown that tooling costs can be a significant part of the cost profile of a manufacturing process. Waste minimisation takes an holistic approach to resource management. In this case, items not traditionally considered as waste, such as tooling, can have significant impacts on the bottom line if not managed as carefully as raw materials.

Case Study

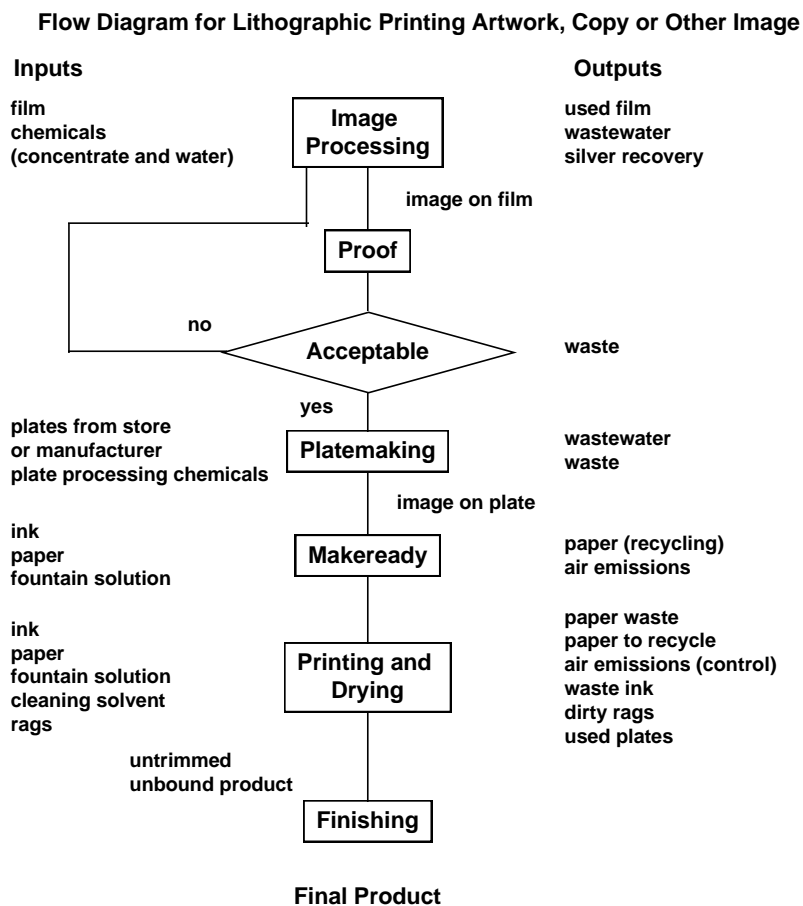
Reduction in Solid Waste for Printing Company

Company Overview

Harlow Printing Limited, based in South Shields, produce a range of products using several printing processes. The company is aiming to implement the ISO 14001 environmental management scheme. The company were interested to see if a waste minimisation study could help with the development of their environmental management system. A study of solid waste management practice was conducted with a view to identifying areas for minimisation and assessing, whether or not this would make a contribution to the development of the environmental management system.

The Study Area

An overview of the types and sources of waste that can be generated in a printing process are shown in the flow diagram.



Using this a basis for investigation the study showed that the following areas had potential for waste reduction:-

- raw materials - paper, cardboard, ink
- ancillary materials - lithoplates and photographic film
- packaging - pallets, ink and chemical containers

Raw Materials

Although the company operate a segregation scheme for clean and dirty waste paper, it was observed that often dirty waste should have been classified as clean. Clean paper has a value and the amount of this available for sale could be increased by some 20 - 30%.

Ancillary Materials

Silver from the photographic chemicals waste stream is recovered and an investigation into the potential for recovering silver from photographic film waste showed that while technically feasible it was not cost effective. Aluminium lithographic plates are used by the company and are recycled. However the value of the plates as scrap is less than 10% of their cost. New technology recently purchased by the company as part of an upgrade programme, had a facility which would allow paper plates to be produced. An investigation into this facility showed that the annual cost of paper plates was some £300 per year. The annual cost of aluminium plates is some £6000 per year. Use of paper plates will lead to a saving of some £5700 per year.

Packaging

Although the company use standard pallets for delivery to customers, often materials are delivered to the company on non-standard pallets, preventing their reuse. The company has attempted to persuade suppliers to use standard pallets so that they can be reused. While there will be no net gain it will help in meeting obligations under packaging waste regulations. In addition the company is seeking ways of reducing special waste from spent ink and chemical containers by seeking companies that are prepared to reuse the containers.

Summary

The purpose of this case study has been to show that waste minimisation studies can contribute to the development of an environmental management system. Waste minimisation studies require an in depth look at the ways in which raw materials are used and waste products generated. This will help to identify a range of options both to minimise the production of waste and to reduce the environmental and economic impact of waste disposal practices. An environmental management system seeks to develop a framework for ensuring that production processes are managed in ways that reduce environmental impact. Waste minimisation can make a significant contribution to the development of such systems.

Case Study

Water Saving in an Electroplating Company

Company Overview

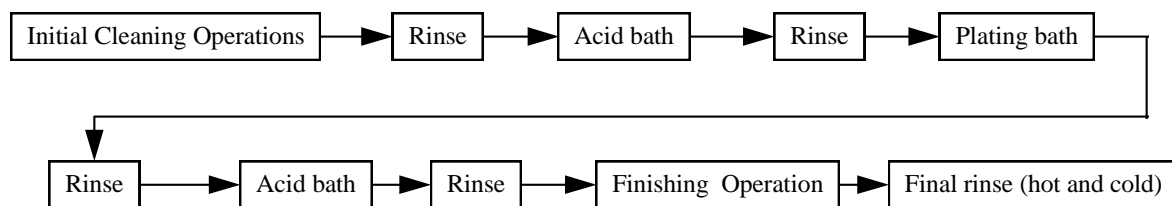
Northumbria Plating are commission platers for various steel components. They are located on the Algernon Industrial Estate in Shiremoor, Newcastle. The company operates three plating lines:-

- an automated plating line for zinc and copper products - this carries out the bulk of their production;
- a manual zinc plating line for small or specialised orders;
- a manual plating line used for nickel and gold plating.

The Study Area

Initial work with Northumbria Plating indicated that water usage would be an area where possible savings could be achieved. A bench-marking exercise had shown that performance in water usage was below average when compared to best practice guidelines established by the Environmental Technology Best Practice Programme. The study focused on the automated plating line. Figure 1 gives an overview of the various stages in the plating line.

Figure 1: Schematic of Plating Line



Work in various forms is either attached to a rack or loaded into a plating barrel. The work is then plated by passing it through a series of baths. Water is used for a variety of purposes in the production process:-

- to make up the treatment baths;
- to rinse work between process stages;
- cleaning.

Method

Fresh water is added in a number of stages in the plating process. The following table shows typical quantities of water used per month. As can be seen the majority of water associated with the process is used for rinsing. Rinse water is applied between the various stages in the plating process. As each rack or barrel of work enters the rinse process a rinse valve is actuated for a pre-set time. A study of the time that the work was in the rinse process and the time the valves are actuated showed that there was scope for optimisation.

| Application | Water usage cubic metres/month |
|--------------------|---------------------------------------|
| Rinse Water | 2621 |
| Bath make up | 71 |
| Cleaning | 6 |
| Total | 2698 |

By adjusting the set up time of the rinse operation it was shown that water usage was reduced by 60% leading to a saving of £2,000 per month on water and effluent treatment costs. There is no payback time associated with this.

An additional study was conducted of the potential for recycling rinse water from the rinse following the hydrochloric acid dip to the rinse following the initial cleaning operations. Studies have shown recycling water in this way will have no overall impact on the quality of production of the overall plating line. Costs of the modification have been estimated at £1,500 and could lead to savings of £400 per month in water and effluent charges. This would give a payback period of 4 months.

Summary

Waste minimisation can have a number of benefits. In this case waste minimisation has shown that by optimising resource use the organisation can obtain a financial benefit as well reduce their environmental impact.

| Action | Financial Benefit | Payback | Environmental Benefit |
|-----------------------|--------------------------|----------------|---|
| Process Optimisation | £2000 per month | None | Reduced water consumption and effluent production |
| Recycling Rinse Water | £400 per month | 4 months | Reduced water consumption and effluent production |

Case Study

Reducing Costs for a Bespoke Furniture Manufacturer

Company Overview

Robinson and Liddel are bespoke furniture manufacturers based in Westerhope, Newcastle upon Tyne. Utilities (electricity, fuel oil, natural gas and water) cost the company some £10,000 per year and were interested in finding ways of reducing usage.

The Study Area

In order to identify where savings could be made the project gathered data on utility usage and compared this with benchmark performance data. This would help to identify areas where savings were likely to be made. Benchmark performance data is available from the Energy and Environment Helpline which supplies a range of publications that can be used to compare usage with best practice. The following table shows the spend per utility for the company.

| Utility | Annual Consumption | Annual Cost (£) |
|--------------|--------------------|-----------------|
| Electricity | 63,839 kWh | 4212 |
| Fuel Oil | 305,000 kWh | 3532 |
| Natural Gas | 107,508 kWh | 968 |
| Water | 224 m ³ | 1134 |
| Total | | 9847 |

The following discussion outlines areas where savings can be made.

Electricity

Electricity is used in the following ways:-

Power for tools: 29%
Extract fans: 20%
Air compressor: 9%
Lighting: 30%
Office: 3%
Domestic: 9%

Analysis of the data showed that 64% of costs are incurred directly for use of electricity, 19% is for maximum demand charges, 15% is for distribution capacity charges and 2% for quarterly charges.

Lighting

These costs compare favourably against benchmark figures for similar premises. Savings could be made by using more efficient lighting and by ensuring that lighting is turned off when not needed.

Tools and Fans

Savings can be made by ensuring equipment is switched off when not in use and by ensuring that high efficiency motors are used when replacing old units.

Compressed Air

Savings can be achieved by ensuring that the system has no leaks and that compressed air is used only when there is no suitable alternative.

Domestic and Office Equipment

Savings can be realised by ensuring that all equipment is switched off at the end of the day.

From the above areas, potential savings of 20% could be achieved resulting in savings of some £800 per year.

Review of Tariffs

Savings could be realised by reviewing, with the utility provider, both demand and distribution charges.

Fuel Oil

Analysis of data showed that fuel usage was comparable with benchmark values for premises of that size. By establishing a monitoring system of fuel use against degree days the company should be able to better to manage performance against best practice data.

Natural Gas

This is mainly used for batch curing processes. Use of a monitoring system would enable the company to ensure that use is consistent. If not, an investigation of high usage could lead to the identification of areas for improvements. In general, for processes of this type, improvements are likely to be in insulation levels and by minimising loss through the exhaust system.

Water

Water on site is used primarily for domestic purposes. Data analysis showed that usage was compatible with benchmark values. Further analysis showed fixed charges accounted for some 80% of the cost. It was recommended that the company investigate this as well as look at introducing water saving measures on taps and toilets.

Summary

The study concluded that it would be possible to reduce utility usage by 15% per year leading to annual savings of some £1500. All organisations can benefit from improving utility efficiency. This study shows the importance of developing a monitoring system to show trends in usage, which will enable the organisation to investigate exceptions. The project showed the benefits of comparing use against benchmarks. Considerable work has done in establishing what typical usage rates should be for organisations and working out your performance against these values is not difficult. Knowing your performance against a benchmark can help identify areas where savings can be made.

Case Study

Raising Awareness about Waste in a Manufacturer of Foam Products.

Company Overview

Carobel Foam, based in North Shields, convert large foam block into a range of products including padding for the furniture and automotive industries and packaging materials. The costs of raw material are a major part of production costs. The purpose of the study was twofold:-

- to explore ways of improving raw material utilisation;
- identify options for off-cuts that were too small to be re-used.

Study Area

Foam is cut on site using CNC machines and band saws. Any foam that does not leave the site as finished product is collected by a recycling company. There is a differential between the purchase price of raw materials and income received from the recycling company. If raw material utilisation could be improved then this would benefit the company. The project looked at the feasibility of developing a targeting and monitoring system, that could be used to identify areas where improvements to raw material utilisation could be made. Typical causes and sources of scrap and potential areas of improvement are highlighted below.

Causes and Sources of Scrap

There are many possible causes and sources of scrap in a foam cutting operation. These can range from:-

- skin removal for new blocks - this can be made worse if new blocks are irregular in shape, for example, concave;
- physical damage, for example, scoring;
- ageing - cut blocks tend to discolour over time;
- wastage factors for various machine operations;
- nesting losses;
- block and part losses that result when blocks are cut into parts and parts into products;
- off-cut wastes that are too small to be used for other products.

Opportunities for Scrap Reduction

There are a number of areas where raw material utilisation may be improved:-

- cutting minimum thickness when removing skins or cleaning blocks
- careful storage and handling to prevent physical damage
- selection of blocks and reuse of blocks and large off-cuts for work that minimise waste
- segregated, identified storage areas for part blocks and large off-cuts
- scheduling production to help maximise utilisation of blocks

are all key factors.

Monitoring and Targeting

To effectively implement changes designed to improve raw material utilisation, information about scrap levels throughout the production process is needed. To do so requires a monitoring and targeting system.

A computer based monitoring and targeting system was developed using data on raw materials purchased and data from the recycling company. This gives information on raw material utilisation on a monthly basis. This could be further improved by implementing a scrap logging system on site, enabling weekly returns. This will highlight areas where improvements have been made. Areas where performance has deteriorated will also be highlighted, allowing the causes to be investigated and remedial actions to be promptly put in place. At present the company is evaluating the effectiveness of the system and evaluating what further steps need to be taken.

Alternative Uses of Scrap Material

This some of scrap that cannot be reused in the current production areas. These are small off-cuts, which, at present, are recycled. The company will need to consider whether it is better to seek ways of utilising these in other product fields or continue with the present product range and accept that there will be some level of scrap. Areas that the organisation could examine are:-

- Toy manufacturers, for example, fun cushions.
- Sportswear, for example, protective equipment.
- Office products, for example, mouse mats.
- Clothing, for example, padding for jackets.
- Retail packaging products, for example, presentation and gift boxes.

Summary

The success of any waste minimisation initiative depends on a range of factors. This study showed that the company recognised that the production process did generate scrap materials. It was also recognised that information about scrap rates would enable actions to improve utilisation rates. Understanding scrap levels and the impact this can have on the performance can demonstrate that waste minimisation is about ensuring that the company operates optimally, hence contributing to job security.

The study also shows that there is some scrap that cannot be reused. In situations like this, the waste minimisation approach is to seek other products that this waste may be used to make, hence helping to improve the long term viability of the organisation. This area is likely to require long term investigation.

Case Study

Coatings Savings in Industrial Pipeline Company

Company Overview

Pipeline Protection specialises in coating industrial pipelines that service the water, oil, gas and petrochemical industries. External paint coatings are applied manually and internal coatings by using a motorised lance. The aim of this study was to identify ways of minimising coatings waste.

The Study Area

The study focused on minimising coatings waste as initial work had identified that a third of all paint purchased was lost as waste. This represents about £160,000 per year. Considerable benefits could accrue to the company if ways could be found of reducing the amount of paint wasted.

Method

In order to identify the opportunities for minimising waste paint, structured brainstorming sessions were held with the paint shop personnel. A total of 12 opportunities were identified. Opportunities were ranked either high, medium or low in terms of feasibility and effectiveness in reducing waste. Of these a total of 6 areas that were prioritised for investigation. The following table summarises the opportunities identified.

| | Option | Will it Work? | Will it reduce waste? | Ranking |
|----|---|---------------|-----------------------|---------|
| 1 | Obtain gauge for wet film thickness tests on bends | H | M | 1 |
| 2 | Coat pipes in two stages, instead of single operation as at present | L | H | 3 |
| 3 | Control temperature of paint in tin | H | L | 3 |
| 4 | Insulate lines to ensure consistent temperature at point of application | H | H | 1 |
| 5 | Install a motorised bogey for external spraying | M | H | 2 |
| 6 | Improve control of manual blasting for pipe preparation | L | H | 3 |
| 7 | Produce internal guidance booklet that relates microns per pass to boom speed and tip size for different paints | H | H | 1 |
| 8 | Improve control of internal boom speed | H | H | 1 |
| 9 | Record actual material usage on job/batch sheets | H | H | 1 |
| 10 | Encourage customers to specify coating thickness on a nominal rather than a minimum basis | L | H | 2 |
| 11 | Fix spraying point for small bore pipe | M | H | 1 |
| 12 | Level the floors in the paint shop | H | M | 2 |

Options 1, 4, 7, 8, 9 and 11 were given the highest priority as it was viewed that these would be the easiest to implement and be the most cost effective in terms of payback. The remaining options were generally more expensive or technically difficult to implement and would be tackled at a future time. The following discussion relates to those options.

Obtain gauge for wet film thickness tests on bends

Thickness was only measured on straight parts of the pipe and bends were often oversprayed. By measuring wet film thickness on bends, paint loss due to overspray could be avoided.

Insulate lines to ensure consistent temperature at point of application

Coating temperature at point of application is often crucial, as incorrect temperatures can have a significant impact on quantities used. Coating material is delivered by flexible pipes to point of application. Insulating the supply lines ensure that heat losses are minimised.

Produce internal guidance booklet that relates microns per pass to boom speed and tip size for different paints

Best practice information was supplied to ensure that the appropriate tip was used for the coating being used. This ensures that the correct amount is sprayed per pass.

Improve control of internal boom speed

Internal coating of pipes is done using a motorised boom. The speed control was very coarse, which can result in the over application of coating. An upgraded speed controller minimises over thickness.

Record actual material usage on job/batch sheets

The success of any waste minimisation exercise depends on usage of materials being monitored. A daily production log enable operators to monitor performance against minimum theoretical usage.

Fixed spraying point for small bore pipe

External coating of pipes was done using hand held equipment. In order to reduce losses a simple horizontal guide bar ensures that the coating is delivered from a fixed point, minimising overspray.

Summary

Initial work with the company had shown that the true cost of waste for the painting operation was about £166,000.00 per year (equivalent to 33,000 litres of paint). The costs of waste disposal associated with the paint operation are about £6,000 per year (based on 1997 data). This shows that an understanding of the true cost of waste can identify areas where companies can make substantial savings. Many of the ideas generated could easily and quickly be implemented on-site, leading to savings of around £16,000 per year. Others are longer term, requiring either investment or discussions with customers.

Case Study

Solvent Savings in Industrial Pipeline Coatings Company

Company Overview

Pipeline Protection specialises in coating industrial pipelines that service the water, oil, gas and petrochemical industries. The site uses up 10,000 litres per year of solvent for paint thinning and cleaning operations. Although the organisation has a solvent recovery system on site, this has not been used for two years as the recovered solvent was of low quality and not suitable for reuse. Some 6,000 litres of waste solvent are stored on site. The aim of this study was to understand the reasons why the on-site system was unsuitable and to investigate the options for off-site recovery.

The Study

The study focused on a number of areas:-

1. types, quantities and costs of solvents used on site;
2. investigation of reasons why on-site recovery had not been effective;
3. costs of on-site recovery;
4. costs of off-site recovery;
5. disposal costs of solvents.

The following highlights the study findings.

Six main solvents products were used on site. An analysis of the waste solvents showed 90% of the waste was made up of two solvents products. Investigations of previous attempts at solvent recovery showed that while the recovery system worked well for segregated batches of waste solvent, it did not work effectively for mixed batches. Previous attempts at solvent recovery had failed as it had been found difficult to introduce segregation practices on site.

A study showed that if proper segregation systems were put in place then it would be possible to recover a large proportion of the waste solvent generated on-site. About 3,000 litres of waste solvent could be produced per year, equivalent to 15 drums. Introduction of proper segregation technique would enable 90% of this to be recovered.

| | |
|---|-------|
| Savings in new solvent at £1.00 per litre | £2700 |
| Savings in solvent disposal costs | £2025 |
| Total annual savings | £4725 |

Waste solvents can be recovered off-site.

| | |
|----------------------------|-----------------|
| Cost of recovery off-site: | £60 per drum |
| Cost of residue disposal: | £10-25 per drum |

Total off-site recovery cost: £70-85 per drum
On an annual basis site produces about 15 drums of waste per year

Recovery costs are: £1,050-1,275

Assuming a 90% recovery rate then avoided costs are: £2700

Savings are: £1650-£1425 depending on disposal cost of residues.

If a disposal route is chosen then the costs associated with this are:-

| | |
|--------------|---------------|
| Cemfuel | £85 per drum |
| Incineration | £220 per drum |

The following table illustrates the costs and benefits of the dealing with the annual production of 15 drums of spent solvent.

| | On-site recovery | Off-site recovery | Cemfuel | Incineration |
|---------------|-------------------------|--------------------------|----------------|---------------------|
| Cost | | | 1275 | 3300 |
| Saving | 4725 | 1425-1650 | | |

It is clear from the above analysis that on-site recovery is the best financial option. However experience had shown that previous attempts had been unsuccessful due to lack of segregation. A segregation system has been devised for the company and is in operation.

Also the company has an inventory on site at present is 30 drums. This is made up of unsegregated solvent waste. The best way to deal with would be to have this recovered off-site at the costs shown above.

Summary

Although the company had invested in solvent recovery equipment, it had not proved to be successful. This shows that the success of technology is dependent on ensuring that the equipment is used correctly and that the correct inputs are used. The study showed that 90% of solvent waste on site consisted of two solvent types. By introducing a segregation scheme then the inputs to the recovery system would be optimum. This would ensure that the company was able to recycle solvents successfully, leading to ongoing savings as shown above.

Case Study

Reducing Waste in a Packaging Company.

Company Overview

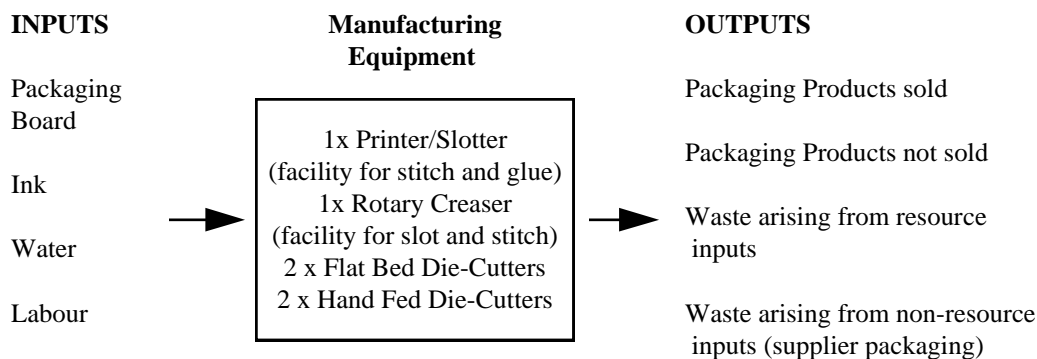
Valenbeck, based in Jarrow, Tyne and Wear manufacture packaging and provide a packaging service for a range of businesses both locally and nationally. The main activities of the company are:-

- timber based packaging - this is mainly for customers who deliver products to the site and packaging is specifically designed prior to shipment;
- paper based packaging - mainly heavy duty packaging for local and national business
- transport - provision a range of transport services

Initial discussions with Valenbeck identified the paper based packaging part of the company as an area that offered potential for savings. This part of the business represents almost one third of the turnover of the business and the raw material costs represent a high proportion of the costs of production - some 60%. An initial review confirmed that this area would provide opportunities for savings.

The Study Area

The paper manufacturing process consists of a series of machines that take flat corrugated packaging board and convert it to corrugated packaging cases. The following diagram gives an overview of the production area.



A mass balance study was undertaken in order to identify resource inputs, where they are used and how much is used or wasted. This was done with reference to pre production, the production process and post production. Information generated from the mass balance study was used to generate data for the resource use yield. This data was used to identify the cost of waste for all aspects of the production process. The study revealed that average loss over the production process was 12%, which gives a cost of waste to the business of about £86,000 per year. The next stage in the process was to identify the areas where losses were occurring and produce an action plan to reduce those losses. Two main areas were identified:-

- Raw materials - these represent 60% of the costs of production and opportunities for improved resource yield were identified.
- Productive utilisation capacity - the study revealed that there was under utilisation of the production equipment.

Developing an action plan for implementation is an important part of any waste minimisation study. Those actions which make an immediate or short term contribution to reducing waste at low or no cost should have the highest priority. Those which require investment or will result in savings in the medium to longer term, require a lower priority.

Summary

Although the study revealed a potential for a 12% saving in the paper packaging manufacturing process, the action plan developed sets out a staged approach. This recognises the importance of prioritising those actions which will have the most immediate impacts.

Opportunities for savings were developed would result in a 14% per year reduction in raw material use loss resulting in savings of £5,000 per year in the short term. These are set out below.

| Area of Activity | Reasons for Waste Arising | Possible Solutions |
|-------------------------------|--|---|
| Estimating and Ordering | Excess material ordered Excess cut and trim Excess stock - not used | Install stock records system. Improve optimisation of sheet size. Install system to record stock levels and usage. |
| Material Handling and Storage | Damage in transit Damage in handling and storage | Change method of packaging and delivery. Introduce monitoring system. Change method of handling and storage. Install monitoring system to record damage history. |
| Set-up and Make Ready | Incorrect set up and misinterpretation of production data Incorrect ink colour match to meet customer samples | Review order processing system to ensure order specification is accurately interpreted in production documents. Install pre-production sample inspection system. |
| Production Run | Defective production equipment causing product to be out of specification Out of specification product due to unsuitable paper board supply | Install control and inspection system to allow monitoring of key production data and out of specification product. Install system for paperboard inspection. |

Opportunities for improved production capacity resulting in an 10% improvement which would realise savings of about £5,000 per year.

| Area of Activity | Reasons for Waste Arising | Possible Solutions |
|--------------------------|------------------------------------|--|
| Paper packaging business | Production capacity under utilised | Try to obtain increase in orders to match capacity. Obtain agreement with existing customers to longer planning phase to enable longer production runs. Seek to rationalise production - fewer machines and personnel. |

The importance of prioritising options for an organisation cannot be overemphasised. In this case a particular area was identified for actions. However the study covered other areas of operation of the business and highlighted opportunities to make savings. By identifying specific areas where savings can easily be achieved this has demonstrated the benefits of taking a waste minimisation approach across the whole organisation.

Case Study

Energy Saving in an Aluminium Components Manufacturer

Company Overview

Norfran Aluminium manufactures a wide range of aluminium components using high pressure die casting machines. Aluminium ingots are melted in three gas fired furnaces. Molten aluminium is transferred to holding furnaces associated with each die-casting machine. Metal utilisation is greater than 98%, better than the industry average, and waste disposal costs are low, typically £4,000 per year. Energy costs run at some £240,000 per year for the site as a whole. The study focused on energy use in the production area as this is the major user.

The Study Area

Both natural gas and electricity are used on site, which account for expenditures of £80,000 and £160,000 per year respectively. An analysis of use was conducted in order to identify the major energy users on site and to identify areas where savings could be made.

Electricity

The site has only meter and data concerning usage for different production aspects was gathered from on-site measurements which showed that the main electricity users were:-

| | |
|---------------------------------|-----|
| die casting machines (20 units) | 39% |
| holding furnaces (20 units) | 22% |
| ladles (20 units) | 11% |
| air compressor | 6% |
| lighting | 5% |

From the above it can be seen that the die casting machines and associated furnaces and ladles are the principle users of electricity. Molten aluminium is transferred from the holding furnace to the die casting machine using an electrically powered ladle. The following discusses a number of energy efficiency improvement opportunities.

Die Casting Machines and Ladles

Both the ladle and die casting machines contain a number of motors. It should be established that they are appropriately sized and are energy efficient. Oversized motors are inefficient and replacement high efficiency units are available at no extra cost. By implementing a replacement strategy, as part of the maintenance programme, efficiency can be improved. Introducing measures to ensure that motors are switched off when not in use, for example sensors, will improve efficiency, as motors typically consume 15% of rated power when idling.

Holding Furnaces

Each die casting machine has an electrically heated furnace. These use about 22% of site electricity consumption. Roof radiant electric furnaces are currently used on fifteen die casting machines. These units can use up to 50% less energy for the same capacity when compared to conventional electrically heated furnaces. In the long term, the company plans to replace the remaining 5 units with roof radiant electric furnaces where feasible, hence increasing efficiency. A further improvement the company has implemented concerns the refractory lining of the furnaces. The current board linings used are not robust and in time become damaged leading to corundum build up and have to be replaced, typically every eighteen months. This lowers the efficiency of the furnace. The company is replacing these with a face lining material, which has arisen work conducted by the Space Programme in Japan, that is stronger and more robust. This will give a much longer life, reduce corundum build up and further enhance the efficiency of the holding furnaces.

Studies by ETSU, the Energy Technology Support Unit, have shown that in non-ferrous foundries it is not unusual for metal to be held at 30 - 50 degrees centigrade above that required. Investigation of practice on site showed that furnace temperatures are monitored on a weekly basis, hence ensuring that energy use is optimised.

Air Compressor

Compressed air is used on site for a range of duties including actuating guards on machinery and for blowing down dies. The largest area of waste associated with the generation and use of compressed air is leakage. Studies have shown that leakage can account for some 50% of total compressed air consumption. Savings can be made by establishing a leakage check and maintenance programme and by ensuring that compressed air is used when and where appropriate.

Lighting

Lighting is the lowest user electricity on site. Nonetheless there are opportunities to reduce electricity consumption by the introduction of more efficient light fittings. In addition an awareness campaign to switch off lights will further help to reduce consumption.

Natural Gas

As with electricity, there is only one meter for the site. The major user of gas on site is the aluminium melting furnaces. There are three shaft furnaces units on site. This type of unit uses the exhaust gases to preheat the solid aluminium charge, making them the most efficient option for this purpose. They use natural gas and the low cost of this fuel makes them cost effective. The following outlines a number of options that could improve the efficiency of the furnace operation.

1. The performance of the furnaces should be monitored. This is best done by installing sub-metering so that performance trends for each unit can be monitored and exceptions investigated.
2. Care should be taken to ensure that the furnace shafts are fully charged with solid material for preheating to ensure a high degree of energy recovery.
3. The efficiency of this type of furnace can be impaired if it is not operated as close to maximum throughput as possible. Studies have shown that this type of furnace, run at 50% of capacity, increases energy consumption per tonne of metal by between 50 and 90%.

Summary

Although data was collection was conducted as part of the study, a more accurate estimate of savings that could be made would require data collection over a long period. Monitoring systems are an essential component of an energy management strategy and the installation of sub-metering systems would provide a basis for this. Typically, energy savings in the order of 10% are achievable for large energy users. In this case a number of areas have been identified and these could lead to savings of about £24,000 per year, if fully implemented. The options identified require technical improvements as well changes in operating procedures. However, it should be noted that the company does endeavour to adopt best practice principles where possible, for example, the holding furnaces. There is a considerable amount of information available from the Energy and Environment Helpline about best practice. By ensuring that all members of staff are aware of best practice techniques and by providing systems that will enable information of performance to be produced, then it should be possible to reduce energy use even further.

Case Study

Reducing Ancillary Costs for a Food Manufacturer

Company Overview

Ross Pickles is a family owned business based on Tyneside. The main activity of the company is the preservation of raw vegetables by pickling and packaging. The company operates in a highly competitive market and see quality and a commitment to continuous improvement as a key to their future success. As part of the commitment to continuous improvement Project Tyneside was invited to visit the company to see if a waste minimisation approach could offer any environmental and economic improvements.

Waste minimisation is holistic approach to improving performance. The initial review looked at all aspects of the operation. The post production period, which is concerned with hygiene, was identified as one area worthy of further study.

Hygiene, as with all food processors, is of crucial importance. The process on-site is classified as a low risk operation for hygiene purposes as the product has intrinsic resistance to most, but not all, microbiological contamination. Although the company is regularly audited on hygiene procedures, as part of its commitment to continuous improvement, the company is conscious of the need to:-

- maintain the highest standards;
- ensure best value for money.

The Study Area

The company operates a single production line running one product at a time which requires hygiene operations following each daily production run. The operation usually takes place at night. There area number of process areas in the company:-

- Raw material intake and storage
- Primary cleaning
- Washing
- Brining
- Cooking
- Packaging
- Pasteurisation
- Palletisation and storage

The company produces a number of products, for example, silverskin onions, beetroot, piccalilli, etc. Each product may involve different process areas at the front end depending on the product being packaged. Associated with the process areas are conveyors, mechanical peelers, storage barrels and utensils.

The hygiene process involves the physical and chemical removal of vegetable debris and general dirt from all area involved in the production of a product batch. It also involves sanitisation; that is the reduction of microbial levels to a specified safe standards. Following the hygiene process the production area and associated equipment should be free from physical and microbiological contamination.

The hygiene process is conducted by a specialist team working to an agreed method and standard. Hygiene standards are prescribed in legislation and hygiene operatives are trained in the responsibilities they have.

As part of the hygiene process a considerable amount of consumables are used. These include clothing materials worn by operatives but also include cleaning utensils and cleaning chemicals and

materials. The spend in 1997 for consumables was about £7,500. A study was undertaken of the chemicals used and alternative sources that would perform the same task.

An investigation into alternative sources revealed that there were suitable alternatives available at considerably less cost. The potential saving, based on 1997 data, was about 60% leading to a cost benefit to the company of about £4,400 per year.

Summary

Waste minimisation takes a holistic view of organisations and looks for opportunities in all areas to reduce costs and improve efficiency. It is not claimed that this study has improved efficiency, however it has demonstrated that organisations need to be consistently vigilant about alternative or new products that can perform equally as well as existing products, but at a more cost effective rate. Information and access to information about what is available to meet needs in cost effective ways is an integral part of any waste minimisation study.

Case Study

Reducing Raw Material Costs of Textiles for a Garment Manufacturer

Company Overview

Cramptons, a garment manufacturer, are based on two sites at Tanfield Lea. One site cuts the fabric and the other assembles the finished garments. The company expressed an interest in recycling textile waste generated on-site. An investigation of this showed that the material could not be recycled, as they mainly synthetic and contained fire retardant substances. A waste minimisation approach was suggested in order to identify ways of reducing textile waste.

The Study Area

A review of waste disposal costs showed that this was small (about £3,600 per year) when compared to the cost of fabric waste (about £687,000 per year), that is the purchase costs of all waste that is not sold as garments to customers. A study was undertaken to identify areas where fabric waste could be reduced.

Raw materials consisting of rolls of pre-printed textile are delivered to the site. Two blanket lengths are used on-site; one for adult garments and the other for children's garments. The rolls are cut crossways into standard blanket sections. Each blanket section is then cut into panels. The panels are then sent for additional printing and then assembled into the finished product.

The main sources and causes of fabric waste can be categorised into two groups; those associated with raw materials, such as fabric quality from suppliers (colour, faults, roll length, etc.) and those resulting from the production process (waste from trimming blanket length and width and selve edge trimming to ensure straight edge, production errors, etc.). Data analysis of waste allowed areas and costs of waste to be identified. These are shown in the following table.

| Sources | % of Waste | Length (m) | Cost (£) |
|----------------------------|------------|------------|----------|
| Width trim | 49 | 122,500 | 336,875 |
| Blanket length trim | 19 | 47,500 | 130,625 |
| Fabric faults | 19 | 47,500 | 130,625 |
| Selve edges | 8 | 20,000 | 55,000 |
| Between panel allowances | 3 | 7,500 | 20,625 |
| Incomplete blanket lengths | 2 | 5,000 | 13,750 |
| Total | 100 | 250,000 | 687,500 |

Structured brainstorming sessions were held to identify specific areas where waste could be reduced. The following table outlines the areas identified during those sessions.

| | Option | Will it work? | Reduce waste? | Ranking |
|---|--|---------------|---------------|---------|
| 1 | Remove dotted line separating blanket lengths | L | M | 3 |
| 2 | Install computerised lay planning | H | H | 1 |
| 3 | Use two standard lengths for adult sizes | H | M | 2 |
| 4 | Education awareness for employees | H | H | 1 |
| 5 | Purchase fabric by number of blankets and not length | M | M | 2 |
| 6 | Fabric inspection of full rolls before cutting | H | H | 1 |
| 7 | Penalty clauses for late delivery | M | H | 2 |
| 8 | Improve performance of key suppliers | M | H | 2 |
| 9 | Specify fabric width to suit size range | M | H | 2 |

The options identified are discussed below.

1 Blanket Cut Line: Printed fabric has a visible cut line which runs across the width of the fabric. By reducing this to a small line at each side of the fabric then for some garments it would be possible utilise material for other garment parts.

2 Computerised Lay Planning: This will help to optimise the current process in comparison to the current manual methods. This will help to reduce waste from width and blanket length trim.

3 Specific blanket lengths to suit size range: The company supplies the print roll used to generate the textiles rolls. For adult sizes it was shown that by supplying two print rolls for runs of up to 40,000 garments, then the cost of the additional print roll could be recovered. This means that for print runs higher than 40,000 garments then the company would generate fabric savings.

4 Education and Awareness: Employees have a major influence on the quantity of fabric waste generated. Awareness training will contribute to minimising those losses.

5 Eliminate Part Blankets: Rolls of printed textile typically have a part blanket at each end of the roll - this represents waste before the process is even started. The study showed that this could cost up to £11,000 per year. Suppliers have been asked to supply rolls which start and finish on blanket break lines.

6 Fabric Inspection: Analysis of data shows that waste from fabric faults and "short" rolls represents some 6% of all fabric supplied, representing some £165,000 per year. Roll length or faults were not identified until after the fabric had been cut, meaning that this could not be returned to the supplier for a claim. A fabric inspection unit has been installed that enable rolls to be checked for length and faults prior to cutting. An agreed number of faults has been established with the supplier enabling the company to claim when these are exceeded. For example, if 2% was agreed this would lead to a saving of £110,000 per year in fabric costs.

7 Improving Fabric Deliveries: Late delivery places additional pressures on production that leads to mistakes causing waste. Penalty clauses late delivery would help ensure more reliable deliveries.

8 Improve Performance of Key Suppliers: A system highlighting performance of fabric quality and delivery would bring the greatest benefits. A simple database has been developed to enable fabric faults and "short" length information to be collected and analysed.

9 Specify Fabric width to Suit Size Ranges: The roll width is determined by the number of garment sections that can be cut for one width and this is determined by the largest adult size. However smaller adult sizes are cut from the same width resulting in some 35% waste. The feasibility of supplying different widths is being investigated.

Options ranked the highest, 2, 4 and 6 can be implemented in-house. The remaining options whilst offering considerable benefits require discussions with suppliers. By implementing in-house improvements fabric utilisation can be improved by at least 5% leading to savings of £137,500 per year. Almost half of the waste results from width trim leading to potential savings of some £340,000 per year. This is a difficult improvement to make, requiring suppliers to be involved.

Summary

In this study it has been shown that the costs of waste can be significant, in this case amounting to some £687,000 per year. By working with all employees involved in the process a number of options were identified. Not all of the options identified can be implemented immediately and not all of the options could be implemented in-house. Those options that can be implemented in-house offer the opportunity to reduce waste by at least 5%. By working with suppliers the study showed that there was considerable gains to be made in the longer term. Waste minimisation is an holistic approach to making improvement and recognises that often savings can be made by looking beyond in-house processes and identifying areas where work with suppliers can bring considerable benefits.